CITY OF EDINBURG SET NO. 1

PROJECT MANUAL

FOR

EL TULE RECREATION CENTER

FOR THE

CITY OF EDINBURG

2021

City of Edinburg
415 W. University Drive
Edinburg, Texas 78539
(956) 388-8211

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City of Edinburg
415 W. University Drive
Edinburg, Texas 78539
(956) 388-8211

Document 00001

TITLE SHEET

PROJECT MANUAL
FOR
CITY OF EDINBURG
EL TULE RECREATION CENTER

FOR

EDINBURG, TEXAS

CITY ENGINEER

Digitally signed by Mardoqueo Hinojosa
Date: 2021.06.04 15:13:11 -05'00'

Mardoqueo Hinojosa, P.E., CFM Date

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Document 00003

TABLE OF CONTENTS

ADDENDA

(For filing) Documents listed "for filing" are to be provided by the Bidder and are not included in this Project Manual unless indicated for example only. The Document numbers and titles hold places for actual documents to be submitted by the Contractor during the bid, post-bid, or construction phase of the Project.

*1 For newspaper publication; not included as part of Project Manual.

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Document 00004

LIST OF DRAWINGS

The list of Drawings is provided on the Sheet Index page for El Tule Recreation Center plans.

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THE CITY OF Edinburg

REQUEST FOR BIDS

The City of Edinburg is soliciting sealed bids to be received by the City Secretary's Office located at 415 W. University Drive, Edinburg, Texas 78541. City of Edinburg normal business days are Monday through Friday between the hours of 7:30 a.m. to 5:30 p.m. and shall be closed on recognized holidays.

Bids will be received until **3:00 p.m. Central Time**, on **Tuesday, June 22, 2021**, shortly thereafter all submitted bids will be gathered and taken to the Edinburg City Hall Community Room, 1st Floor, to be publicly opened and read aloud. In addition bid opening will be available in the zoom meeting link: https://cityofedinburg.zoom.us/j/87364359756. Any bid received after the closing time will not be accepted and will be returned to the bidder unopened. It is the responsibility of the bidder to see that any bid submitted shall have sufficient time to be received by the City Secretary's Office prior to the bid opening date and time. A non-mandatory pre-bid meeting will be held virtually in the zoom meeting link on June 14th at 1:30 pm: https://cityofedinburg.zoom.us/j/86055583797. The receiving time in the City Secretary's Office will be the governing time for acceptability of the bids. Bids will not be accepted by telephone or facsimile machine. All bids must bear original signatures and figures. The Bid shall be for:

BID #2021-29
EL TULE RECREATION CENTER

This project is being funded in whole or in part by the Edinburg Economic Development Corporation and the City of Edinburg. Bidders on the work will be required to comply with the President's Executive Order No. 11236 and Order No. 11375 which prohibits discrimination in employment regarding race, creed, color, sex, or national origin. Bidder must comply with the Title VI of the Civil Rights Act of 1964, Section 504, Minority and Women Owned Business Enterprise standards, affirmative action requirements, the Davis-Bacon and Related Acts, the Copeland "Anti-Kickback" Act, the Contract and Work Hours and Safety Standards Act, Federal Labor Standards Provisions HUD-4010,and all contract provisions listed in 24 CFR Part 85.36(i). **Bidder shall be responsible for downloading the Fair Standard Provisions from the City's website at:**

http://cityofedinburg.com/departments/finance/open_bid_notices.php

Prospective contractors/ subcontractors shall be registered in the SAM System for Award Management database prior to award of a contract or agreement. Registration can be completed at **www.sam.gov.** All contractors and/or subcontractors who are debarred, suspended, or otherwise excluded from or ineligible for participation on federal assistance programs may not undertake any activity in part or in full under this project.

"The City of Edinburg is an Equal Employment Opportunity Employer"

If you have any questions or require additional information regarding this bid, you may contact LORENA FUENTES, PURCHASING AGENT, LOCATED AT 415 W. UNIVERSITY DRIVE, Edinburg, TX 78541 by calling (956) 388-1895 or via e- to the following e-mail address: lfuentes@cityofedinburg.com.

The City of Edinburg reserves the right to refuse and reject any or all bids and to waive any or all formalities or technicalities and to accept the bid deemed most advantageous to the City, and hold the bids for a period of **90** days without taking action.

Bids must be submitted in an envelope sealed with tape and prominently marked on the lower left hand corner of the bid envelope with corresponding bid number and title.

CITY OF EDINBURG
INSTRUCTIONS TO BIDDERS

DEVIATION FROM SPECIFICATION

Please read your specifications/requirements thoroughly and be sure that the SERVICES offered comply with all specifications/requirements. Any variation from the specifications/requirements must be clearly indicated by letter attached to your bid referencing variations on a point-by-point basis. If no exceptions are noted, and you are the successful bidder, it will be required that the SERVICES be provided as specified.

PURPOSE

1. The purpose of these specifications/requirements and bidding documents is for the **EL TULE RECREATION CENTER** for the City of Edinburg.

2. The SERVICES to be furnished under this bid shall be as specified in these bid documents. All specifications/requirements shown are minimum. There is no intention to disqualify any bidder who can meet these specifications/requirements.

SUBMITTAL OF BID

Bids will be submitted in sealed envelopes upon the blank bid form attached hereto. Submit three (3) complete sets of the bid, one (1) original marked "**ORIGINAL,"** and two (2) copy marked "**COPY**". Each bid must be completely filled out and **SUBMITTED IN ORIGINAL FORM**, complete with all supporting documentation. Bids submitted by facsimile (fax) or electronically will **NOT** be accepted. Submittal of a bid in response to this solicitation for Bids constitutes an offer by the Bidder. Bids which do not comply with these specifications/requirements may be rejected at the option of the City. Bids must be filed with the City of Edinburg, before opening day and hour. No late Bids will be accepted. They will be returned to Bidder unopened (if properly identified).

If Hand-delivering Bids:	415 West University Drive, c/o City Secretary Department (1st Floor)
If using Land Courier (i.e., FedEx, UPS):	415 West University Drive, c/o City Secretary Department (1st Floor), Edinburg, Texas 78541
If Mailing Bids:	P.O. Box 1079, Edinburg, TX 78540-1079

PREPARATION OF BID

Bids MUST give full firm name and address of bidder, and be manually signed. Failure to do so will disqualify your bid. Person signing bid must show title or AUTHORITY TO BIND HIS/HER FIRM IN A CONTRACT.

Firm name and authorized signature must appear on each page that calls for this information. The legal status of the Respondent/Bidder whether corporation, partnership, or individual, shall also be stated in the bid. A corporation shall execute the bid by its duly authorized officers in accordance with its corporate by-laws and shall also list the state in which it is incorporated. A partnership Respondent/Bidder shall give full names and addresses of all partners. All partners shall execute the bid. Partnership and Individual Respondent/Bidder shall state in the bid the names and addresses of all persons with a vested interest therein. The place of residence of each Respondent/Bidder, or the office address in the case of a firm or company, with county and state and telephone number, shall be given after the signature.

ALTERATIONS/AMENDMENTS TO BID

Bids **CANNOT** be altered or amended after opening time. Alterations made before opening time must be initialed by bidder guaranteeing authenticity. No bid may be withdrawn after opening time without acceptable reason in writing and only after approval by the City of Edinburg.

INSTRUCTIONS TO BIDDERS (Continued):

SALES TAX
State sales tax must not be included in the bid.

SUBSTITUTIONS
No substitutions or cancellations will be permitted without written approval of City of Edinburg.

NO BID RESPONSE
If unable to submit a bid, bidder should return inquiry giving reasons.

EXCEPTIONS
Any additions, deletions, or variations from the following specifications/requirements must be noted. The bidder shall attach to his/her bid sheet a list of any exceptions to the specifications/requirements if unable to do so, on specification sheet.

BRAND OR MANUFACTURER REFERENCE
Unless otherwise specified, any catalog or manufacturer's reference or brand name used in describing an item is merely descriptive, and not restrictive, and is used only to indicate type and style of product desired. Bids on alternate brands will be considered if they meet specification requirements. If a bidder quotes on equipment other than the one(s) specified in the bid, sufficient specifications and descriptive (pictured literature) data must accompany same to permit thorough evaluation. In the absence of these qualifications, he/she will be expected to furnish the product called for.

DELIVERY
Number of days required to deliver SERVICES after receiving order must be stated in the bid. Failure to so state will obligate bidder to complete service delivery within ONE day.

DELAY IN SERVICE DELIVERY
When delay can be foreseen, Bidder shall give prior notice to City of Edinburg. Bidder must keep City of Edinburg advised at all times of status of order. Default in promised service delivery (without acceptable reasons) or failure to meet specifications/requirements, authorizes the City of Edinburg to purchase such SERVICES elsewhere and charge increase in cost to defaulting vendor. Acceptable reasons for delayed delivery are as follows: Acts of God (floods, tornadoes, hurricanes, etc.), acts of government, fire, strikes, war; Actions beyond the control of the successful bidder.

SERVICE DELIVERED PRICING
Bids in units of quantity specified - extend and show total. In the event of discrepancies in extension, unit prices will govern. Bids subject to unlimited price increase will not be considered.

VALID BID TIME FRAME
The City may hold bids 90 days after bid opening without taking action. BIDDERS shall be required to hold their Bids firm for the same period of time.

RIGHT TO REJECT/AWARD
The City of Edinburg reserves the right to refuse and reject any or all Bids, and to waive any or all formalities or technicalities, and to make such awards of contract as may be deemed to be the best and most advantageous to the City of Edinburg.

INSTRUCTIONS TO BIDDERS (Continued):

MULTIPLE VENDOR CONTRACTS

Bidders are advised that the City of Edinburg may award Service Contracts to multiple vendors based on low bid per item basis. All items specified on the "Bid Form" **must** reflect the individual unit prices. The City of Edinburg reserves the right to award all items individually or in any combination thereof. The City reserves the right to award each item separately or individually, award to one or multiple vendors, and accept the proposal deemed most advantageous to the City.

INDEMNIFICATION CLAUSE

The Bidder agrees to indemnify and save harmless the City, from all suits and actions of every nature and description brought against them or any of them, for or on account of the use of patented appliances, products or processes, and he shall pay all royalties and charges which are legal and equitable. Evidence of such payment or satisfaction shall be submitted upon request of the Purchasing Agent, as a necessary requirement in connection with the final estimate for payment in which such patented appliance, products or processes are used.

ADDENDA

Bidder shall carefully examine the bid forms, specifications/requirements, and instructions to Bidders. Should the bidder find discrepancies in, or omissions from bid forms, specifications/requirements, or other documents, or should he/she be in doubt as to their meaning, he/she should at once notify the Purchasing Agent at 956-388-1895 and obtain clarification by addendum prior to submitting any bid. Explanations, interpretations, and supplemental instructions shall be in the form of written Addenda which shall become a part of the Contract documents. Said Addenda shall be mailed, e-mailed, hand delivered and/or faxed, to all prospective Bidders. All Addenda issued in respect to this project shall be considered official changes to the original bid documents. Verbal statements in response to inquiries and/or requests for explanations shall not be authoritative nor binding. It shall be the Bidder(s) responsibility to ensure that they have received all Addenda in respect to this project. Furthermore, Bidders are advised that they must recognize, comply with, and attach a signed copy of each Addendum which shall be made part of their Bid Submittal. Bidder(s) signature on Addenda shall be interpreted as the bidder's "recognition and compliance to" official changes as outlined by the City of Edinburg and as such are made part of the original solicitation documents. Failure of any bidder to receive any such addendum or interpretation shall not relieve such Bidder from its terms and requirements. The City may issue a written addendum no later than five calendar days prior to the date bids must be received. Addendums are available online at www.cityofedinburg.com.

PAYMENT

The City of Edinburg will execute payment by mail in accordance with the State of Texas Pay Law after SERVICES have been provided and invoiced. No other method of payment will be considered.

SYNONYM

Where in this bid package ITEMS OR SERVICES is used its meaning shall refer to the **EL TULE RECREATION CENTER** as specified.

ASSIGNMENT

Neither the Bidder's contract nor payment due to an awarded vendor may be assigned to a third party without the written approval of the Purchasing Department for the City of Edinburg.

INTERPRETATIONS

Any questions concerning the conditions and/or specifications/requirements with regards to this solicitation for Bids shall be directed to the designated individuals as outlined in the Request for Bids. Such interpretations, which may affect the eventual outcome of this request for Bids, shall be furnished in writing to all prospective Bidders via

INSTRUCTIONS TO BIDDERS (Continued):

Addendum. No interpretation shall be considered binding unless provided in writing by the City of Edinburg in accordance with paragraph entitled "Addenda".

STATUTORY REQUIREMENTS

It shall be the responsibility of the successful Bidder to comply with all applicable State & Federal laws, Executive Orders and Municipal Ordinances, and the Rules and Regulations of all authorities having jurisdiction over the work to be performed hereunder and such shall apply to the contract throughout, and that they will be deemed to be included in the contract as though written out in full in the contract documents. (To include issues related to health, environmental, and safety to name a few.)

BIDDER'S EMPLOYEES

Neither the Bidder nor his/her employees engaged in fulfilling the terms and conditions of this Purchase Contract shall be considered employees of the City. The method and manner of performance of such undertakings shall be under the exclusive control of the vendor on contract. The City shall have the right of inspection of said undertakings at any time.

RIGHT TO WAIVE

City of Edinburg reserves the right to waive or take exception to any part of these specifications/requirements when in the best interest of the City of Edinburg**.**

TIME ALLOWED FOR ACTION TAKEN

The City of Edinburg may hold bids **90** days after the opening of Bids without taking action. Bidders are required to hold their Bids firm for same period of time.

PREPARATION OF BID

The City of Edinburg shall not be held liable for any costs incurred by any bidder for work performed in the preparation of and production of a bid or for any work performed prior to execution of contract.

CONFIDENTIAL INFORMATION

Any information deemed to be confidential by the bidder should be clearly noted on the pages where confidential information is contained; however, the City cannot guarantee that it will not be compelled to disclose all or part of any public record under Texas Public Information Act, since information deemed to be confidential by the bidder may not be considered confidential under Texas Law, or pursuant to a Court order.

VERBAL THREATS

Any threats made to any employee of the City, be it verbal or written, to discontinue the providing of item/material/services for whatever reason and/or reasons shall be considered a breach of contract and the City will immediately sever the contract with the Vendor on contract.

INSTRUCTIONS TO BIDDERS (Continued):

MATHEMATICAL ERRORS
In the event that mathematical errors exist in any bid, unit prices/rates -v- totals, unit prices/rates will govern.

AUDIT
The City of Edinburg reserves the right to audit the vendor's books and records relating to the performance of this contract. The City of Edinburg, at its own expense, shall have the right at all reasonable times during normal business hours and upon at least twenty-four (24) hours' advance notice, to audit, to examine, and to make copies of or extracts from the books of account and records maintained by the vendor(s) with respect to the Supply/Service and/or Purchase Contract. If such audit shall disclose overpayment by City to vendor, written notice of such overpayment shall be provided to the vendor and the amount of overpayment shall be promptly reimbursed by vendor to the City. In the event any such overpayment is not paid within ten (10) business days after receipt of such notice, the unpaid amount of such overpayment shall bear interest at the rate of one percent (1%) per month from the date of such notice until paid.

PAST PERFORMANCE
Vendor's past performance shall be taken into consideration in the evaluation and award of Service Contract for the Purchase of SERVICES.

JURISDICTION
Contract(s) executed as part of this solicitation shall be subject to and governed under the laws of the State of Texas. Any and all obligations and payments are due and performable and payable in Hidalgo County, Texas.

VENUE
The parties agree that venue for purposes of any and all lawsuits, cause of action, arbitration, and/or any other dispute(s) shall be in Hidalgo County, Texas.

IF YOU HAVE ANY QUESTIONS ABOUT COMPLIANCE, PLEASE CONSULT YOUR OWN LEGAL COUNSEL. COMPLIANCE IS THE INDIVIDUAL RESPONSIBILITY OF EACH PERSON OR AGENT OF A PERSON WHO IS SUBJECT TO THE FILING REQUIREMENT. AN OFFENSE UNDER CHAPTER 176 IS A CLASS "C" MISDEMEANOR.

CONFLICT OF INTEREST
CHAPTER 176 OF THE TEXAS LOCAL GOVERNMENT CODE
Effective January 1, 2006, Chapter 176 of the Texas Local Government Code requires that any vendor or person considering doing business with a local government entity disclose in the Questionnaire Form CIQ, the vendor or person's affiliation or business relationship that might cause a conflict of interest with a local government entity. By law, this questionnaire must be filed with the records administrator of the City of Edinburg not later than the 7th business day after the date the person becomes aware of facts that require the statement be filed. See Section 176.006, Local Government Code. A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor. For more information or to obtain Questionnaire CIQ go to the Texas Ethics Commission web page at www.ethics.state.tx.us/forms/CIQ.pdf.

CERTIFICATE OF INTERESTED PARTIES (Form 1295)
In 2015, the Texas Legislature adopted House Bill 1295, which added section 2252.908 of the Government Code. The law states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency. The law applies only

INSTRUCTIONS TO BIDDERS (Continued):

to a contract of a governmental entity or state agency that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least $1 million. The disclosure requirement applies to a contract entered into on or after January 1, 2016. For more information go to the Texas Ethics Commission web page at www.ethics.state.tx.us/forms/CIQ.pdf.

HB 89

The 85th Texas Legislature approved new legislation, effective Sept. 1, 2017, which amends Texas Local Government Code Section 1. Subtitle F, Title 10, Government Code by adding Chapter 2270 which states that a governmental entity may not enter into a contract with a company for goods or services unless the contract contains a written verification from the company that it:

1) does not boycott Israel; and
2) will not boycott Israel during the term of the contract

AWARD

For purposes of this project, award is not contingent on approval of budget.

SPECIAL CIRCUMSTANCES

In the event that the City of Edinburg has an immediate need for a particular service(s) that is/are on contract and the successful vendor on contract is not able to meet the special service delivery needs of the City of Edinburg, the City of Edinburg reserves the right to purchase such services elsewhere to fulfill its' immediate need.

TERMINATION OF CONTRACT

The City of Edinburg reserves the right to terminate the contract if, in the opinion of the City of Edinburg, the successful vendor's performance is not acceptable, if the City is being repeatedly over charged, improperly charged, no funds are available, or if the City wishes, without cause, to discontinue this contract. Termination will be in written form allowing a 30-day notice. The bidder shall be afforded the same right to terminate this contract in the same manner.

STANDARD INSURANCE REQUIREMENTS

Staff may waive insurance requirements for contracts $0 - $4,999.99, including but not limited to contracts for food, materials, supplies, and construction. Workers' Compensation in amounts which satisfy statutory coverage shall be required for construction projects.

The following insurance requirements will be included in all City contracts of $5,000 - $14,999.99. In contracts not involving building and construction projects, as that activity is defined in TEX. LABOR CODE §406.096, contractors may obtain alternative form of worker accident insurance with minimum limits of liability of $100,000 per claim.

QUESTIONS AND CLARIFICATIONS

Questions and clarifications that change or substantially clarify the Invitation to Bid will be affirmed in writing and copies will be provided to all firms on record responding to BID. **Any inquiries to this BID must be submitted to Ms. Lorena Fuentes, Purchasing Agent, at the following e-mail address: lfuentes@cityofedinburg.com no later than June 16, 2021 at 5:00 p.m.**

INSTRUCTIONS TO BIDDERS (Continued):

Minimum Insurance Requirements	
Type of Coverage	**Limits of Liability**
Worker's Compensation	Statutory Coverage
Comprehensive General Liability (City named as additional insured) Bodily Injury	 $250,000 each person/$500,000 each occurrence
Property Damage	$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits

The following insurance requirements will be included in all City contracts of $15,000 or more.

(1) The successful bidder will be required to carry the following insurance coverage and limits of coverage, as well as list the City as an additional insured to liability coverage as requested by the City. In addition, the successful bidder shall provide the City with evidence of coverage and furnish acceptable proof of payment of insurance premiums.

(2) The successful bidder will be required to secure and/or have insurance coverage in force with an admitted property and casualty insurance company licensed by the State of Texas to conduct business in the State of Texas.

(3) In contracts not involving building and construction projects, as that activity is defined in TEX. LABOR CODE §406.096, contractors may obtain alternative form of worker accident insurance with minimum limits of liability of $100,000 per claim.

Minimum Insurance Requirements	
Type of Coverage	**Limits of Liability**
Worker's Compensation	Statutory Coverage
Employer's Liability	Bodily Injury by Accident: $100,000 each accident Bodily Injury by Disease: $100,000 each employee/$500,000 policy limit
Comprehensive General Liability Bodily Injury	 $250,000 each person/$500,000 each occurrence
Property Damage	$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits
Comprehensive Auto Liability Bodily Injury	 $100,000 each person/$500,000 each occurrence
Property Damage	$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits

INSTRUCTIONS TO BIDDERS (Continued):

City's Protective Liability Bodily Injury	 $250,000 each person/$500,000 each occurrence
Property Damage	$100,000 each occurrence/$100,000 aggregate or $500,000 combined single limits

Policies must name the City of Edinburg as an Additional Insured.
Certificates of insurance naming the CITY as an additional insured shall be submitted to the CITY for approval prior to any services being performed by Contractor. Each policy of insurance required hereunder shall extend for a period equivalent to, or longer than the term of the Contract, and any insurer hereunder shall be required to give at least thirty (30) days written notice to the CITY prior to the cancellation of any such coverage on the termination date, or otherwise. This Contract shall be automatically suspended upon the cancellation, or other termination, of any required policy of insurance hereunder, and such suspension shall continue until evidence that adequate replacement coverage is provided to the CITY. If replacement coverage is not provided within thirty (30) days following suspension of the Contract, the Contract shall automatically terminate.

BID BOND REQUIREMENTS – *CONSTRUCTION PROJECTS ONLY*

If the contract amount is over twenty-five-thousand dollars ($25,000) for construction of the project, the successful bidder shall provide a bid guarantee, give a good and sufficient bond in the full amount of the contract price for the faithful performance of such contract, executed by a surety company authorized to do business in the State of Texas, in accordance with Article 5160, Vernon's Texas Civil Statutes, and amendments thereto. A payment bond in the full amount of the contract price to assure payment shall be required by law of all persons supplying labor and material in the execution of the project provided for in the contract documents.

A bid guarantee equivalent to five percent (5%) of the bid price will be required from each bidder. The "bid guarantee" shall consist of a firm commitment, such as a bid bond, certified check or other negotiable instrument accompanying a bid as assurance that the bidder will upon acceptance of his/her bid, execute such contractual documents as may be required within the time specified.

A performance bond on the part of the contractor for one-hundred percent (100%) of the contract price will be required. A "performance bond" is one executed in connection with a contract to secure fulfillment of all the contractor's obligations under such contract.

A payment bond on the part of the contractor for one-hundred percent (100%) of the contract price will be required. A "payment bond" is one executed in connection with a contract to assure payment, as required by law, of all persons supplying labor and material in execution of the work provided for in the contract documents.

Bidders are expressly advised to review the contract documents fully and insurance requirements of the proposed contract as to their legal requirements and the causes which may lead to the disqualification of a bidder and/or rejection of a bid proposal. No bid may be withdrawn within a period of ninety (90) days after the dated fixed for opening the bids. Unless all bids are rejected, the Owner will give Notice of Award of Contract to the successful bidder as soon as possible consistent with the time for a thorough analysis of bids submitted. Bidders are expected to inspect the site of work and to inform themselves regarding all local conditions which may affect their bid.

HOUSE BILL 89 VERIFICATION

I, _____, the undersigned representative of

_____, (Company or Business name) (hereafter referred to as company) **being an adult over the age of eighteen (18) years of age, verify that the company named-above, under the provisions of Subtitle F, Title 10, Government Code Chapter 2270:**

1. Does not boycott Israel currently; and

2. Will not boycott Israel during the term of the contract.

3) Is not currently listed on the State of Texas Comptroller's Companies that Boycott Israel List located at https://comptroller.texas.gov/purchasing/publications/divestment.php

Pursuant to Section 2270.001, Texas Government Code:

1. "Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes; and

2. "Company" means a for-profit sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or any limited liability company, including a wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate of those entities or business associations that exist to make a profit.

_____

SIGNATURE OF COMPANY REPRESENTATIVE:

_____

TYPE/PRINT NAME AND TITLE:

_____

DATE:

CITY OF EDINBURG
EL TULE RECREATION CENTER

BID NO. 2021-29
BID OPENING DATE: June 22, 2021 at 3:00 p.m.
It is the intent of this Request for Bids to describe and ultimately make it possible for the City of Edinburg to purchase the below mentioned **EL TULE RECREATION CENTER**. You are invited to submit a sealed bid for **EL TULE RECREATION CENTER.**

1. Installation of Solar Light along Cano Hike and Bike Trail as specified in contract documents:
    - Installation of light fixtures with poles, as per specifications.
2. Contractor shall provide all labor, materials and equipment necessary to complete job.
3. Contract shall be responsible for the cleaning and disposal of all debris from job site on a daily basis at a designated dumpsite at Contractor's expense.
4. Contractor shall be held liable for any damages during the course of construction.
5. All areas which fail to meet specification are required to be placed in compliance at no additional cost to the City.
6. Any required prep work shall be included in this bid.
7. Work must be completed within 300 days.
8. A minimum of one (1) year warranty on labor and materials must be provided in writing.
9. Interested parties are encouraged to visit the project site, as shown on plans and specifications.

CITY OF EDINBURG
BID FORM FOR
EL TULE RECREATION CENTER

BID NO. 2021-29

BID OPENING DATE: June 22, 2021 at 3:00 p.m.

I/We submit the following bid in **ORIGINAL FORM** for **EL TULE RECREATION CENTER** according to City of Edinburg requirements, less tax.

ITEM	ESTIMATED QUANTITIES	DESCRIPTION	BID AMOUNT
1	EA	**USE SECTION 00405 Schedule of Unit Price Work**	$_____
		BID TOTAL	$_____

Note: The City reserves the right to consider each group as a separate bid and award any or all, whichever may be more advantageous to the City. The City reserves the right to increase or decrease the quantities depending on availability of funds.

BID FORM FOR EL TULE RECREATION CENTER (Continued):

All Addenda issued in respect to this project shall be considered official changes to the original bidding documents. It shall be the Bidder(s) responsibility to ensure that all Addenda have been received. Furthermore, bidders are advised that they must recognize, comply with, and attach a signed copy of each Addendum which shall be made part of their Bid Submittal. Bidder(s) signature on Addenda shall be interpreted as the vendor's "recognition and compliance to" official changes as outlined by the City of Edinburg and as such are made part of the original bidding documents.

Does the Company have an office located in Edinburg, Texas? Yes _____ No_____

Has the Company ever conducted business with the City of Edinburg? Yes _____ No_____

Respectfully submitted this _____ day of _____, 2021.

SIGNATURE: _____

TYPE/PRINT NAME: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

_____

TELEPHONE NO.: _____

FAX NO.: _____

EMAIL: _____

Document 00020

NOTICE TO BIDDERS

Owner: City of Edinburg
415 W. University Drive
Edinburg, Texas 78539
Phone: (956) 388-8211
Fax: (956) 383-7111

Architect: Milnet Architectural Services, PLLC.
608 S. 12th St.
McAllen, TX. 78501
Phone: (956) 688-5656
Fax: (956) 687-9289

1.00 INVITATION

A. Bidders are invited to submit an offer for performance of a Contract to the City of Edinburg located at the above address, for the following construction Project:

Project: El Tule Recreation Center

Located: 700 S Veterans Blvd, Edinburg, TX 78539

B. Work of the Project consists of construction of El Tule Recreation Center building, parking lots, dog park and land scaping.

C. The Contract Documents are identified El Tule Recreation Center as listed in the Project Manual, issued by the Architect of Record.

D. The bidder shall bear all costs associated with the preparation and submission of its bid, and the Owner will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

E. When requested, the successful Bidder shall present satisfactory evidence that Bidder has regularly engaged in furnishing products and performing construction work as proposed, and has the capital, labor, equipment, and material to execute the Work required by Contract Documents.

2.00 BID SUBMISSION

A. Bids signed by an officer of the company and dated will be received at the City Secretary's Office, at 415 W. University Drive, Edinburg, TX 78539 until **3:00 p.m**. local time, on **June 22, 2021.**

B. Bids submitted after the above time will be returned to the Bidder unopened.

C. Bids shall be submitted in United States Currency and the English language on the Bid Forms and Supplements to Bid Forms provided with this Project Manual.

D. Oral, telephonic, facsimile, or telegraphic bids are invalid and will not receive consideration.

E. Bids will be opened and publicly read in the City of Edinburg City Hall Community Room at 415 W. University Drive, Edinburg, TX 78539 on the same date bids are received.

F. Bids will be irrevocable for 90 **days** from the bid date. Bidder may withdraw after 90 days without penalty if no mutual agreement can be reached.

3.00 MODIFICATION OR WITHDRAWAL

A. Bids submitted early may be modified or withdrawn by notice to the City of Edinburg at the place and prior to the time designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder and shall be so worded as not to reveal the amount of the original Bid.

B. Oral, telephonic, facsimile, or telegraphic modification of Bids will not receive consideration.

C. Withdrawn Bids may be resubmitted up to the time designated for receipt of Bids.

4.00 CONTRACT TIME

A. The Work shall be performed within the date established in the Notice to Proceed.

B. Contractor shall pay liquidated damages in the amounts stated in Document 00500 - Agreement for failure to complete the Work within the Contract Time.

C. The work is to be performed only during weekdays 8:00 AM to 5:00 PM (Monday to Friday). City recognized holidays are recommended to be avoided. Work performed during weekends (Saturday-Sunday) and holidays will incur a Contractor payment of **$50** per hour to Owner for onsite inspection.

5.00 SECURITY DEPOSIT REQUIREMENTS

A. Bids shall be accompanied by a security deposit as stated in Document 00100 - Instructions to Bidders.

6.00 EXAMINATION

A. Bid Documents are on display on the City of Edinburg website, may be examined at the location below or purchased from the Engineer of Record:

City of Edinburg
Engineering Department – 2nd Floor
415 W. University Drive
Edinburg, Texas 78539

7.00 AVAILABILITY

A. Bid Documents may be purchased from the Engineering Department, Engineer of Record or are available for printing at http://cityofedinburg.com/departments/finance/open_bid_notices.php.

B. All official notifications, addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than the designated website.

C. Bid Documents may be purchased by bidders upon receipt of a cashier's check, certified check, money order, company check, or personal check in the amount established by the City of Edinburg or Engineer of Record. The cost includes the Project Manual w/ Specifications and one full sized set of Drawings. They can also be downloaded at no cost, as specified on 7(A).

D. <u>The cost for the bid documents will not be refunded.</u>

E. Bid Documents are made available only for the purpose of obtaining offers for this Project. Purchase of Bid Documents does not grant a license for other purposes.

E. On receipt of Bid Documents, verify that documents are legible and complete. Compare contents of Project Manual with Table of Contents; see that all drawings listed in the List of Drawings are included. Notify City of Edinburg should the documents be incomplete as issued.

8.00 QUESTIONS AND INTERPRETATIONS

A. Bidder is required to study Bid Documents, the site, and conditions affecting the Work, and submit written questions on interpretation of those documents and conditions, or other factors affecting the Work, to the City of Edinburg.

B. Written questions may be submitted by facsimile or email, addressed to the Engineer. **No questions will be accepted after 5:00 PM, June 16, 2021.** All facsimile communications shall be confirmed by mailing the original correspondence to the City of Edinburg Purchasing Department, if applicable.

C. Immediately notify the Engineer upon finding discrepancies or omissions in the Bid Documents.

9.00 ACCEPTANCE/REJECTION OF BIDS

A. The Owner reserves the right to reject or accept any bids as stated in Document 00100 - Instructions to Bidders.

10.00 PRE-BID CONFERENCE

A. One (1) pre-bid conference will be conducted by the Owner on Monday, June 14, 2021 at 1:30 pm local time. The pre-bid conference shall be conducted virtually.

B. **Virtual attendance by prospective Bidders is highly recommended.** Sub-contractors, suppliers, and equipment suppliers may virtually attend.

C. Recognizing that free and open communication will benefit all participants, the Owner does not intend to limit or curtail the exchange of information between the Engineer and the prospective Bidders. However, the pre-bid conference is conducted primarily for the benefit of prospective Bidders. As such, a specific procedure will be followed during the conference:

   a. All attendees will sign-in, indicating their role with the project: contractor, supplier, manufacturer, etc.

   b. Seating priority will be given to Prospective Bidders. Sub-contractors, suppliers, and manufacturer's representatives shall remain behind the contractor area.

   c. The Owner will make introductions of his staff and consultants.

   d. The Owner and consultants will give a brief description of the project.

   e. Only Contracting firms (Prospective Bidders) are permitted to ask questions. Sub-contractors suppliers, and manufacturer's shall deliver their questions to the Contractor they are working with for presentation.

   f. Questions and answers will be recorded and developed into Meeting Minutes. Meeting Minutes will be distributed to meeting attendees. The Owner reserves the right to use electronic recording, or some other method to record the meeting.

D. The meeting will be conducted in English. Translators will not be provided.

E. If necessary, written clarifications or instructions will be issued in the form of an Addendum. Refer to Section 00100 – Instructions to Bidders for specific information concerning Addendums.

END OF DOCUMENT

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Document 00100

INSTRUCTIONS TO BIDDERS

1.00 SUMMARY

1.01 DOCUMENT INCLUDES

A. Bid Documents and Contract Documents.
B. Site Assessment.
C. Subcontractors/Suppliers/Others.
D. Bid Submission.
E. Bid Enclosure Requirements.
F. Offer, Acceptance, Rejection.

1.02 RELATED DOCUMENTS

A. Document 00020 - Notice to Bidders: Date, time and place for receipt of bids; Contract Time.
B. Document 00310 - Form of Proposal.
C. Document 00405 - Schedule of Unit Price Work.
D. Document 00450 - Post Bid Procedures.
E. Document 00500 - Agreement.
F. Document 00700 - General Conditions.
G. Document 00800 - Supplementary Conditions.

2.00 BID DOCUMENTS AND CONTRACT DOCUMENTS

2.01 DEFINITIONS

A. Definitions set forth in Document 00700 – General Conditions and in other Contract Documents, are applicable to the Bid Documents.

B. Addenda: Written or graphic instruments issued prior to the opening of Bids, which clarify, modify, correct, or change the Bid Documents.

C. Alternate Bid: The total amount bid for additions to the Work, as described in the Bid Documents. Each Alternate Bid shall include the cost of effects on adjacent or related components, and the Contractor's overhead and profit.

D. Bid Documents: The Project Manual and Drawings, including Addenda, plus Notice to Bidders, Instructions to Bidders, and Supplements to Bid Forms identified in Document 00310 - Form of Proposal.

E. Bidder: A person or entity who submits a Bid.
F. Low Bidder: The apparent successful Bidder who qualifies as a responsible Bidder and who submits the Bid with the lowest Total Bid Price.

G. Bid, Offer, Bidding: The act of submitting a complete and properly signed offer in accordance with these Instructions to Bidders. The Bid will be in the English language.

H. Total Bid Price: The monetary amount for performing the Work as identified by the Bidder in Document 00310 - Form of Proposal, which amount includes Cash Allowances and Alternate Bids, if any. Bid Price(s) will be in United States.

I. Security Deposit: A certified check, cashiers check or bid bond in at least the sum of 5 percent of the Total Bid Price which includes Cash Allowances and Alternate Bids, if any.

2.02 QUESTIONS, INTERPRETATIONS

A. Bidder shall: 1) carefully study the Bid Documents and compare them with each other, 2) examine the site, conditions thereon, and local conditions, and 3) report at once to the Engineer any errors, inconsistencies or ambiguities discovered.

B. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

C. Direct questions to Engineer.

D. Verbal discussions and answers are not binding. Requests from Bidders for clarifications and interpretations of content of documents must be in writing (mail or facsimile transmission only), and must be received not less than 5 business days before the date set for receipt of Bids.

E. The reply will be by Addendum.

2.03 ADDENDA

A. Addenda issued to Bidding Requirements are applicable only during the bidding period. Addenda to the Post-Bid Procedures are applicable only through the issuance of the Notice to Proceed. Any Addenda issued to Contract Forms, Conditions of the Contract, Specifications or Drawings become a part of the Contract Documents. Include resultant costs in the Total Bid Price.

B. Addenda will be issued by the Engineer to Bidders of record by email. Addenda will also be posted on the City website.

C. Each Bidder shall ascertain, prior to submitting a Bid that the Bidder has received all Addenda issued. The Bidder shall acknowledge their receipt in the place indicated in Document 00310 - Form of Proposal.

2.04 SUBSTITUTIONS OF MATERIALS/EQUIPMENT

A. No substitutions will be considered on this Project during the bidding period.

B. Voluntary substitutions by the Bidder will not be considered.

3.00 SITE ASSESSMENT

A. Bidders shall examine the Project site before submitting a Bid, become familiar with local conditions under which the Work will be performed, conduct appropriate explorations, and correlate personal observations with requirements of the Bid Documents. Work will be performed in public right-of-way and City property. The site may be examined at any time during daylight hours.

B. Bidder shall make site investigations to the extent Bidder deems necessary to ascertain the extent of subsurface conditions and variations thereof.

C. Failure to perform such investigations during the bid period shall not relieve Bidder from responsibility for investigations, interpretations and proper use of available information in preparation of Bidder's proposal.

D. Publications by the United States Department of Agriculture, Soil Conservation Service and others may be helpful to the bidder in his subsurface site investigation.

E. Geotechnical investigation reports for the proposed project site may also be helpful to the bidder in his subsurface site investigation.

4.00 SUBCONTRACTORS/SUPPLIERS/OTHERS

A. The Owner reserves the right to reject a proposed Subcontractor or Supplier for reasonable cause.

5.00 BID SUBMISSION

5.01 SUBMISSION PROCEDURES

A. Bidders shall be solely responsible for the delivery of their Bids in the manner and time prescribed in Document 00020 - Notice to Bidders.

B. Submit **one copy of the original executed offer** on the bid forms provided, properly signed, with required Security Deposit, and other Supplements to Bid Forms, in a sealed, opaque envelope. On the outside of the envelope, clearly indicate that it is a sealed bid and include the Bidder's name, Project name and Owner name. Bids submitted by mail shall be enclosed in a separate envelope addressed for mailing, and identifying the enclosure as a bid. In addition**, four copies must also be submitted**.

C. Fill in all blanks in the Bid forms. Acknowledge receipt of Addenda. Bid all Alternate Bids required by Bid Documents.

D. A summary of submitted Bids will be made available to Bidders following the Bid opening.

E. All costs and expenses incurred by the Bidder that are associated with preparation of the Bid shall be paid by and be the sole responsibility of the Bidder.

5.02 BID INELIGIBILITY

A. Failure to provide required Security Deposit in the proper amount will be cause to declare the Bid invalid.

B. Improperly completed information may be cause for declaring the Bid invalid.

C. Bids that are unsigned, improperly signed, illegible, obscure, altered, or which contain qualifications or irregularities of any kind, may be declared invalid. Document 00310 - Form of Proposal, Supplements to the Bid Forms identified in the Form of Proposal, or enclosures which are improperly prepared, may be declared invalid.

6.00 BID ENCLOSURE REQUIREMENTS

6.01 SUPPLEMENTS TO BID FORMS

A. Bid submittals shall include any other documents specified in Document 00310 - Form of Proposal.

6.02 SECURITY DEPOSIT

A. Bids shall be accompanied by a Security Deposit.

B. The Security Deposit of the Bidders will be retained until after the Contract is executed.

C. After execution of the Contract, Security Deposits will be returned to the Bidders.

D. If no Contract is awarded, all Security Deposits will be returned to the respective Bidders.

6.03 CERTIFIED CHECK/CASHIER'S CHECK

A. Make certified check or cashier's check (security checks) payable to the Owner.

B. The security checks are submitted on the condition that if the Bidder is named apparent Low Bidder and then fails either to timely execute the Agreement or to timely provide any required bonds, or to do both, then in that event the Owner will cash the security check.

C. The Owner will retain an amount equal to the difference between the Bid of the Bidder providing the security check and the Bid of the Bidder who is finally awarded the Contract and who executes the Agreement and provides the required bonds.

D. Any balance remaining will be reimbursed by the Owner to the Bidder who provided the security check.

6.04 BID BOND

A. The bid bond must be a valid and enforceable bond, executed by a corporate Surety authorized by the Texas State Board of Insurance to conduct insurance business in the State of Texas and shall comply with other requirements set out by law or included in the Bid Documents.

B. Endorse the bid bond in the name of the Owner as obligee, signed by the Contractor as principal and executed, signed and sealed by the Surety.

C. The bid bond must be conditioned such that if the Bidder is named apparent Low Bidder and then fails either to execute the Agreement timely or to provide any required bonds timely, or to do both, then in that event the Surety will be obligated to pay to the Owner an amount equal to the difference between the Bid of the Bidder on whom the bond was written and the Bid of the Bidder who is finally awarded the Contract and who executes the Agreement and provides the required bonds, up to the penal sum of the Bond.

D. In addition, the Owner expressly reserves the right to reject any Bid if the Bid Bond (or Bid Bond rider) conditions the Bid in a way inconsistent with the Bid Documents. Examples include but are not limited to:

1. a condition prohibiting the Owner from making a Claim against the Performance Bond Surety that would be allowable under the Contract and Performance Bond form published in the Bid Documents;
2. a condition that provides that the Performance Bond Surety cannot be held liable for completing the Contract in case of default; or
3. a condition limiting the Performance Bond Surety's liability for damages inconsistent with the Contract and Performance Bond form published in the Bid Documents.

E. On all contracts that will equal to or exceed $100,000, the performance bond and the payment bond must be provided by a surety that has a rating of “A” from AM BEST, MOODY’S or STANDARD & POORS.

In the event that the total bid amount is $50,000 or less, the successful contractor has the option to enter into a single payment contract with the City of Edinburg in lieu of a Performance Bond, provided that no money shall be paid to the contractor until completion of the work by the contractor and accepted of same by the City of Edinburg. In the event that the total bid amount is $25,000 or less, the successful contractor has the option to enter into a single payment contract with the City of Edinburg in lieu of a Payment and Performance Bond.

6.05 BID FORM SIGNATURE

A. Document 00310 - Form of Proposal shall be signed by the Bidder as follows:

1. Sole Proprietorship: Full name, address, and signature of sole proprietor, signed in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature.

2. Partnership: Name and address of the firm, signature of each partner in the presence of a witness who will also sign. The full name and address of each partner shall be given.

3. Corporation: Signature of duly authorized officer.

4. Joint Venture: Each party of the joint venture shall execute Document 00310 - Form of Proposal under their respective seals in a manner appropriate to such party as described above, similar to the requirements of a Partnership.

7.00 DETERMINING LOWEST RESPONSIVE, RESPONSIBLE BIDDER

7.01 BIDDERS QUALIFICATIONS

A. Bids must contain evidence of Bidder's qualifications to do business in the state of Texas. To demonstrate that the Bidder is responsible and able to perform the Work, funding policies dictate each Bidder must submit, as a part of the Bidding Documents, all of the items listed below:

00310 Form of Proposal

00405 Schedule of Unit Price Work

00411 Bid Bond

00420 Statement of Bidder’s Qualifications

00423 Certification of Bidder’s Qualifications

00425 Equipment & Material Suppliers List

00429 Non-Bribery Model Form

00460 Non-Collusion Affidavit

00470 Conflict of Interest Disclosure

B. Only the above data/information provided with the Bidding Documents may be used for evaluation and developing the Recommendation to Award by the Engineer. Bidders will not be

allowed to substitute any “Key Personnel” other than alternates presented in the bid or examples of previous projects submitted in the bid package. Minor clarifications of submitted materials will be permitted after bid opening. Such request for clarifications will only be initiated by the Engineer in writing and only written responses will be accepted.

C. In determining the lowest responsible, responsive Bidder, in addition to price, the following elements will be considered:

1. The quality, availability, and adaptability of the supplies, materials, equipment, or contractual services, to the particular use required;

2. The ability, capacity and skill of the bidder to perform the contract or to provide the service required;

3. Whether the bidder can perform the contract and provide the service promptly, or within the time required, without delay or interference;

4. The character, responsibility, integrity, reputation, and experience of the bidder;

5. The quality of performance of previous services, or contracts;

6. The previous and existing compliance by the bidder with laws relating to the contract or service;

7. Any previous or existing noncompliance by the bidder with specifications, or requirements relating to time of submission of specified data such as samples, models, drawings, certificates, or other information;

8. The sufficiency of the financial resources and ability of the bidder to perform the contract or to provide the service; and

9. The ability of the bidder to provide competent personnel for the job, as demonstrated by the submitted listing of the names and the skills of experienced personnel, including potential alternates, whom the bidder currently employs and who will be available for performing this work;

10. The experience of the bidder in performing work similar in type, size and complexity to this project, as demonstrated by a listing of projects, with verifiable references (names, addresses, phone numbers, etc.), successfully completed.

11. Bidder shall provide with the Bid an experience statement with pertinent information regarding similar projects and other evidence of qualifications for each such Subcontractor, Supplier, person, or organization.

7.02 BIDDER MUST MEET THE FOLLOWING MINIMUM CRITERIA:

(A) The Bidder must demonstrate **Successful Completion during the last five (5) years of at least one project comparable in nature and scope to this project. The comparable scope shall be at least 1/4 the size of the proposed project.

(B) At least two *Key Personnel, and their potential alternate, employed by the Bidder must have a minimum of five (5) years experience in similar construction projects.

(C) The Bidder must have an employee, to be dedicated to this project, who is experienced in scheduling, with demonstrated ability in employing scheduling techniques similar to those to be used for this project.

(D) Bidder may, at its discretion, include resumes of alternates for Key Personnel, and if in the process of bid evaluation, the Owner rejects any Key Personnel, the Owner will consider the alternates.

* KEY PERSONNEL: Individuals who will be directly assigned to this project. Resumes of Key Personnel must be submitted with the Bid (include in Document 00420) and accepted by the Owner in order for Bidder to receive the Award. At the minimum, the resumes for the following personnel that are to be assigned to this Project are to be submitted.

(a) Owner or Principals of the Bidder

(b) The Project Manager

(c) The Project Superintendent

(d) The Project Scheduler

(e) Minimum of two Foremen

**SUCCESSFUL COMPLETION: Defined as completion of a project on time, no more than thirty (30) days later than the original contract time, and within budget, within 5% of the original contract price. If there is any project submitted by the Bidder as qualifying, but which does not meet these requirements, in order to be fully responsible, the Bidder is required to submit detailed information on that project demonstrating what caused the increases to cost or time. The name and telephone numbers of the Design Engineer and the Client are to be provided for evaluation as to whether the project may be considered “successful”. For any project where liquidated damages were assessed, the Bidder will not be considered to have been on time.

7.03 BIDDERS ARE REQUIRED TO SUBMIT WITH THEIR BID:

00310 Form of Proposal

00405 Schedule of Unit Price Work

00411 Bid Bond

00420 Statement of Bidder’s Qualifications

00423 Certification of Bidder’s Qualifications

00425 Equipment & Material Suppliers List

00429 Non-Bribery Model Form

00460 Non-Collusion Affidavit

00470 Conflict of Interest Disclosure

(A) Failure to submit these items with the bid will result in a finding that the bid is non-responsive and the bid will be disqualified.

7.04 The Owner will evaluate and compare only the bids determined to be responsive in accordance with the following:

(a) Is the bid complete (all Bidding Documents submitted);

(b) Have documents been properly signed;

(c) Are the required bid securities part of the bid package; and

(d) Are there any computational errors present?

7.05 The Owner reserves the right to accept or reject any variation, deviation, or alternative offer which is not submitted in accordance with the bidding documents. Variations, deviations, alternative offers, and other factors that are in excess of the requirements of the bidding documents or which otherwise result in unsolicited benefits for the Owner, shall not be taken into account in bid evaluation.

7.06 In evaluating the bids, the Owner will determine for each bid, the evaluated bid price by adjusting the bid price as follows:

A. Making any correction for errors;

B. Excluding provisional sums and the provision, if any, for contingencies in the price schedules;

C. Taking an appropriate adjustment for any other quantifiable acceptable non-material variations, deviations or alternative offers; and

D. Making appropriate adjustments to reflect additional factors in the manner and to the extent indicated in the Bidding Documents.

7.07 The Owner will award the contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the lowest evaluated bid price provided that such bidder has been determined to be qualified to perform the contract satisfactorily in accordance with the provisions of the Bidding Documents.

8.00 OFFER ACCEPTANCE, REJECTION

8.01 ACCEPTANCE

A. The Owner will give notice of intent to award the Contract to the Low Bidder. Acceptance by the Owner is conditioned upon Bidder's submission of information for establishing satisfactory qualifications, if required; and execution of submittals required in Document 00450 - Post-Bid Procedures.

B. The Bid shall remain open to acceptance and shall be irrevocable for the Period for Bid Acceptance stated in Document 00020 – Notice to Bidders.

C. Additional time taken by Contractor to fulfill requirements for submittals, including review and re-submittal, shall be added to the acceptance period.

8.02 REJECTION

A. The Owner reserves the right to reject any and all Bids or to accept any Bid deemed advantageous to it.

8.03 BID TABULATION

A. The Engineer will tabulate, record, and evaluate the Bids of all responsible Bidders after the Bid opening.

B. In tabulating Bids, the amount written for a unit price governs over the total amount calculated. Therefore, the Engineer may correct any mathematical errors in the extension of the total amount based on the unit price given by a Bidder and adjust their Total Bid Price.

9.00 APPROVAL BY THE FUNDING AGENCIES

A. All addenda, contracts, work directives, change orders, time extensions, and other matters specified in the Contract Documents are not valid until approved in accordance with the City of Edinburg's Purchasing Policies and Procedures Manual.

END OF DOCUMENT

Document 00300

CONTRACTOR NOTICE OF INTENT TO RESPOND

Firms interested in submitting a bid on the project as outlined in the specifications, should indicate their intention by signing, dating and returning the form to the address below prior to June 17, 2021, so that they may receive any addendums to the specifications should the need arise.

Owner:
City of Edinburg
Attn**:** Finance Department
415 W. University Drive
Edinburg, Texas 78539
lfuentes@cityofedinburg.com

Architect:
Milnet Architectural Services, PLLC.
Attn: Rudy Molina, AIA
608 S.12th St.
McAllen, TX. 78501
rudym@milnet-archservices.com

EMAIL THIS FORM BACK TO CITY FINANCE AND ARCHITECT

Bidder: _____
[Please print or type the full name of your proprietorship, partnership, corporation, or joint venture.*)

Contact Name: _____
[Please print or type name] [Title]

Address: _____
[Mailing]

_____
[Street, if different]

Telephone: _____
[Print or type telephone number]

Fax: _____
[Print or type telephone number]

Email: _____
[Print or type telephone number]

END OF DOCUMENT

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Document 00310

FORM OF PROPOSAL

To: CITY OF EDINBURG

Project No.: **Bid#: 2021-29**

Project: **El Tule Recreation Center**

Bidder: _____
[Print or type full name of proprietorship, partnership, corporation, or joint venture]

1.0 OFFER

Having examined the place of the Work and all matters referred to in the Bid Documents, and the Contract Documents prepared by or approved by the Engineer for the named Project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Total Bid Price of:

_____(Dollars)

[Print or type in words, Bidder's Total Bid Price]

($_____)
[Print or type in figures, Bidder's Total Bid Price]

300 days
[Calendar Days]

Unit Price or Combination Stipulated Price and Unit Price Contract. If the Bid is for a Unit Price Contract or a combination of Stipulated Price and Unit Price Contract, the Total Bid Price, including Cash Allowances, if any, is tabulated in: Document 00405 - Schedule of Unit Price Work for a Project with no Alternate Bids, or Document 00407 - Schedule of Alternates for a Project with Alternate Bids.

Cash Allowances. All Cash Allowances, totaled in either Document 00405 - Schedule of Unit Price Work, as applicable, and described in the Bid Documents are included in the Total Bid Price.

Changes in Contract Price Due to Variations in Actual Quantities. For items quoted in Document 00405 - Schedule of Unit Price Work, the Total Bid Price is based in whole or in part on the Unit Price multiplied by the quantity for each of the items listed. The Contract Price is subject to change due to variation in the actual quantities of each item in the completed Work in accordance with the Contract Documents.

Alternate Bids. Alternate Bid work, as described in the Bid Documents, will be performed for an amount added or deducted to the Total Bid Price for each Alternate Bid that is accepted by the Owner. The Owner may accept or reject any or all Alternate Bids.

Security Deposit. Included herewith is a Security Deposit in the amount of 5 percent of the greatest amount of the Total Bid Price, or Total Alternate Bid Price(s).

Period for Bid Acceptance. This offer shall be open to acceptance and is irrevocable for 90 days from the Bid date. That period may be extended by mutual written agreement of the Owner and the Bidder. After 90 days, the Bidder may withdraw without penalty if no mutual agreement can be reached.

2.0 CONTRACT TIME

If this offer is accepted, Substantial Completion of the Work will be achieved within the time stated in Document 00020 - Notice to Bidders. The Date of Commencement will be established by the Notice to Proceed.

3.0 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted therein have been considered and all costs relating thereto are included in the Bid Price:

Addendum No._____, dated _____

Addendum No._____, dated _____

Addendum No._____, dated _____

Addendum No._____, dated _____

Addendum No._____, dated _____

Addendum No._____, dated _____

4.0 SUPPLEMENTS TO THIS BID:

The following Supplements are attached as an integral part of this Bid:

[ ] Document 00405 - Schedule of Unit Price Work, if applicable
[ ] Document 00411 – Bid Bond (*Form supplied by Bidder*)
[ ] Document 00420 – Statement of Bidder's Qualifications
[ ] Document 00423 – Certification to Bidder's Experience & Qualifications
[ ] Document 00425 – Equipment & Material Suppliers List

5.0 SIGNATURES:

Bidder: _____
[Please print or type the full name of your proprietorship, partnership, corporation, or joint venture.*)

By:_____
[Signature]** [Date]

Name:_____
[Please print or type name] [Title]

Address:_____
[Mailing]

_____
[Street, if different]

Telephone:_____
[Print or type telephone number]

* *If the Bid is a joint venture, add additional Bid form signature sheets for each member of the joint venture.*

** *The undersigned, as bidder, certifies that the only person or parties interested in this proposal as principals are those named herein; that the Bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the Contract for the Project.*

Note: This document constitutes a government record, as defined by § 37.01 of the Texas Penal Code. Submission of a false government record is punishable as provided In § 37.10 of the Texas Penal Code.

END OF DOCUMENT

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Document 00405

SCHEDULE OF UNIT PRICE WORK

This Document, constitutes a Supplement to Document 00310 - Form of Proposal.
When a Contract is awarded, this Document becomes a supplement to Document 00500 - Form of Agreement between Owner and Contractor.

Base Bid					
SPEC NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE (in figures)	UNIT TOTAL (in figures)
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				$	$
				Total	$
In case of DISCREPANCIES, Unit Price RULES OVER Unit Total and Total Amounts.					

TOTAL BID PRICE (Total Unit Prices)

$_____

Notes:

(1) United States Dollars. In the event of a discrepancy, this column shall govern.

Project:_____

Project No._____ Bidder's Signature:_____

Company:_____ Name: _____

Date:_____ Title:_____

END OF DOCUMENT

Document 00411

BID BOND

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section describes the standardized bid bond form to be submitted with the bid on the project.

1.02 REFERENCES – Not Used

1.03 DEFINTIONS – Section 0700

1.04 BID BOND FORMS

Bidder is to inset an original bid bond or a copy of cashiers check provided for bid bond Purposes. Original check is to be submitted along with bid.

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION

STANDARIZED FORMS FOLLOW

Bidder	**Surety**
Name: **[Full formal name of Bidder]** Address *(principal place of business)*: **[Address of Bidder's principal place of business]**	Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner	**Bid**
Name: **[Full formal name of Owner]** Address *(principal place of business)*: **[Address of Owner's principal place of business]**	Project *(name and location)*: **[Owner project/contract name, and location of the project]** Bid Due Date: **[Enter date bid is due]**
Bond Penal Sum: **[Amount]** Date of Bond: **[Date]**	

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
_____ *(Full formal name of Bidder)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation will be null and void if:

   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

   3.2. All Bids are rejected by Owner, or

   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.

6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the

provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

END OF SECTION

DOCUMENT 00420

STATEMENT OF BIDDER'S QUALIFICATIONS

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?	☐ Yes ☐ No ☐ Pending		

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business, if applicable:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		

☐ HUBZone Business (Historically Underutilized) Business			
☐ Other			
☐ None			

ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide Annual Gross Revenue (Past Year): ❑$100,000 or less ❑ $100,000 - $500,000 ❑ $500,000 - $1,000,000 ❑ $1,000,000 - $5,000,000 ❑ $5,000,000 and over

5.02 Will bidder/proposer provide copy of its financial statements for the past two years , if requested by the City of Edinburg? ❑ Yes ❑ No

ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:	
Surety is a corporation organized and existing under the laws of the state of:	
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No

Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?			☐ Yes ☐ No
Does provider have an A.M. Best Rating of A-VII or better?			☐ Yes ☐ No
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business's safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.

E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent		Safety Manager	Quality Control Manager
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

END OF DOCUMENT

DOCUMENT 00423

CERTIFICATE OF BIDDER'S EXPERIENCE & QUALIFICATIONS

The undersigned bidder certifies that he is, at the time of bidding, and shall be, throughout the period of the contract, licensed by the State of Texas to do the type of work required under terms of the contract documents. Bidder further certifies that he is skilled and regularly engaged in the general class and type of work called for in the contract documents.

The bidder represents that he is competent, knowledgeable and has special skills on the nature, extent and inherent conditions of the work to be performed. Bidder further acknowledges that there are certain peculiar and inherent conditions existent in the construction of the particular facilities which may create, during the construction program, unusual or peculiar unsafe conditions hazardous to persons and property. Bidder expressly acknowledges that he is aware of such peculiar risks and that he has the skill and experience to foresee and to adopt protective measures to adequately and safely perform the construction work with respect to such hazards.

Signed this _____ day of _____, 20____.

_____
Name of Bidder

_____
Signature of Bidder

_____
Title of Signatory

END OF SECTION

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DOCUMENT 00425

EQUIPMENT & MATERIAL SUPPLIERS LIST

PURPOSE: To assist the Owner in determining the ability of each Bidder to properly fulfill the requirements of this proposed contract, the Bidder shall complete the following items. All questions must be answered and the data given must be clear and comprehensive. If necessary, questions may be answered on separate attached sheets as specified by 00420 Statement of Bidder's Qualifications. If, in the course of evaluating the bids, the Owner discovers that answers to these questions are false or misleading then the Owner reserves the right to reject the bid based on non-responsiveness. **This statement must be notarized.**

The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Qualifications.

A. EQUIPMENT AVAILABLE FOR THIS CONTRACT: The Bidder shall provide below a list of equipment available for use on this contract:

EQUIPMENT	OWN	RENT/LEASE (Supplier & Phone #)

B. MATERIALS AND MAJOR EQUIPMENT: The Bidder shall provide below a list of manufacturers and suppliers of major equipment and materials proposed on this contract:

ITEM	MANUFACTURER OR SUPPLIER

BIDDER

Executed this: _____ Day of : _____ 20.

By: _____

BIDDER

Title: _____

NOTARY PUBLIC

State of Texas

County of:

Subscribed and sworn to before me this: _____

_____

NOTARY PUBLIC

END OF SECTION

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DOCUMENT 00429

CITY OF EDINBURG NON-BRIBERY MODEL FORM

[*Bidder's letterhead*]

[*Date*]

[*Name and address*]

Dear [*Name of Owner*] :

The undersigned party certifies that [*Name of bidding company*] complies with the following criteria:

1. They have not engaged and will not engage in bribery of officials related to potential or active City of Edinburg projects.

2. Respondents shall not offer gratuities, favors or any monetary value to any official or employee of the City for purpose of influencing the selection. Any attempt by any Respondent to influence the selection process by any means, other than disclosure of qualifications and credentials through the proper channels, shall be grounds from exclusion from the selection process. Once the project is advertised, there shall be no contact with any city official or employee unless using the formal process through the Purchasing Department. Failure to comply will result in the firm being disqualified from the process.

3. They have corporate policies that clearly prohibit the use of any bribery in a corporate activity.

4. They have neither been convicted of (nor found by a civil judgment to have committed) bribery of domestic officials, fraud, embezzlement, theft, forgery, destruction of records, making false statements to government officials, receiving stolen property, or any other offense indicating a lack of business integrity or business honesty, within five years of the date of this certification.

_____
Printed name

_____
Signature

_____
Position in bidding company

_____
Date

END OF SECTION

Document 00450

POST-BID PROCEDURES

1.0 DOCUMENT INCLUDES

A. Notice of Intent to Award.

B. Agreement.

C. Requirements of Bidder.

D. Failure of Bidder to comply with requirements.

E. Notice to Proceed.

F. Pre-construction Conference.

G. Starting the Project.

2.0 NOTICE OF INTENT TO AWARD

A. Owner will provide written Notice of Intent to Award (the Contract) to the selected bid or proposal, stating that upon compliance with the conditions listed herein within 14 days after receipt of the notice, and on approval by Owner, Owner will execute and deliver the Agreement.

3.0 FORM OF AGREEMENT

A. The Agreement shall be Document 00500 - Agreement between the Owner and Contractor, together with Supplements enumerated in and attached thereto.

4.0 REQUIREMENTS OF BIDDER

A. Within 14 days of receipt of the Notice of Intent to Award, the selected bidder or proposal shall execute and deliver to the Engineer for the Owner's approval those documents indicated by an "X" below:

[X] Document 00500 - Agreement Between the Owner and Contractor

[X] Document 00610 - Performance Bond (100% of the Contract Amount)

[X] Document 00620 - Payment Bond (100% of the Contract Amount)

[X] Document 00625 - Affidavit of Insurance *(with Certificate of Insurance attached)*

5.0 FAILURE OF BIDDER TO COMPLY WITH REQUIREMENTS

A. Should the Bidder on receipt of the Notice of Intent to Award fail to comply with requirements of this Document 00450 within the stated time, the Owner may declare the award in default and require forfeiture of the Security Deposit.

B. After Owner's written notice of default to the Bidder or proposal, Owner may award the Contract to the responsible Bidder whose offer is the next advantageous bid or proposal, and the Security Deposit of the Bidder in default shall be forfeited to the Owner in accordance with the provisions of Document 00100 - Instructions to Bidders.

6.0 NOTICE TO PROCEED

A. Upon Owner's execution of the Agreement and delivery to Contractor, the Engineer shall give the Contractor Notice to Proceed within 30 days after the Effective Date of the Agreement, which notice shall establish the Date of Commencement of the Work.

7.0 PRE-CONSTRUCTION CONFERENCE

A. Not later than 10 days after the date of Notice to Proceed, but before Contractor starts work at the site, Owner will convene a Pre-construction Conference as specified in Section 01312 - Coordination and Meetings.

8.0 STARTING THE PROJECT

A. Contractor shall start performance of the Work at the site on the Date of the Commencement of the Work, but no Work shall be done at the site prior to that date.

B. As Contractor, verify that you and all Subcontractors pay the Prevailing Wage.

END OF DOCUMENT

SECTION 00460

NONCOLLUSION AFFIDAVIT

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section describes the standardized forms for use in Bidder and Contractor representations and certifications for the project.

1.02 REFERENCES – Not Used

1.03 DEFINTIONS – Section 0700

1.04 REPRESENTATIONS AND CERTIFICATIONS

A. Affidavit of Non-collusion

B. Historically Underutilized Business (HUB) Certification (Bidder to insert appropriate certification notice at the end of this Section).

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION – Not Used

STANDARIZED FORMS FOLLOW

NONCOLLUSION AFFIDAVIT OF PRIME BIDDER

STATE OF TEXAS
COUNTY OF HIDALGO

_____, being first duly sworn, deposes and says that:
(Name)

(1) He is President of _____, the Bidder that has submitted the attached Bid;
(Company)

(2) He is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid.

(4) Neither said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest , including this affiant, has in any way colluded, conspired, connived or agreed directly or indirectly with another Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix an overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the **CITY OF EDINBURG**, or any person interested in the proposed Contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including affiant.

Sign _____

Title _____

Subscribed and sworn to me this_____ day of _____, 20____.

By:

Notary Public
My commission expires

END OF SECTION

SECTION 00470

NONCOLLUSION AFFIDAVIT

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section describes the standardized forms for use in Bidder and Contractor representations and certifications for the project.

1.02 REFERENCES – Not Used

1.03 DEFINTIONS – Section 0700

1.04 REPRESENTATIONS AND CERTIFICATIONS

A. Conflict of Interest Disclosure

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION – Not Used

STANDARIZED FORMS FOLLOW

CONFLICT OF INTEREST DISCLOSURE

Prospective contractors should carefully consider whether any of their activities may give rise to an improper conflict of interest situation. Conflict of interest situations that are not properly addressed can result in a loss of funding to a specific program and/or to the City of Edinburg, and in some cases can result in civil or criminal liability.

Organizations that may enter into a contract with the City of Edinburg should examine the following:

* Are any employees or board members of the organization,
  - A City of Edinburg employee or consultant who exercises program or project specific functions as part of their City position?
  - A member of a Board, Council or Committee that may participate in the City's selection or award process?
  - A City Official?

* Are any immediate family members or business associates of my employees or board member's,
  - A City of Edinburg employee or consultant who participates in the City's selection or award process as part of their City position?
  - A member of a Board, Council or Committee that may participate in the City's selection or award process?
  - A City Official?

* Will any of my employees or board members receive a financial interest or benefit from any project funded and administered through the City (other than employee salaries or personnel benefits)?

* Will any immediate family members or business associates of my employees or board members receive a financial interest or benefit from any project funded and administered through the City (other than employee salaries or personnel benefits)?

* To my knowledge, will my program or project have a financial effect on a City official or employee who exercises City-related functions, or an immediate family member or business associate of such person? For example, will any of these persons be receiving rental payments, other business income, or program services from my company or services offered?

If you can answer "yes" to any of these questions, it is possible that there may be a conflict of interest. You should review the rules below to determine whether an actual conflict situation is raised, and, if so, what action needs to be taken to avoid a violation of the law. You should contact City staff immediately if you suspect that there might be an issue.

Any contractor entering into an agreement with the City will be required to warrant and represent, to the best of his/her knowledge at the time the contract is executed, he/she is not aware of any improper conflict of interest as described. Also, the contract will obligate contractors to exercise due diligence to ensure that no improper conflict situations occur during the contract.

The following Federal, State and local regulations and policies, govern projects funded through the City of Edinburg:

* 2 CFR Part 200 [Subpart B 200.112 and Subpart D 200.318]
* Texas Local Government Code Chapter 171.004
* City of Edinburg Policies & Procurement Manual

a. Certification:

I, the undersigned, certify and report that to the best of my knowledge,

☐ I have no conflict of interest to disclose

☐ I have the following conflict of interest to disclose:

_____
_____
_____

Date: Company/Vendor Name:

_____ _____

Printed Name and Title: Authorized Signatory:

_____ _____

END OF SECTION

Document 00500

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

1. A101 - 2017 Standard form of Agreement owner and contractor (see attached).
2. A101 Exhibit 'A' - 2017 Insurances and Bonds (see attached).
3. A201 - 2017 General Conditions of the contract for Construction (see attached).

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the _____ day of _____ in the year _____
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement.

AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

☐ The date of this Agreement.

☐ A date set forth in a notice to proceed issued by the Owner.

☐ Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

☐ Not later than ( ) calendar days from the date of commencement of the Work.

☐ By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

_____ % _____

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

☐ Arbitration pursuant to Section 15.4 of AIA Document A201–2017

☐ Litigation in a court of competent jurisdiction

☐ Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

☐ The Sustainability Plan:

Title	Date	Pages

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	CONTRACTOR *(Signature)*
(Printed name and title)	*(Printed name and title)*

AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the _____ day of _____ in the year _____
(In words, indicate day, month and year.)

for the following PROJECT:
(Name and location or address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

THE OWNER:
(Name, legal status and address)

THE CONTRACTOR:
(Name, legal status and address)

TABLE OF ARTICLES

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's

property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Cause of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures
If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.
The Owner shall purchase and maintain the insurance selected and described below.
(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

☐ § A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

☐ § A.2.4.2 Ordinance or Law Insurance, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

☐ § A.2.4.3 Expediting Cost Insurance, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

☐ § A.2.4.4 Extra Expense Insurance, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

☐ § A.2.4.5 Civil Authority Insurance, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

☐ § A.2.4.6 Ingress/Egress Insurance, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

☐ § A.2.4.7 Soft Costs Insurance, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

☐ § A.2.5.1 Cyber Security Insurance for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

☐ § A.2.5.2 Other Insurance
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than _____ ($__) each occurrence, _____ ($__) general aggregate, and _____ ($__) aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
.2 personal injury and advertising injury;
.3 damages because of physical damage to, or destruction of, tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the work involves such hazards.

.11 Claims related to explosion, collapse, and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than _____ ($__) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than _____ ($__) each accident, _____ ($__) each employee, and _____ ($__) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than _____ ($__) per claim and _____ ($__) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than _____ ($__) per claim and _____ ($__) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than _____ ($__) per claim and _____ ($__) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than_____ ($__) per claim and_____ ($__) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than_____ ($__) per claim and_____ ($__) in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

☐ § A.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below.

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

☐ § A.3.3.2.2 Railroad Protective Liability Insurance, with policy limits of not less than _____ ($__) per claim and _____ ($__) in the aggregate, for Work within fifty (50) feet of railroad property.

☐ § A.3.3.2.3 Asbestos Abatement Liability Insurance, with policy limits of not less than _____ ($__) per claim and _____ ($__) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

☐ § A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

☐ § A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

☐ § A.3.3.2.6 Other Insurance

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	
Performance Bond	

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

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INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining

provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building

information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the

site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's

capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes

remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the

time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under

Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the

Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate

Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The

Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable

by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The

foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers

to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not

constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents;
.3 terms of special warranties required by the Contract Documents; or
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the

endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The

Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the

Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section

15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly

consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00510

NOTICE OF AWARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section describes the standardized Notice of Award form for use in the project.

1.02 REFERENCES – Not Used

1.03 DEFINTIONS – Section 0700

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION (FORMS ON FOLLOWING PAGES)

STANDARIZED FORM FOLLOWS

NOTICE OF AWARD

Date

Owner: City of Edinburg Owner's Project No.: Bid#: 2021-29

Engineer: Name

Project: Name

Bidder: Name

Bidder's Address: Address

You are notified that Owner has accepted your Proposal dated **(Date)** for the above Contract, and that you are the Successful Proposal and are awarded a Contract for:

Base Proposal

The Contract Price of the awarded Contract is **(Contract Amount).** Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

Four (4) unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☒ Drawings will be delivered separately from the other Contract Documents by Engineer of Record.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **four (4)** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **City of Edinburg**

By *(signature)*: _____

Name *(printed)*: Mardoqueo Hinojosa, P.E., CFM, CPM

Title: City Engineer

Cc: (Engineering Firm)

END OF SECTION

SECTION 00550

NOTICE TO PROCEED

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section describes the standardized Notice to Proceed form for use in the project.

1.02 REFERENCES – Not Used

1.03 DEFINTIONS – Section 0700

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION

TO BE ISSUED BY ENGINEER

NOTICE TO PROCEED

Date:

To:

Project No.: Bid#: 2021-29
Project: El Tule Recreation Center

You are notified that the Contract Time under the above contract will commence to run on _____. By this date you are to start performing your obligations under the Contract Documents.

In accordance with the Agreement the date of Substantial Completion is _____ and Final Completion is _____, respectively.

Before you may start any Work at the site, the General Conditions and Contract Documents provides that you and Owner must each deliver to the other (with copies to ENGINEER) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also before you may start any work at the site you must
1. Notify the City 48 hours prior to beginning construction.
2. Setup construction barricades.
3. Setup erosion control measures.
4. _____
5. _____

Copy to ENGINEER:

(Engineer/Firm Name)

OWNER: City of Edinburg

By_____
(Name)

(Title)_____
Title

By_____
Mardoqueo Hinojosa

City Engineer_____
Title

ACCEPTANCE OF NOTICE BY BIDDER

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____, this the _____ day of _____, 20____. (Contractor)

BY: _____

TITLE: _____

END OF SECTION

PERFORMANCE BOND

Contractor Name: **[Full formal name of Contractor]** Address *(principal place of business)*: **[Address of Contractor's principal place of business]**	**Surety** Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner Name: **[Full formal name of Owner]** Mailing address *(principal place of business)*: **[Address of Owner's principal place of business]**	**Contract** Description *(name and location)*: **[Owner's project/contract name, and location of the project]** Contract Price: **[Amount from Contract]** Effective Date of Contract: **[Date from Contract]**

Bond

Bond **[Amount]**

Date of Bond: **[Date]**

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **[None]**

PAYMENT BOND

Contractor Name: **[Full formal name of Contractor]** Address *(principal place of business)*: **[Address of Contractor's principal place of business]**	**Surety** Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner Name: **[Full formal name of Owner]** Mailing address *(principal place of business)*: **[Address of Owner's principal place of business]**	**Contract** Description *(name and location)*: **[Owner's project/contract name, and location of the project]** Contract Price: **[Amount, from Contract]** Effective Date of Contract: **[Date, from Contract]**

Bond

Bond Amount: **[Amount]**

Date of Bond: **[Date]**

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
    5.1. Claimants who do not have a direct contract with the Contractor
        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
    7.2. Pay or arrange for payment of any undisputed amounts.
    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have

reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

16.1. *Claim*—A written statement by the Claimant including at a minimum:

16.1.1. The name of the Claimant;

16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

Modifications to this Bond are as follows: **[None]**

Document 00625

AFFIDAVIT OF INSURANCE

THE STATE OF TEXAS §
§ KNOW ALL MEN BY THESE PRESENTS:
THE COUNTY OF _____

BEFORE ME, the undersigned authority, on this day personally appeared

_____, who
[Affiant]

being by me duly sworn on his oath stated that he is_____, of
[Title]

_____
[Contractor's Company Name]

the Contractor named and referred to within the Contract Documents; that he is fully competent and authorized to give this affidavit and that the attached original insurance certificate truly and accurately reflects the insurance coverage that is now available and will be available during the term of the Agreement.

_____
[Affiant's Signature]

SWORN AND SUBSCRIBED before me on _____.
[Date]

_____
Notary Public in and for the State of TEXAS

_____
[Print or type Notary Public name]

[Notary Seal] My Commission Expires:_____
[Expiration Date]

END OF DOCUMENT

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Document 00630

FORM OF BUSINESS

Please, fill in the appropriate area describing your firm's form of business and include the relevant attachments.

Corporation:

Corporate Name:_____
State of Incorporation:_____
Mailing Address:_____

- Certificate of Assumed Name, if operating under a name different than that on the corporate charter (the Certificate must have been issued within the past ten years to be valid)
- Certificate of Good Standing*
- Certificate of Existence (if non-Texas corporation, Certificate of Authority) *

Partnership/Joint Venture:

Partnership/Joint Venture Name:_____
Mailing Address:_____

- Copy of the Partnership or Joint Venture Agreement, or Affidavit with the name of the partnership or joint venture, the names of the individual partners or participants in the joint venture, and a statement that the partnership or joint venture is in existence
- Certificate of Assumed Name, (the Certificate must have been issued within the past ten years to be valid)
- If firm is a limited partnership, the Certificate of Limited Partnership
- If any partner or joint venturer is a corporation, the above information relating to corporation must be included as to each sum partner or joint venturer.

Sole Proprietorship

Name:_____
Mailing Address:_____

- Certificate of Assumed Name, if operating under a name different than that of the sole proprietor (the Certificate must have been issued within the past ten years to be valid)

* *Must be furnished upon request of the Owner and must be less than 90 days old*.

_____
[Typed Name and Title of Authorized Representative]

_____ _____
[Signature of Authorized Representative] [Typed Date]

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Document 00631

RESOLUTION OF CORPORATION

I hereby certify that it was RESOLVED by a quorum of the directors of

_____
[Name of Corporation / Contractor]

meeting on this_____day of_____, 20____, that_____,
[Corporate Representative]

be, and hereby is, authorized to act on behalf of the Corporation, as its representative, in all business transactions conducted in the State of Texas, and that the above resolution was unanimously ratified by the Board of Directors at said meeting and that the resolution has not been rescinded or amended and is now in full force and effect; and in authentication of the adoption of this resolution, I subscribe my name and affix the seal of the Corporation on this

_____day of, _____, 20____.

_____
Secretary/Assistant Secretary

_____
[Seal]

END OF DOCUMENT

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CONTRACTOR'S RESOLUTION
ON
AUTHORIZED REPRESENTATIVE (ED-104)

_____
Name or Names

I hereby certify that it was RESOLVED by a quorum of the directors of the

_____, meeting
name of corporation

on the day of _____, 20__, that _____, _____,

_____, and _____, be, and hereby is,

authorized to act on behalf of _____, as its
name of corporation

representative, in all business transactions conducted in the State of Texas, and;

That all above resolution was unanimously ratified by the Board of Directors at said

meeting and that the resolution has not been rescinded or amended and is now in full forces

and effect; and;

In authentication of the adoption of this resolution, I subscribe my name and

affix the seal of the corporation this _____ day of _____, 20__.

_____
Secretary

(seal)

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Document 00635

CONTRACTOR'S ACT OF ASSURANCE

THE STATE OF TEXAS

KNOW ALL MEN BY THESE PRESENTS:

THE COUNTY OF _____

BEFORE ME, the undersigned authority, a Notary Public in and for the State of Texas,

on this day personally appeared_____, Affiant,
[Affiant]

who being by me duly sworn on his oath stated that he is_____, of
[Title]

the_____, Contractor, that he is authorized to represent Contractor
[Contractor]

pursuant to provisions of a resolution adopted on this_____day of_____,20____. A duly certified copy of such resolution is attached to and is hereby made a part of this document.

Affiant, in such capacity declares and assures the City of Edinburg that Contractor will construct the Project in accordance with sound construction practice and all laws of the State of Texas.

_____
[Affiant]

SWORN AND SUBSCRIBED before me on this_____day of_____, 20____.

_____
Notary Public in and for the State of TEXAS

_____
[Print or Type Notary Public Name]

_____ My Commission Expires:_____
[Seal] [Expiration Date]

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Document 00640

CERTIFICATION REGARDING DEPARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal, State, or local department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction: violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Section 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both.

_____
[Typed Name of Company:]

_____
[Typed Name & Title of Authorized Representative]

_____ _____
[Signature of Authorized Representative] [Date]

If unable certify the above statements, explanation is attached.

END OF DOCUMENT

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Document 00811

FEDERAL WAGE RATE DECISION

1.01 In accordance with the Davis-Bacon Act (Public Law No. 403, 7th Congress), the public body awarding this Contract does hereby specify the following to be assigned minimum wage rates which will be paid by the Contractor and all Subcontractors for this Project.

1.02 This prevailing wage rate does not prohibit the payment of more than the rates stated.

1.03 The wage scale for (Specify type of work).

Note to Specifier: Davis-Bacon Wage Rates can be found at http://www.wdol.gov/dba.aspx. Use the Wage Rates for Hidalgo County. Select the WD Determination that is appropriate for the Project Copy the Wage Rate directly from the DOL website to this Section.

SECTION 00830

WARRANTY

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section describes the warranty. The conditions contained in this Section are specific administrative and policy requirements in addition to the general conditions and other requirements listed in the contract documents.

1.02 REFERENCES – Not Used

1.03 DEFINITIONS – Section 0700

1.04 CONTRACTOR'S WARRANTY OF TITLE

CONTRACTOR warrants and guarantees that all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

1.05 SUBSTANTIAL COMPLETION

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER and ENGINEER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that ENGINEER issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving the reasons therefore. If ENGINEER considers the Work substantially complete, ENGINEER will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Work is not substantially complete, ENGINEER will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefore. If, after consideration of OWNER's objections, ENGINEER considers the Work substantially complete, ENGINEER will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ENGINEER believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ENGINEER in writing prior to ENGINEER's issuing the definitive certificate of Substantial Completion, ENGINEER's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

1.06 PARTIAL UTILIZATION

A. Use by OWNER at OWNER's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

B. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ENGINEER that such part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER and ENGINEER in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving the reasons therefore. If ENGINEER considers that part of the Work to be substantially complete, the above provisions will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirement of regarding property insurance.

1.07 FINAL INSPECTION

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ENGINEER will promptly make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

1.08 FINAL PAYMENT

A. Application for Payment

1. After CONTRACTOR has, in the opinion of ENGINEER, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified above and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or

OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. Review of Application and Acceptance

If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing ENGINEER's recommendation of payment and present the Application for Payment to OWNER for payment. At the same time ENGINEER will also give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the above provisions. Otherwise, ENGINEER will return the Application for Payment to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due

Thirty days after the presentation to OWNER of the Application for Payment and accompanying documentation, the amount recommended by ENGINEER will become due and, when due, will be paid by OWNER to CONTRACTOR.

D. Final Completion Delayed

If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required above, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

1.09 WAIVER OF CLAIMS

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to the above, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

END OF SECTION

Document 00900

ADDENDUM NO._____
(Sample Form)

Date of Addendum:_____
[Enter date]

PROJECT NAME: El Tule Recreation Center

PROJECT NO: Bid#: 2021-29

BID DATE: (Month, Date, Year). (There is no change to the Bid Date.)

FROM: City of Edinburg
Att: Lorena Fuentes, Purchasing Agent
415 W. University Drive
Edinburg, Texas 78539
Phone: (956) 388-1895

TO: **Prospective Bidders**

This Addendum forms a part of the Bidding Documents and will be incorporated into Contract Documents, as applicable. Insofar as the original Project Manual and Drawings are inconsistent, this Addendum governs. Acknowledge receipt of the Addendum by inserting its number in Document 00310 - Form of Proposal. **FAILURE TO DO SO MAY SUBJECT BIDDER TO DISQUALIFICATION.**

****

Use the following heading and select the appropriate wording for postponement of the Bid Date. Delete the statement beside Bid Date above which indicates that the Bid Date is unchanged. If change in Bid Date, issue as separate addendum. Delete this section entirely if there is no change in Bid Date.

****

CHANGE IN BID DATE

The bid date for this Project has been changed from_____ to_____
[Date] [Date]
[Time of day and place for submittal of bid remains the same]. [Time of submittal has been changed from_____ to_____. The place for submittal remains the same].
[Time] [Time]

[OR]

The bid date for this project has been indefinitely postponed. Another Addendum will be issued to reset the bid date or to cancel bidding on this Project.

****

Delete the following paragraph if the sole purpose of the Addendum is to postpone the Bid Date.

****

This Addendum uses the change page method: remove and replace or add pages, or Drawing sheets, as directed in the change instructions below. Change bars (|) are provided in the right margins of pages from the Project Manual to indicate where changes have been made; no change bars are provided in added Sections. Reissued Drawing Sheets show the Addendum number above the title block and changes in the Drawing are noted by a revision mark.

****

Number each item of the Addendum beginning with 1 through the total number of change items in the Addendum. Sample entries are provided in brackets.

****

CHANGES TO PREVIOUS ADDENDA

****

Reference Addendum Number and item number to correct clarifications or make minor corrections of changes issued by previous Addenda.

****

ADDENDUM NO._____

[1. Add item]

CHANGES TO PROJECT MANUAL

****

Follow this format to sequence changes to the Project Manual.

****

BIDDING REQUIREMENTS

****

Give the individual change instructions for each item of change by Document number and title. List changes in order of Document number.

****

[2. Add Item]

CONTRACT FORMS

[3. Add Item]

CONDITIONS OF THE CONTRACT

[4. Add Item]

SPECIFICATIONS

[5. Add Item]

CHANGES TO DRAWINGS

[6. Add Item]

CLARIFICATIONS

[7. Add Item]

MINUTES OF PRE-BID CONFERENCE

Minutes of the Pre-Bid Conference held on_____, _____, 20___ , are
[Day] [Date]
attached as a record and for the Bidders information.

END OF ADDENDUM NO._____

_____ DATED:_____
Name, P.E.

END OF DOCUMENT

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DOCUMENT 00910

MODIFICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section contains information pertaining to modifications and changes for the Contract Documents for the Project.

1.02 REFERENCES – Not Used

1.03 DEFINTIONS - Section 0700

1.04 MODIFICATIONS OF CONTRACT DOCUMENTS

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) Engineer's approval of a Shop Drawing or Sample; or (iii) Engineer's written interpretation or clarification.

C. Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with Owner: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or Engineer's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adoption by Engineer. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

PART 2 - PRODUCT – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION

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PROJECT MANUAL

Plans and Specifications – Project No. 219014

City of Edinburg
"El Tule" Recreation Center
Edinburg, Texas 78539

TEXAS BOARD OF ARCHITECTURAL EXAMINERS
333 Guadalupe, Suite 2-350, AUSTIN, TX 78701-3942
(Tel: 512/305-9000)
HAS JURISDICTION OVER INDIVIDUALS LICENSED UNDER
THE ARCHITECT'S REGISTRATION LAW
ARTICLE 249a, VERNON'S CIVIL STATUTES".

MILNET ARCHITECTURAL SERVICES, PLLC
608 S. 12th St.
McALLEN, TEXAS 78501
(956) 688-5656 - FAX (956) 687-9289

City of Edinburg
El Tule Recreation Center
Edinburg, Texas 78539
Project No. 219014

END OF TABLE OF CONTENTS

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MEP ENGINEERING

3533 Moreland Dr. Suite A | Weslaco, Texas 78596
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Texas Registered Engineering Firm No. - F10362

6/04/21

DIVISION 21 – FIRE PROTECTION

21 13 13 WET-PIPE FIRE SPRINKLER SYSTEMS

DIVISION 22 – PLUMBING

22 00 00 SUMMARY OF PLUMBING WORK
22 05 00 COMMON WORK RESULTS FOR PLUMBING
22 05 29 HANGERS AND SUPPORTS FOR PLUMBING EQUIPMENT
22 05 53 IDENTIFICATION FOR PLUMBING PIPES AND EQUIPMENT
22 07 19 PLUMBING PIPING INSULATION
22 11 16 DOMESTIC WATER PIPING
22 11 19 DOMESTIC WATER PIPING SPECIALTIES
22 13 13 FACILITY SANITARY SEWERS
22 13 19 FACILITY SANITARY SEWERS SPECIALTIES
22 33 00 ELECTRIC DOMESTIC WATER HEATERS
22 42 00 PLUMBING FIXTURES
22 47 13 ELECTRIC DRINKING FOUNTAIN

DIVISION 23 – HEATING VENTILATION & AIR CONDITIONING

23 00 00 HVAC
23 05 00 COMMON WORK RESULTS FOR HVAC
23 05 29 HANGERS AND SUPPORTS
23 05 30 SUPPORTS AND ANCHORS
23 05 63 IDENTIFICATION FOR HVAC PIPING
23 05 93 TESTING AND BALANCING
23 07 13 DUCT INSULATION
23 23 00 REFRIGERANT PIPING
23 26 00 CONDENSATE DRAIN PIPING
23 31 13 METAL DUCTS
23 33 00 HVAC DUCT ACCESSORIES
23 33 46 FLEXIBLE DUCTS
23 34 16 CENTRIFUGAL FANS
23 37 13 REGISTERS AND GRILLES
23 74 10 PACKAGED ROOFTOP UNITS

DIVISION 26/27/28 – ELECTRICAL

26 00 00 ELECTRICAL
26 01 20 OPERATIONS & MAINTENANCE OF LOW VOLTAGE ELECTRICAL DISTRIBUTION
26 05 00 COMMON WORK RESULTS FOR ELECTRICAL
26 05 19 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 33 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 05 73.13 SHORT CIRCUIT STUDIES
26 05 73.19 ARC-FLASH HAZARD ANALYSIS
26 09 23 LIGHTING CONTROL DEVICES
26 24 16 PANELBOARDS
26 27 26 WIRING DEVICES
26 28 13 FUSES
26 28 16.16 ENCLOSED SWITCHES
26 43 13 SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
26 51 00 INTERIOR LIGHTING
26 56 00 EXTERIOR LIGHTING

27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS
27 10 00 STRUCTURED CABLING

28 23 00 VIDEO SURVEILLANCE
28 31 00 INTRUSION / ACCESS INTEGRATED SYSTEM
28 46 21.11 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEMS

SECTION 00 61 00 — PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND:

A. The Contractor shall, prior to the execution of the Contract, furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in the amount of 100% of the Contract Price covering 100% performance and 100% payment, and with such sureties secured through the contractor's usual sources as may be agreeable to the parties.

B. The Contractor shall deliver the required bonds to the Owner not later than the date of execution of the Contract, or if the work is commenced prior thereto in response to a letter of intent, the Contractor shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be finished.

C. The Contractor shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certificate and current copy of his Power of Attorney.

D. Any Payment Bond and Performance Bond furnished pursuant to the provisions of Art. 5160, Vernon's Texas Civil Statutes, connected with this project, shall be furnished by a corporate surety or corporate or corporate sureties in accordance with Article 7.19-1, Vernon's Texas Insurance Code, that has a stated capital and surplus (as reported by it to the Texas Insurance Commission in its most recent report) that is in excess of ten times the stated amount of the Payment Bond or the Performance Bond. Provided however, that if any Payment Bond or any Performance Bond is in an amount in excess of ten percent (10%) of the surety company's capital and surplus (as reported to the Texas Insurance Commission in its most recent report), as a condition to accepting the bond, the Owner must receive written certification and information, satisfactory in form and substance to the Owner, that the surety company has reinsured the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus, with one or more reinsurers who are duly authorized, accredited or trusteed to do business in the State of Texas. For the purpose of this requirement, any amount reinsured by any reinsurer may not exceed ten percent (10%) of the reinsurer's capital and surplus (as reported to the Texas Insurance Commission by the reinsurer in its most recent report). In the event there is one or more reinsurer, the surety company must provide all necessary information and certification related to the current financial condition of the surety company and any and all reinsurers required by the Owner, together with copies of all reinsurance contracts with the surety company, before any such Payment Bond and Performance Bond is eligible to be considered acceptable by the Owner.

E. ALL CONTRACTORS SHALL SUBMIT THE NAME, ADDRESS AND TELEPHONE NUMBER OF THE CORPORATED SURETIES PROVIDING THE PAYMENT BOND AND PERFORMANCE BOND AND THE LOCAL AGENT.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 00 62 76.13 — TAX EXEMPT ORGANIZATION CERTIFICATE

PART 1 - GENERAL

1.1 DEFINITION

A. This Contract is to be performed for an exempt organization as defined by Title 2; Subtitle E; Chapter 150 of the Texas Limited Sales, Excise and Use Tax Act and Section 151.311 of the State Statutes. The Owner will furnish the Contractor proof or Certificate of Exemption upon award of contract.

B. Proposer shall not include sales tax in their Proposal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 00 73 00 — SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: SUPPLEMENTARY CONDITIONS

A. The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.

B. The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.

C. Paragraph numbers and titles refer to like numbers and titles in the General Conditions.

1.2 EXECUTION, CORRELATION AND INTENT

1.3 Add the following subparagraphs.

1.4 1.2.6 Scope paragraphs placed at the beginning of the SECTIONS present a brief indication of the principal Work included in that SECTION, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.

1.5 The Relation of Specifications and Drawings shall be equal in authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above mentioned disagreements, shall be determined by the Architect, at no additional cost to the Owner.

1.6 1.2.8 Failure to report a conflict in the Contract Documents, prior to opening of Proposal, shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner, at no additional cost to the Owner.

A. 1.2.9 The Specifications have been partially “streamlined” and some words and phrases have been intentionally omitted. Missing portions shall be supplied by inference as with notes on drawings.

B. 1.2.10 The words “inspected”, “directed”, “selected”, and similar words and phrases shall be presumed to be followed by “by Architect”. The words “satisfactory”, “submitted”, “reported”, and similar words and phrases shall be presumed to be followed by “to Architect”. Words like “install”, “provide”, “locate”, “furnish”, and “supply” shall be construed to include complete furnishing and installing of construction. Words like “Bids”, “Bidders”, shall be construed to be “Proposals”, Proposers”, or “offers”, offerors”, respectively.

C. INFORMATION AND SERVICES REQUIRED OF THE OWNER

D. Delete 2.2.5 and replace with the following subparagraph.

E. 2.2.5The General Contractor will be furnished, free of charge, fifteen (15) sets of Drawings and Specifications for use in construction of this Project. Additional Drawings and Specifications will be

furnished the General Contractor at the Contractor's expense, but shall remain the property of the Architect. Cost of additional sets will be the cost of reproduction.

F. LABOR AND MATERIALS

G. Add the following subparagraphs 3.4.3 and 3.4.4 to 3.4:

H. After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications).

I. By making requests for substitutions based on subparagraph 3.4.3 above, the Contractor:

1. Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
2. Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
3. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects, all at no additional cost to the Owner.

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.3.1 CHANGE TO READ:

Mutual acceptance of a lump sum properly itemized in accordance with 7.3.6.1, 7.3.6.2 and 7.3.6.3. Items listed in 7.3.6.4 and 7.3.6.5 shall be a part of the overhead scheduled 7.3.10 following. Items shall be supported by sufficient substantiating data to permit evaluation;

7.3.6 In the first sentence, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in accordance with Clauses 7.3.10.1 through 7.3.10.6 following:

7.3.6.4 DELETE the final "and" then add the following to the sentence: are a part of overhead schedule in 7.3.10 following".

7.3.6.5 ADD the following to the sentence: "are apart of overhead schedule in 7.3.10 following".

ADD the following subparagraph 7.3.10 to 7.3:

7.3.10 In subparagraph 7.3.6, the allowance for the combined and profit included in the total cost to the Owner shall be based on the following schedule:

1. For the Contractor, for Work performance by the Contractor's own forces, 10 percent of the cost.
2. For the Contractor, for Work performance by the Contractor's contractor, 6 percent of the amount due to the Sub-subcontractor.
3. For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's or Sub-subcontractor's own forces, 10 percent of the cost.
4. For each Subcontractor, for Work performed by the Subcontractor's, Sub-subcontractor's, 6 percent of the amount due the Sub-subcontractor.
5. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
6. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over $500.00 be approved without such itemization.

8.1 DEFINITIONS

Add the following subparagraph.

8.1.5 The term working Day as used in the Contract Documents for extensions of time shall mean normal working day excluding weekends and legal holidays.

8.3 DELAYS AND EXTENSIONS OF TIME

Delete paragraph 8.3.2 and replace with the following subparagraph.

8.3.2 Any claim for extension of time shall be made in writing to the Architect not more than ten (10) days after the commencement of the delay; otherwise, it shall be waived. In case of a continuing delay only one claim is necessary. In case of claims for extensions of time because of adverse weather, such extensions of time shall be granted only when such adverse weather prevented the execution of major items of Work on normal working days

and exceeds the number of days included in the Contract time. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work. In the event an extension of time is granted such extension shall be the complete claim allowed. Contractor shall not be entitled to additional compensation such as, but not limited to, compensable extended overhead or lost profit.

9.6 PROGRESS PAYMENTS

Add the following subparagraph to 9.6.1

1. Unless otherwise indicated in the Agreement, the Owner will pay ninety-five (95%) percent of the amount due the Contractor on account of progress payment until final payment.

Add the following paragraphs to 9.11 to Article 9:

9.11 LIQUIDATED DAMAGES:

9.11.1 If the Contractor neglects, fails or refuses to complete the Work within the time specified in the Contract, or any proper extension thereof granted b the Owner, then the Contractor does hereby agree, as part consideration of the awarding of this Contract, to pay the Owner the amount of ***EIGHT HUNDRED DOLLARS ($800.00)*** not as a penalty but as a liquidated damages for such breach of Contract as hereinafter setforth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contractor for completing the Work.

9.11.2 The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would, in such event, sustain.

9.11.3 TIME SPECIFIED IN CONTRACT IS AS FOLLOWS:

The Undersigned agrees to commence work within ten (10) days of Notice to Proceed and to substantially complete the work on or before 300 calendar days after the date of Notice to Proceed.

11.1 Article 11.1 Modify to include the following:

The Contractor shall furnish three (3) copies of insurance certificates to the Architect's office two (2) days after award of the project and before signing of the contract. The Certificate of Insurance shall include thirty (30) Day Notice of Cancellation; Architect and Owner shall receive the same notice in regard to any policy changes.

Owner and Architect shall be named as additional insured by the Contractor but not with respect to payment of premiums due under Contractor's policies. Coverage shall include any off site-work on adjacent public or private property.

Insurance Company/Carrier issuing the certificates must be listed by A.M. Best and have an "A" rating or better and based in the United States Mainland.

The insurance as required in Article 11.1 shall have "Minimum Limits" as follows:

A. WORKER'S COMPENSATION INSURANCE: Statutory Requirements-
   1. All States Endorsements (Broad)
   2. Voluntary Compensation
   3. Waiver of Subrogation Endorsement

B. MINIMUM EMPLOYER'S LIABILITY: $100,000/$100,000/$500,000

C. COMPREHENSIVE GENERAL LIABILITY INSURANCE MINIMUM LIABILITY AND COVERAGE:
   1. Bodily Injury $500,000 each person/$500,000 each occurrence
   2. Property Damage $100,000 each occurrence/$100,000 aggregate

   OR-

   3. $500,000 Combined Single Limit Per Occurrence Bodily Injury and Property Damage.

      a. Premises and operations coverage
      b. Explosion and collapse hazard coverage
      c. Underground hazard coverage
      d. Products/completed operation hazard coverage with limits and coverage continuing one (1) year after job completion.
      e. Broad Form property damage coverage
      f. Personal injury coverage
      g. Waiver of subrogation endorsement
      h. Contractual liability (Broad Form) coverage
      i. Independent contractors coverage (Owners, Architects, and Contractors protective)

NOTE: If General Liability coverage is written on a "Claims Made" basis, the Certificate of Insurance should so indicate. If so written, Contractor agrees that coverage so certified beyond job completion and that coverage written will apply to claims made DURING CONSTRUCTION AND FOR ONE (1) YEAR THEREAFTER.

D. AUTOMOBILE LIABILITY INSURANCE with minimum limits of:
1. Bodily Injury: $250,000 each person/$500,000 each occurrence
2. Property Damage: $250,000 each occurrence/$500,000 Combined Single Limit per Occurrence Bodily Injury and Property Damage.
3. Automobile Liability Insurance shall include coverage for owned, non-owned, and hired vehicles with limits not less than shown above.

E. OWNER'S AND CONTRACTOR'S PROTECTIVE LIABILITY:
1. Bodily Injury $500,000 Single limit each occurrence
2. Property Damage $250,000 each occurrence/$250,000 aggregate

F. UMBRELLA LIABILITY:

Minimum combined single limits $100,000 with same inception and expiration dates as underlying liability policies and with coverage no less broad than in primary program.

G. BUILDER'S RISK INSURANCE:

The Contractor shall FURNISH AND PAY FOR and issue a Certificate of Builder's Risk Coverage to the Owner/Architect in accordance with the General Conditions and Conditions of the Contract.

H. ARTICLE 11.4: PERFORMANCE BOND AND PAYMENT BOND:

Delete in its entirety and substitute the following:

11.4.1: Prior to signing of the Contract, the CONTRACTOR, at HIS/HER OWN EXPENSE, shall furnish a Performance Bond, and a Labor and Materials Payment Bond for one hundred (100%) percent of the Contract price on such form and with such sureties as the Owner may approve. ***Surety company furnishing the Bond must be listed by A.M. BEST and have an "A" rating or better and be based in the United States Mainland and authorized to provide such bonds on public work in the State of Texas.***

J. Any Payment Bond and Performance Bond furnished pursuant to the provisions of Art. 5160, Vernon's Texas Civil Statutes, connected with this project, shall be furnished by a corporate surety or corporate or corporate sureties in accordance with Article 7.19-1, Vernon's Texas Insurance Code, that has a stated capital and surplus (as reported by it to the Texas Insurance Commission in its most recent report) that is in excess of ten times the stated amount of the Payment Bond or the Performance Bond. Provided however, that if any Payment Bond or any Performance Bond is in an amount in excess of ten percent (10%) of the surety company's capital and surplus (as reported to the Texas Insurance Commission in its most recent report), as a condition to accepting the bond, the Owner must receive written certification and information, satisfactory in form and substance to the Owner, that the surety company has reinsured the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus, with one or more reinsurers who are duly authorized, accredited or trusteed to do business in the State of Texas. For the purpose of this requirement, any amount reinsured by any reinsurer may not exceed ten percent (10%) of the reinsurer's capital and surplus (as reported to the Texas Insurance Commission by the reinsurer in its most recent report). In the event there is one or more reinsurer, the surety company must provide all necessary information and certification related to the current financial condition of the surety company and any and all reinsurers required by the Owner, together with copies of all reinsurance contracts with the surety company, before any such Payment Bond and Performance Bond is eligible to be considered acceptable by district.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

MEG GEOTECHNICAL ENGINEERING REPORT

PROPOSED
EL TULE PROJECT

EDINBURG, HIDALGO COUNTY, TEXAS

Geotechnical Engineering • Construction Materials Engineering & Testing
Environmental • Consulting • Forensics

GEOTECHNICAL ENGINEERING REPORT
FOUNDATION AND PAVEMENT RECOMMENDATIONS
PROPOSED EL TULE PROJECT
EDINBURG, HIDALGO COUNTY, TEXAS

Prepared For
Mr. Ruben R. Ramirez
Edinburg Economic Development Corp.

MEG Report No. 01-19-29222

November 20, 2019

MILLENNIUM ENGINEERS GROUP, INC.
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5804 N. GUMWOOD AVENUE
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November 20, 2019

Mr. Ruben R. Ramirez
Edinburg Economic Development Corp.
415 W. University Drive
Edinburg, Texas 78541
director@edinburgedc.com

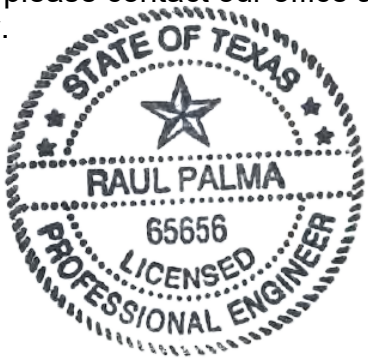
Subject: **Geotechnical Engineering Report**
MEG Report No. 01-19-29222
Foundation and Pavement Recommendations
Proposed El Tule Project
Edinburg, Hidalgo County, Texas

Dear Mr. Ramirez:

Millennium Engineers Group, Inc. is pleased to submit the enclosed geotechnical engineering report that was prepared for the above subject project. This report addresses the procedures and findings of our geotechnical engineering study. Our recommendations should be incorporated into the design and construction documents for the proposed development.

We want to emphasize the importance that all our recommendations presented in this report and/or addendums to this report be followed. We look forward to continuing our involvement in the project by providing construction monitoring in accordance with the report recommendations and materials testing services during construction. We strongly recommend that we be a part of the preconstruction meeting to address any specific issues that are pertinent to this project.

Thank you for the opportunity to be of service to you in this phase of the project and we would like the opportunity to assist you in the upcoming phases of the project. If you have any questions, please contact our office at the address, telephone, fax or electronic address listed below.



Cordially,
Millennium Engineers Group, Inc.
TBPE Firm No. F-3913

Raul Palma, P.E.
President

The seal appearing on this document was authorized by Raul Palma, P.E. 65656 on November 20, 2019. Alteration of a sealed document without proper notification to the responsible engineer is an offence under the Texas Engineering Practice Act

Cc: 1 Original and PDF Document

TABLE OF CONTENTS

APPENDIX

1.0 INTRODUCTION

Millennium Engineers Group, Inc. (MEG) has completed and is pleased to submit this document that presents our findings as a result of a geotechnical engineering study of this project to our client. The project site is located at the southeast corner of the intersection between Veterans Blvd. and Champion Street in Edinburg, Hidalgo County, Texas. The project location is shown on the Project Location Map, found in the Appendix section of this report. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendation, for foundation design and construction considerations.

Our scope of services for the project was outlined in MEG proposal No. 01-18-323G, dated October 29, 2019.

2.0 PROJECT DESCRIPTION

It is our understanding that the proposed site will accommodate the construction of a new indoor recreational center. It is also our understanding that the proposed indoor recreational center will consist of a one (1) story structure. The site construction for the proposed structure is anticipated to be on a slab-on-grade or on-fill foundation provided expansive, soil-related movements will not impair the performance of the structure.

The site will also accommodate the construction of either a rigid or flexible pavement that will serve for light duty and/or heavy duty traffic. Both flexible and rigid pavement types are viable and the selection on the type to be used will depend on the specific needs and criteria of this project site.

3.0 SCOPE AND LIMITATIONS OF STUDY

This engineering report has been prepared in accordance with accepted geotechnical engineering practices currently exercised by geotechnical engineers in this area. No warranty, expressed or implied, is made or intended. This report is intended for the exclusive use by the client and client's authorized project team for use in preparing design and construction documents for this project only. This report may only be reproduced in its entirety for inclusion in construction documents. This report in its entirety shall not be reproduced or used for any other purposes without the written consent of our firm. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.

The recommendations presented in this report are based on data obtained from the soil borings drilled at this site and our understanding of the project information provided to us by our client and other project team members, and the assumption that site grading will result in only minor changes in the existing topography. Subsurface soil conditions have been observed and interpreted at the boring locations only.

This report may not reflect the actual variations of the subsurface conditions across the subject site. It is important to understand that variations may occur due to real geologic conditions or previous uses of the site. The nature and extent of variations across the subject site may not become evident until specific design locations are identified and/or construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time during the design phase and/or construction phase, we should be notified immediately to determine if our opinions, conclusions and recommendations need to be reevaluated. It may be necessary to perform additional field and laboratory tests and engineering analyses to establish the engineering impact of such variations. These services are additional and are not a part of our project scope.

The engineering report was conducted for the proposed project site described in this report. The conclusions and recommendations contained in this report are not valid for any other project sites. If the project information described in this report is incorrect, is altered, or if new information becomes available, we should be retained to review and modify our recommendations. These services are additional and are not a part of our project scope.

Our scope of services was limited to the proposed work described in this report, and did not address other items or areas. The scope of our geotechnical engineering study does not include environmental assessment of the air, soil, rock or water conditions on or adjacent to the site. No environmental opinions are presented in this report. If the client is concerned with environmental risk at this project site, the client should perform an environmental site assessment.

If final grade elevations are significantly different from existing grades at the time of our field activities (more than plus or minus one (1) foot), our office should be informed about these changes. If desired, we will reexamine our analyses and make supplemental recommendations.

4.0 FIELD EXPLORATION PROCEDURES

Subsurface conditions at the subject site were evaluated by five (5) 20-foot soil borings and four (4) 5-foot soil borings. The Borings were drilled at the locations shown on the Borings Location Map, found in the Appendix section of this report. This location is approximate and distances were measured using a measuring wheel, tape, angles, and/or pacing from existing references. The structural soil borings were drilled in general accordance with American Society of Testing Materials (ASTM) D 420 procedures.

As part of our sampling procedures, the samples were collected in general conformance with ASTM D 1586 procedures. Representative portions of the samples were sealed in containers to reduce moisture loss, identified, packaged, and transported to our laboratory for subsequent testing. In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff. The geotechnical engineering properties of the strata were evaluated by a series of laboratory tests. The

results of the laboratory and field-testing are tabulated on the boring logs and Summary of Soil Sample Analyses which are found in the Attachments section of this report.

Standard penetration test results are noted on the boring logs as blows per 12 inches of penetration. Two 6 inch increments are performed for each standard penetration test. The sum of the blows for the two 6 inch increments is considered the "standard penetration resistance value" or "N-value." Where hard or very dense materials were encountered, the tests are terminated as follows: (1) when a total of 50 blows have been applied in any of the 6 inch increments, or (2) when a total of 100 blows have been applied, or (3) when there is no observed advance of the sampler in the application of 10 successive blows. The boring logs in the case of hard or very dense materials will be noted as follows: 50/3", where 50 is the number of blows applied in 3 inches of penetration, or 100/7½" where 100 is the number of blows applied in a total of 7 ½ inches of penetration, or 10/0", where 10 is the number of blows applied in 0 inches of penetration.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the Client.

5.0 GENERAL SITE CONDITIONS

5.1 Site Description

The project site is located at the southeast corner of the intersection between Veterans Blvd. and Champion Street in Edinburg, Hidalgo County, Texas. The project location is shown on the Project Location Map, found in the Appendix section of this report. At the time of our field operations, the subject site can be described as an undeveloped tract of land. The general topography of the site is relatively flat sloping down to the west and to the east with a visually estimated vertical relief of less than 3 feet. Surface drainage is visually estimated to be fair.

5.2 Site Geology

According to the Soil Survey of Hidalgo County, Texas, published by the United States Department of Agriculture – Soil Conservation Service, the project site appears to be located within the Hidalgo soil association.

- The Hidalgo series consist of nearly level to gently sloping soil. Boundaries commonly coincide with the outer limits of subdivisions, built up areas, and cities. Slopes range from 0 to 3 percent. Areas are broad and irregular in shape and range from 10 to 900 acres or more. The corresponding soil symbol is 31, Hidalgo-Urban land complex.

5.3 Subsurface Conditions

On the basis of our borings, five (5) generalized strata that possess similar physical and engineering characteristics can describe the subsurface stratigraphy at this site. Table 5.1 summarizes the approximate strata range in our boring logs. These were prepared by visual classification and were aided by laboratory analyses of selected soil samples. The lines designating the interfaces between strata on the boring logs represent approximate boundaries. Transitions between strata may be gradual details for each of the borings can be found on the boring logs in the appendix of this report.

Table 5.1. Approximate Subsurface Stratigraphy Depths.

Stratum	Range in Depth, ft[1]	Stratum Description[1]
I	0 – 4	sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff
II	4 – 6	fat CLAY with sand, grey, dry, stiff to very stiff
III	6 – 8	lean CLAY with sand to fat CLAY with sand, brown, dry, stiff to very stiff
IV	8 – 17	fat CLAY with sand, light brown, dry, stiff to very stiff
V	17 – 20	lean CLAY with sand, tan, moist to wet, soft to stiff

Note 1: The stratum thickness and depths to strata interfaces are approximate. Our measurements are rounded off to the nearest foot increment and are referenced from ground surface at the time of our drilling activities. Subsurface conditions may vary between the boring locations.

5.4 Groundwater Conditions

The dry auger drilling technique was used to complete the soil borings in an attempt to observe the presence of subsurface water. During our drilling operations we encountered the groundwater table to be at approximately thirteen (13) feet below natural ground elevation for short term conditions. Table 5.2 summarizes the approximate groundwater and cave in depths measured in our explorations. It should be noted that the groundwater level measurements recorded are accurate only for the specific dates on which measurement were obtained and does not show fluctuations throughout the year.

Fluctuations in Groundwater levels are influenced by variations in rainfall and surface water run-off from season to season. The construction process itself may also cause variations in the groundwater level. If the subsurface water elevation is critical to the construction process the contractor should check the subsurface water conditions just prior to construction excavation activities.

Table 5.2. Approximate Groundwater and Cave-in Depths.

Boring No.	Depth to Subsurface Water, Ft[1]		Depth to Cave-In, Ft[1]	
	Time of Drilling	24 Hr. Reading	Time of Drilling	24 Hr. Reading
B-1	17	9	18	12
B-2	17	9	18	10
B-3	16	None	17	11
B-4	17	11	18	11
B-5	17	11	17	12
P-1	None	None	4	4
P-2	None	None	4	4
P-3	None	None	4	4
P-2	None	None	4	4

Note 1: Subsurface water levels and cave-in depths have been rounded to the nearest foot.

Based on the findings in our borings and on our experience in this region, we believe that groundwater seepage may be encountered during site earthwork activities. If groundwater seepage is encountered during site earthwork activities, it may be controlled using temporary earthen berms and/or conventional sump-and-pump dewatering methods.

6.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

6.1 General

The analysis and recommendations presented in this report are applicable specifically to the proposed foundation structure. The data gathered from both the field and laboratory testing programs on soil samples obtained from the borings was utilized to establish geotechnical engineering parameters to develop recommendations for the proposed structure. The foundation system(s) considered in this report to provide support for the proposed structure must meet two independent criteria. One of the criteria is that the movement below the foundation structure due to compression (consolidation) or expansion (swell) of the underlying soils must be within tolerable limits. This criterion is addressed in the Soil Related Movements section of this report. The other criterion is that the dead and live loads must be distributed appropriately and the foundation structure designed with an acceptable factor of safety to minimize the potential for bearing capacity failure of the underlying soils.

Geotechnical and structural engineers in this general area consider soil movements or Potential Vertical Rise (PVR) of approximately one (1) inch or less to be within acceptable

structural design tolerances for most structures but may be different depending on structure use and the desired performance of the foundation. Therefore, movements of the underlying soils are not eliminated and thus one should expect a slab foundation structure to exhibit differential vertical movements. However, structural engineers design slab foundations for the expected magnitude of soil movements without failure of the structure. More stringent soil movement criteria may be established but the owner should consider the exponential increase in cost required to design and construct a structure for such soil movements. Data obtained in this study indicate that the soils at this site have strength characteristics capable of supporting the foundation and structure if designed appropriately. Stratum I is composed of sandy lean clay to lean clay with sand and has a moderate potential to exhibit volumetric changes (contraction and expansion). Stratum II is composed of fat clay with sand and has a high potential to exhibit volumetric changes. Stratum III is composed of lean clay with sand to fat clay with sand and has a moderate to high potential to exhibit volumetric changes. Stratum IV is composed of fat clay with sand and has a high potential to exhibit volumetric changes. Stratum V is composed of lean clay with sand and has a moderate potential to exhibit volumetric changes. The potential for soil volumetric changes is dependent on variations in moisture contents of the underlying soils. Based on this data, this site is suitable for a slab foundation provided the subgrade is modified in accordance with the recommendations established in this report to reduce the potential for these soil volumetric changes.

6.2 Soil-Related Movements

The anticipated ground movements due to swelling of the underlying soils at this site were estimated for slab foundation construction using the Texas Department of Transportation (TxDOT) procedures of test method TEX-124-E for determining Potential Vertical Rise (PVR). A PVR value of two and a half (2 1/2) inches was estimated for the stratigraphic conditions encountered in our subsurface borings. A surcharge of 1 pound per square inch for the concrete slab, an active zone of 15 feet, and dry subsurface moisture conditions were assumed in estimating the above PVR values.

The following methods are generally acceptable for use in modifying the subgrade to reduce the potential for soil movements and volumetric changes below the foundation structure.

Excavate expansive clay soils and replace with select fill.
Chemical injection of expansive clay soils.
A combination of methods 1 and 2.

The method to be used is dependent on specific site conditions. At this site the grade will most likely need to be raised to obtain the proposed Finished Floor Elevation (FFE). As of the date of this report the CLIENT/OWNER has not provided the proposed FFE. We recommend that the project civil engineer evaluate the proposed FFE with our recommendations to ensure that the subgrade modifications presented in the report are not diminished or compromised. Adding select fill is generally the most cost-effective method for reducing the potential for soil related movements. Therefore, we only discuss this method in this report but we can provide details for the other methods if requested.

Based on the data obtained, the assumed FFE of two (2) feet above natural ground elevation, information provided by our client and our analysis of the site, we recommend the following modification (Table 6.1. Subgrade Modifications) of the subgrade at this area to accomplished finish floor elevation of the subgrade at this site. This method will maintain the potential for soil related movements to an approximate PVR value of less than one (1) inch, which is generally desired for projects of this type.

Table 6.1. Subgrade Modifications

Item	Description
1	See and adhere to the Site Preparation Recommendations section of this report.
2	Excavate existing soils to a depth of two and a half (2 1/2) feet below natural ground elevation in accordance with the Site Preparation Recommendations section of this report.
3	Condition and compact twelve (12) inches of subgrade below excavated soils in accordance with the Site Preparation Recommendations section of this report.
4	Place **select fill,** (a minimum of two (2) feet above natural ground, for a total of four and a half (4 1/2) feet select fill) condition and compact up to the proposed FFE in accordance with the Select Fill Recommendations section of this report.

The PVR method of estimating expansive, soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive, soil-related movements are available, such as estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analyses of expansive, soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the calculated PVR values as a result of isolated changes in moisture content (such as leaks, landscape watering, etc.) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching and/or excavations.

6.3 Conventional Shallow Slab-on-Grade Foundation Design Criteria

As indicated previously a slab foundation may be used at this site in conjunction with the subgrade modifications listed under the Soils Related Movements section. We recommend the following soil bearing pressures, and dimensional criteria for the slab grade beams. These recommendations ensure proper utilization of soil bearing capacity of continuous beam sections in the slab-on-grade foundation and reduce the potential of water migration from the outside to beneath the slab foundation. For structural considerations the beams may need to be greater and should be evaluated and designed by the structural engineer. Where concentrated load areas are present the grade beams

or slab may be thickened and widened to serve as spread footings. Soil bearing pressures and beam dimensional criteria are as follows:

Table 6.2. Bearing Criteria

Grade Beams and Continuous Footings	
Minimum depth below finished grade:	24 inches
Maximum depth below finished grade:	36 inches
Maximum width:	30 inches
Maximum allowable bearing pressure:	1,800 psf
Spread Footings (square)	
Minimum depth below finished grade:	24 inches
Maximum depth below finished grade:	36 inches
Maximum width:	60 inches
Maximum allowable bearing pressure:	2,100 psf

The above-presented maximum allowable bearing pressures will provide a factor of safety of 3 with respect to the design soil strengths. For a slab foundation structure designed and constructed in accordance with the recommendations of this report, it is anticipated that total settlements will be in the order of one (1) inch or less. If lower anticipated total settlements are required for this project further mitigation may be required and MEG must be consulted for further recommendations.

Furthermore, the above design parameters are contingent upon the fill materials (if utilized) being selected and placed in accordance with the recommendations presented in the Select Fill Recommendations section of this report. Should select fill selection and placement differ from the recommendations presented herein, MEG should be informed of the deviations in order to reevaluate our recommendations and design criteria.

Excavations for slab on grade and spread footing foundations should be performed relatively clean and with an undisturbed bearing area. The bottom 6 inches of the excavation should be performed using a flat plate excavation bucket. The excavations should be neatly excavated. No foreign debris or undisturbed soil should be left in the footing bottom. Should there be any abundance of foreign debris or disturbed soil found, it may be necessary to re-assess the fill site of its bearing capacity suitability. If the bearing area is found to be disturbed, the bearing area will require preparation and compaction for the entire depth of the disturbance in accordance with the Site Preparation and/or the Select Fill sections of this report.

The bearing surface of the grade beams and spread footings should be evaluated after excavation and immediately prior to concrete placement. We recommend that footing inspections be performed by a representative of MEG. The required inspections shall

include inspecting for clean, dry (The moisture content should be within limits specified by the appropriate section in this report.) and undisturbed footing bottom, depth of footing, clearances from sides and size and spacing of reinforcing steel. Test results shall comply with the recommendations of this geotechnical report and shall be verified by an on-site representative of MEG.

Over excavation, if necessary, for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over excavation depth below footing base elevation. The over excavation should then be backfilled up to the footing base elevation select fill placed in lifts of 8 inches or less in loose thickness and prepared and compacted in accordance with the Site Preparation and/or the Select Fill sections of this report. Equipment should not be operated and materials should not be placed or stockpiled within a horizontal distance equal to the excavation depth from the edge of the excavation. Excavations should not be placed next to existing structures or buried utilities/structures closer than a horizontal distance equal to the excavation depth unless some form of protection for the facilities is provided.

Water should not be allowed to accumulate at the bottom of the foundation excavation. Proper barriers such as berms or swales should be placed to divert any surface runoff away from excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavations are completed, properly prepared and cleaned. Excavations should not be left open overnight.

6.4 BRAB Design Criteria for Slab-on-Grade Foundations

Table 6.3 list the values for criteria developed by the Building Research Advisory Board (BRAB) for the design of shallow slab-on-grade foundations. On the basis of stratigraphy encountered and the anticipated site modifications discussed earlier, the design criteria are as follows:

Table 6.3. BRAB Values

For Existing Conditions	
Effective Plasticity Index	31
Climatic Rating Cw.	15
Soil Support Index, (c)	0.83
For Proposed Conditions	
Effective Plasticity Index	24
Climatic Rating Cw.	15
Soil Support Index, (c)	0.90

Note 1: Subgrade Modifications as outlined in the recommendations of this report;

7.0 CONSIDERATIONS DURING CONSTRUCTION

7.1 Site Grading Recommendations

Site grading plans can result in changes in almost all aspects of foundation recommendations. We have prepared the foundation recommendations based on the existing ground surface; there is a two (2) feet surcharge addition for the stratigraphic conditions encountered at the time of our study. If site grading plans differ from existing grades by more than plus or minus 1 foot, we must be retained to review the site grading plans prior to bidding the project for construction. This will enable us to provide input for any changes in our original recommendations that may be required as a result of site grading operations or other considerations.

7.2 Site Drainage Recommendations

Drainage is one of the most important aspects to be addressed to ensure the successful performance of any foundation. Positive surface drainage should be implemented prior to, during and maintained after construction to prevent water ponding at or adjacent to the building facilities. It is recommended that the building and site design include rain gutters, downspouts and concrete gutters to channel runoff to paving or storm drains.

7.3 Site Preparation Recommendations

Building areas and all area to support select fill should be stripped of all vegetation and organic topsoil up to a minimum of 5 ft. beyond the building perimeters. After stripping, remove at least six (6) inches of on-site soil as measured from existing grade when excavation of existing subgrade is not recommended in other sections of this report. The excavated material, if free of organic and/or deleterious material, may be stockpiled for use in the non-structural areas of the site. Where excavation of the subgrade is recommended in this report, the bottom of the excavation will extend at least five (5) feet beyond the limits of the planned building perimeter including canopies and sidewalks. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots have been removed within the limits of excavation should be removed and replaced with a suitable, compacted select fill in accordance with the recommendations presented under the Select Fill Recommendations section of this report. Proof rolling operations and any excavation/backfill activities should be observed by **MEG** representatives to document subgrade preparation.

Prior to fill placement, the exposed subgrade shall be prepared based on what option is selected from the foundation and pavement recommendations. The exposed subgrade should be prepared, moisture-conditioned by scarifying to a minimum depth as recommended in the foundation and pavement recommendations and recompacting to a

minimum 98 percent of the maximum dry density as determined in accordance with ASTM D 698, moisture-density relationship. The moisture content of the subgrade should be maintained within the range of minus two (-2) percentage points below optimum to plus two (+2) percentage points above the optimum moisture content until the fill is permanently covered. The soil should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.4 Select Fill Recommendations

Materials used for select fill shall meet the following requirements:

1. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base; Type A, Grades 1 through 3.
2. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base, Types B or C, Grades 1 through 5 with a minimum plasticity index of 7.
3. Material shall conform to TxDOT 2014 Specification Item 247, Flexible Base, Type E, Grade 4 with a plasticity index between and inclusive of 7 and 15. Type E material shall be defined as Caliche (argillaceous limestone, calcareous or calcareous clay particles) and may contain stone, conglomerate, gravel, sand or granular materials when these materials are in situ with the caliche. Flexible Base (Type E, Grade 4) shall conform to the following requirements:

Table 7.1. Type E, Grade 4 Requirements

Retained on Sq. Sieve	Percent Retained
2”	0
½”	20-60
No. 4	40-75
No. 40	70-90
Max. PI:	15
Max. Wet Ball PI:	15
Wet Ball Mill Max Amount:	50
Wet Ball Increase, Max Passing No. 40 sieve	20

4. Soils classified according to USCS as SM, SC, GM, GC, CL, ML and combinations of these soils. The soils shall be relatively free of organic matter. In addition to the USCS classification, select materials shall have a liquid limit of less than 40 and a plasticity index between and inclusive of 10 and 17.
5. Soils classified, as CH, MH, OH, OL and PT, under the USCS are not considered suitable for use as select fill materials at this site.

Select fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum 98 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within

the range of minus two (-2) percentage points below optimum to plus two (+2) percentage points above the optimum moisture content until the fill is permanently covered. The select fill should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.5 Site Fill Recommendations

Site fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum 98 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of minus two (-2) percentage points below optimum to plus two (+2) percentage points above the optimum moisture content until the fill is permanently covered. The site fill should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.6 Back Fill Recommendations

Back fill shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and compacted to a minimum 98 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the fill shall be maintained within the range of minus two (-2) percentage points below optimum to plus two (+2) percentage points above the optimum moisture content until the fill is permanently covered. The back fill should be properly compacted in accordance with these recommendations and tested by **MEG** personnel for compaction as specified.

7.7 Utility Considerations

Utilities that project through the slab-on-grade, slab-on-fill, floating floor slabs, or any other rigid unit should be designed with some degree of flexibility or with sleeves. Such features will help reduce the risk of damage to utility facilities from soil movements related to shrinkage and expansion.

7.8 Utility Trench Recommendations

Bedding and initial backfill are buried around utility lines to support and protect the utility. The secondary backfill above the initial backfill also helps protect and support the foundation and/or pavement above. To ensure that settlement is not excessive in this secondary backfill we recommend the following:

1) If possible, trench and install utilities prior to work such as lime treatment and/or compaction of subgrade or placement of other fills or bases.
2) Place, moisture condition and compact the secondary backfill in accordance with the pertinent project requirements. Within the footprint of a building pad the secondary backfill should meet the same compaction requirements for select fill. Within the footprint of a pavement structure the secondary backfill should meet the same compaction requirements for the subgrade. When compaction of the subgrade is not specified it should meet the same compaction level of the adjacent

natural ground. An alternative to compaction of secondary backfill is the use of flowable fill where secondary backfill is to be placed. If properly designed, the flowable fill can be excavated easily at a later date if necessary. No compaction and no testing is required when properly designed flowable fill is used.

7.9 Excavation, Sloping and Benching Considerations

If trenches are to extend to or below a depth of five (5) ft., the contractor or persons doing the trenching should adhere to the current Occupational Health and Safety Administration (OSHA) guidelines on trench excavation safety and protection measures. Other industry standards may be applicable. The collection of specific geotechnical data and development of a plan for trench safety, sloping, benching or various types of temporary shoring, is beyond the scope of this study.

7.10 Shallow Foundation Excavation Considerations

The Geotechnical Engineer or his representative prior to the placement of reinforcing steel and concrete should observe shallow foundation excavations. This is necessary to verify that the bearing soils at the bottom of the excavations are similar to those encountered during the subsurface soil exploration phase and that excessive loose materials and water are not present in the excavations. If soft pockets of soil are encountered in the foundation excavations, they should be removed and replaced with a compacted non-expansive fill material or lean concrete up to the design foundation bearing elevation.

7.11 Landscaping Considerations

Even though landscaping is a vital aesthetic component of any project, the owner, client and design team should be aware that placing trees or large bushes adjacent to any structure may distress the structure in the future. It is recommended that if any landscaping is to be placed adjacent to the structure in this project, it should be limited to small plants and shrubs. Trees and large bushes should be placed at a distance such that at their mature height, their canopy or “drip line” does not extend over the structures. The owner, client and design team should also be aware that if any watering is to be done in connection with the landscaping for this project it should be controlled, consistent and timely. Excessive or prolonged watering is not recommended. If watering is part of the landscaping plan, termination of watering for any extended period of time may also be detrimental to the structure. It is important that the moisture level in the subsurface soils remain constant so that shrinking and swelling of soils may be mitigated.

7.12 Perimeter Foundation Cap

We recommend that a cap of impervious fill be placed around the perimeter of the foundation to mitigate the intrusion of moisture into the soils surrounding the foundation. The top eighteen inches of fill around the foundation structure should be a low permeance clay cap to keep surface water away from the foundation. The low permeance clay cap should be sloped away from the foundation at a minimum slope of 2% and the surrounding

areas should have positive drainage. The low permeance clay shall meet the USCS classification of CL and meeting the requirements in Tables 7.2 Gradation Requirements and Table 7.3 Atterberg Limits Requirements. The low permeance clay shall be compacted to minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D 698. The moisture content of the subgrade should be maintained within the range of optimum to four (4) percentage points above the optimum moisture. If plantings are intended, add 4 to 6 inches of loam on top of the clay cap.

Table 7.2. Gradation Requirements

Sieve Size	Percent Passing (by dry weight)
1/2 inch	100
No 4	70-100
No. 200	50 – 100

Table 7.3. Atterberg Limits Requirements

Test / ASTM	Requirement
Atterberg Limits D4318	LL ≤ 45 20 ≤ PI ≤ 30

7.13 Existing Trees

Some trees are located at the site. These trees may be within the construction limits of the planned structure and/or pavement areas. There are concerns regarding the location of the existing trees or any recently cleared trees in the immediate vicinity of planned improvements. Based on the present layout of the planned structure and/or pavement areas and the location of the existing trees in the area, it is our opinion there is a moderate potential for distress to the planned improvements in the future, if the trees and root systems are not completely removed or corrective measures are not taken.

Distress to the structure can be caused by existing trees and vegetation if the root systems extend under the planned foundation system. The potential distress to the structure can be caused in several ways which may include one or more of the following:

- Settlement beneath the foundation due to decay of the tree roots should the trees die or be cut down.
- Uplift forces on the foundations due to growth of the tree roots pushing up on the foundation system. Foundations and Concrete sidewalks are very susceptible to this type of distress.
- Volume reduction or shrinkage of the subsurface soils due to loss of moisture content from the tree root systems adjacent to and beneath the improvements, which may cause settlement.

Solutions and/or remedies to this situation may include the following:

- Remove (cut down) the trees, grub the roots as completely as possible and replace the area of soil and roots with select fill.
- Cutting the roots extending under foundations and/or pavements to prevent moisture loss and installing a root barrier to retard future growth of roots under the foundations. Grub the cut roots as completely as possible. Depending on the size and density of the existing root system left in place this may cause future settlement due to the eventual decay of the roots. However, this may take 5 to 10 years; or
- Leave the trees in place but construct a “cut-off wall” or “root barrier” between the foundations and/or pavements and trees. The cut off wall should be at least 12 inches in width and a minimum of 5 feet deep. However, the actual depth should be based on the type of root system the tree has, i.e., shallow or deep root, etc. A landscape consultant should be retained to assess this situation. If the tree has a shallow root system, the 5-foot cut-off wall depth should be adequate. The cut-off wall may need to extend deeper than 5 feet if the roots are deep, in addition a controlled watering program will need to be developed so the tree root systems maintain a good water balance thus the root systems will not want to extract moisture from beneath the foundation and/or pavements.

7.14 Constructions Debris Removal

Construction debris was found within the limits of this site. The debris may be found within the construction limits of the planned structure and/or pavement areas. It is our opinion that there is a potential for distress to the planned improvements in the future in the form of differential settlement on the proposed structure. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots, foundation footings and/or utility lines have been removed within the limits of excavation should be removed and replaced with a suitable, compacted select fill in accordance with the recommendations presented under the Select Fill Recommendations section of this report. Proof rolling operations and any excavation/backfill activities should be observed by **MEG** representatives to document subgrade preparation

8.0 PAVEMENT SECTION RECOMMENDATIONS

8.1 General Information

The study was also performed to determine recommendations for the construction of a flexible pavement and these recommendations are presented in this report. The pavement recommendations are limited to samples taken from the existing soils within the roadway areas present at the site. The pavement design implemented for this project

should be evaluated the civil engineer based on a traffic and design analysis for this project.

Recommendations for both flexible and rigid pavements are presented in this report for further evaluation by the project civil engineer. Both pavement types are viable and the selection on the type to be used will depend on the specific needs and criteria of this project site. Generally, flexible pavements have a lower initial construction cost when compared to rigid pavements. On the other hand a rigid pavement has lower maintenance cost throughout the life of the pavement structure as compared to flexible pavements. Flexible pavements generally require more frequent repairs and overlays at intervals from 6 to 10 years to meet the structural and functional requirements of the pavement during the design life. All pavements are very dependent on the condition of the soil platform on which they are supported and thus moisture conditions will play an important role in the performance of the pavement during its structure life. Proper consideration to drainage of the pavement structure and the surrounding areas is essential to the successful performance of a pavement structure.

After proof rolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in the Site Preparation section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

8.2 Soil Stabilization Recommendations

The plasticity index of the surface soils at this site is approximately 18 to 27 percent. The existing subgrade soils require lime stabilization for soil shrink and swell mitigate. We recommend the addition of four (4) percent lime by weight to the existing surface soils. We recommend that the existing soils be tested after the pavement areas have been excavated or filled to the top of the subgrade elevation to verify the soil stabilization requirements. The natural ground should then be prepared as stated in the Site Preparation Recommendations of the pavement section. Proper consideration to drainage of the pavement structure and the surrounding areas is essential to the successful performance of a pavement structure.

8.3 Design Methodology and Traffic Information

Our engineering analysis of the pavement type considered the information obtained from our soil borings, the field and laboratory testing, our past experience with similar soils and site conditions. Design of new pavements for the project has been based on the procedures outlined in the 1993 Guide for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO). The client did not provide projected ESALs. We recommend that the project Civil Engineer or a Traffic Engineer review the project for the appropriate traffic levels and design periods to ensure that they are appropriate and consistent with the specific project site

requirements. The assumptions for traffic used in the pavement design analysis are as follows:

Table 8.1. Flexible Pavement Traffic Criteria Utilized

Criteria	Value[1]
Reliability Level	80%
Standard Deviation	0.45
Initial Serviceability level	4.0
Terminal Serviceability level	2.0

Note 1: The above traffic criteria as per 1993 AASHTO Pavement Design Guidelines.

Table 8.2. Rigid Pavement Traffic Criteria Utilized

Criteria	Value[1]
Reliability Level	95%
Standard Deviation	0.35
Initial Serviceability level	4.0
Terminal Serviceability level	2.0

Note 1: The above traffic criteria as per 1993 AASHTO Pavement Design Guidelines.

8.4 Recommended Pavement Sections

The proposed pavement section for entrances, drives and parking areas may be chosen from one of the following options in the tables below.

The selection process of the appropriate pavement option should consider the following:

1. The client should consider the options presented as minimum pavement sections for the appropriate use and expected traffic levels. The civil engineer of record should evaluate the minimum pavement sections recommended with the appropriate class of pavement required for this project. The local government requirements should be met when they are more stringent than the minimum pavement sections recommended in our report.

Table 8.3. Flexible Pavement Options

Materials	Light Duty[1]	Heavy Duty[2]
Asphaltic Concrete (In)	2.0	3.0
Untreated Caliche Base (In)	8.0	12.0
Limed Treated Subgrade (In)	6.0	10.0

Note 1: Light Duty Pavement (ESALS = 11,000)
Note 2: Heavy Duty Pavement (ESALs = 160,000)

Table 8.4. Rigid Concrete Pavement Options

Materials	Light Duty[1]	Heavy Duty[2]
Reinforced Concrete Pavement (In)	5.0	7.0
Untreated Caliche Base or Limed Treated Subgrade (In)	6.0	10.0

Note 1: Light Duty Pavement (ESALs =11,000)
Note 2: Heavy Duty Pavement (ESALs = 160,000)

It is recommended that concrete pavements be reinforced. At a minimum, the reinforcing bars should be placed as follows:

Table 8.5. Longitudinal Drives and Entrances

Thickness (in)	Bar Size	Longitudal Spacing (in)	Transverse Spacing (in)
<=6	3	12	24
<=7	4	12	24
<=8	5	11	22

Table 8.6. Parking Areas

Thickness (in)	Bar Size	Longitudal Spacing (in)	Transverse Spacing (in)
<=6	3	16	16
<=7	4	16	16
<=8	4	14.5	14.5

Longitudinal reinforcement should be placed at ½ the slab depth +/- ½ inch from the surface. At a longitudinal edge, the first two spacing's for longitudinal reinforcement shall be at ½ the normal longitudinal spacing. At transverse construction joints, additional longitudinal reinforcement shall be placed at a spacing one half the normal longitudinal spacing for a length of 42 inches. At transverse joints, the first two spacing's for transverse reinforcement shall be at ½ the normal transverse spacing. All reinforcement

should be specified as deformed steel meeting the requirement of ASTM A-615 (Grade 60) or ASTM A-616 (Grade 60). Splices should be a minimum of 33 nominal bar diameters. Reinforcing should not extend across longitudinal and expansion joints. Dowels across longitudinal and expansion joints are recommended to be 7/8 inch diameter, smooth bars with a length of 42 inches and spaced at a maximum 24 inches on center.

Longitudinal and transverse joints are recommended at a maximum spacing of 10 feet for pavements with a thickness of less than 6 inches and at a maximum spacing of 15 feet for pavements with a thickness of 6 inches or greater. The longitudinal and transverse joints should be formed or saw cut to a depth of 1/3 of the slab depth for concrete containing siliceous coarse aggregate and ¼ of the slab depth for limestone aggregate. Sawing of joints should begin as soon as the concrete will not chip and ravel. It is recommended that longitudinal and expansion joints be doweled to promote load transfer. Expansion joint spacings are not to exceed a maximum of 75 feet and no expansion or contraction joints should be located within a swale or drainage collection area. Expansion joints are also needed to separate the concrete slab from fixed objects such as inlets, light standards and buildings.

It is recommended that the concrete pavement surface have a minimum slope of 0.015 ft/ft to provide adequate surface drainage. It is recommended that the concrete pavement should cure a minimum 7 days before allowing any traffic provided that adequate concrete strength has been attained as determined by the project Civil Engineer.

The curb shall be constructed in lengths equal to the adjoining pavement slab lengths, and expansion joints shall be provided in the curb opposite each transverse expansion joint in the pavement. Expansion joint material shall be of the same thickness, type and quality as specified for the pavement and shall be of the section as shown for the curb. All expansion joints shall be carried through the curb. Transverse contraction joints shall be sawed across the curb at the same time as sawing of the transverse contraction joints in the pavement are sawed. The curb shall be placed monolithically with the pavement for edge support and reinforced with a minimum one (1) #5 rebar. A finish coat of mortar shall be applied on the exposed surfaces of monolithic curbs.

8.5 Garbage Dumpster Considerations

Within flexible pavement areas, it is recommended that reinforced concrete pads be provided in front of and beneath garbage dumpsters. Concrete paving is also recommended in areas where the dumpster trucks make turns with small radii to access the dumpsters. The pads should be a thickened concrete slab and reinforced similar to the concrete pavement recommendations or a minimum 10 inches thick.

9.0 PAVEMENT MATERIAL SPECIFICATION SECTIONS

9.1 Pavement Preparation Recommendations

Pavement areas should be stripped of all vegetation and organic topsoil up to a minimum of two (2) feet beyond the pavement perimeters. After stripping, remove at least six (6) inches of on-site soil as measured from existing grade when excavation of existing subgrade is not recommended in other sections of this report. The excavated material, if free of organic and/or deleterious material, may be stockpiled for use in the non-pavement areas of the site. Where excavation of the subgrade is recommended in this report, the bottom of the excavation will extend at least two (2) feet beyond the limits of the planned pavement perimeter including canopies and sidewalks. Exposed subgrades should be thoroughly proof rolled in order to locate and compact any weak, compressible and soft spots. Proof rolling shall be in accordance with TxDOT 2014 Specification Item 216. Proof rolling operations should be observed by the Geotechnical Engineer or his representative to document subgrade condition and preparation. Weak or soft areas identified during proof rolling or areas where large tree roots have been removed within the limits of excavation should be removed and replaced with a suitable, compacted fill in accordance with the recommendations presented in TxDOT 2014 Specification Item 132 for density control and material requirements for Types A and B. If the fill is a clay it shall meet USCS Classification CL. Proof rolling operations and any excavation/backfill activities should be observed by MEG representatives to document subgrade preparation.

The exposed subgrade shall then be prepared based on what option is selected from the pavement recommendations. The soil should be worked in accordance with the recommendations and tested by MEG personnel for compaction as specified.

9.2 Hot Mix Asphaltic Concrete Surface

The asphaltic surface shall meet the requirements of the current TxDOT 2014 Specification Item 340 for Dense Graded Hot Mix Asphalt (small quantity) for projects with total production of less than 5,000 tons and TxDOT 2014 Specifications Item 341 Dense Graded Hot Mix Asphalt for projects with total production of 5,000 tons or greater. The hot mix asphaltic surface will be compacted to between 3.0 and 8.5 percent in place air voids in conformance with the specification. It is recommended that the testing required by this specification be performed during production.

Table 9.1. Dense Grade Hot Mix Asphalt Additional Requirements

Test Procedure	Requirement
Target Design Laboratory Density, %	97.0 (for light duty areas)
	96.5 (for heavy duty areas)

9.3 Reinforced Concrete

Concrete shall meet a minimum 28-day compressive strength of 3200 psi for light duty pavements and 4000 psi for medium and heavy duty pavements and a maximum water/cement ratio of 0.45. The concrete for concrete paving shall meet the requirements for Class P Concrete of TxDOT 2014 Specification Items 360 and 421. Aggregates used in the concrete design should meet the requirements of TxDOT 2014 Specification Item 421 or ASTM C33.

9.4 Untreated Caliche Base

The base shall be caliche base and meet the requirements of TxDOT 2014 Specification Item 247 Type E, Grade 3 or better and including the requirements of Table 9.2 shown below. The base shall be compacted to a minimum 98 percent of the maximum dry density as determined by the standard moisture density relation (ASTM D 698) at moisture contents ranging between minus two (-2) and plus two (+2) percentage points of the optimum moisture content. The base shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and not less than 5 ½ inches (4 inches compacted).

Table 9.2. Flexible Base Type E, Additional Requirements

Retained Procedure	Requirements
Max. PI:	12 (15 for treated base)
Max. Wet Ball PI:	12 (15 for treated base)
Wet Ball Mill Max Amount:	50
Wet Ball Increase, Max Passing No. 40 sieve	20

9.5 Lime Treated Caliche Base

The base shall meet all the requirements of untreated caliche base. In addition the base shall be treated with a minimum one and a half (1 ½) percent lime or Portland cement by weight. Lime shall meet the requirements of TxDOT 2014 Specification Item 260. Portland cement shall be Type I meeting ASTM C150 or Type IP meeting ASTM C595. Lime treatment will be in accordance with TxDOT 2014 Specification Item 260 or 263 for base courses and Item 260 for subgrades. Cement treatment shall be in accordance with TxDOT 2014 Specification Item 275 or 276. The base shall be compacted to a minimum 98 percent of the maximum dry density as determined by the standard moisture density relation (ASTM D 698) at moisture contents ranging between minus two (-2) and plus two (+2) percentage points of the optimum moisture content. The base shall be placed in loose lifts not to exceed 8 inches (6 inches compacted) and not less than 5 ½ inches (4 inches compacted).

9.6 Lime Treated Subgrade

Lime stabilization of the soils may be used for soil shrink and swell mitigation and to increase the structural capacity of the subgrade as platform for the pavement. It is recommended that the subgrade plasticity index be verified after the site is stripped of the loose topsoil and the subgrade is exposed up to the subgrade elevation. Stabilization treatment of the subgrade soils may also be utilized to provide a platform for the base for resistance to moisture intrusion and changes. Prevention of moisture intrusion is extremely important to the life of a pavement. Increases in moisture content of the subgrade and the base will significantly reduce the material's structural ability to carry loads. The optimum lime content should reduce the PI of the soil to 20 or less and should result in a soil lime mixture with a pH of at least 12.4 when tested in accordance with ASTM C 977, Appendix XI. The lime should be blended with a mixing device such as a pulvermixer to produce a soil mixture passing water added and be allowed to cure for at least 48 hours. After curing the lime soil mixture it shall pass the grading requirements of TxDOT 2014 Specification Item 260 and compacted to a minimum 95 percent of the maximum dry density determined in accordance with ASTM D 698 at moisture contents ranging from minus two (-2) percentage points below optimum to plus two (+2) percentage points above optimum moisture content. If the in-place gradation requirements can be achieved during the initial mixing, the remixing after the curing period can be eliminated. Please note that there is a relationship between the time of mixing of the lime and soils with the maximum dry density. Any mixture older than three (3) days will require determination of new moisture density relationships.

Portland cement may be considered instead of lime to treat the subgrade. See the cement treated subgrade section of this report.

9.7 Cement Treated Subgrade

Cement treatment of the on-site subgrade soils may be used for soil shrink and swell mitigation and to increase the structural capacity of the subgrade as a platform for the pavement. It is recommended that the subgrade plasticity index be verified after the site is stripped of the loose topsoil and the subgrade is exposed up to the subgrade elevation. Treatment of the subgrade soils may be utilized to provide a uniform platform for the base for resistance to moisture intrusion and changes. Prevention of moisture intrusion is extremely important to the life of a pavement. Increases in moisture content of the subgrade and the base will significantly reduce the material's structural ability to carry loads. The optimum cement content should be determined in accordance with TxDOT 2014 Specifications Item 275 and with a minimum dry strength requirement of 175 psi. It is anticipated that the soils will require about 2 to 3 percent cement by dry weight of the soils to meet the specification requirements. The cement should be blended into the soil and preferably with a mixing device such as a pulvermixer to produce a uniform soil-cement mixture. The soil-cement mixture shall be placed in accordance with TxDOT 2014 Specification Item 275 and compacted to a minimum 95 percent of the maximum dry density determined in accordance with ASTM D 698 at moisture contents ranging from

minus two (-2) percentage points below optimum to plus two (+2) percentage points above the optimum moisture content.

Cracking of the subgrade can be expected when using cement treatment due to the increased rigidity of the soil. Maintenance of any reflected cracks will require immediate sealing to keep moisture from penetrating to the pavement layers below the surface. If reflective cracking on the pavement from the treated subgrade is a concern, we recommend that microcracking of the subgrade be performed and the procedure outlined in TxDOT 2014 Specification Item 275 be used to mitigate reflective cracking. Microcracking should be performed on treated subgrade layers not to exceed 8 inches compacted thickness.

9.8 Moisture Conditioned Subgrade

The subgrade shall be scarified to a depth of eight (8) inches and moisture conditioned to within the range of minus two (-2) percentage points below optimum to plus two (+2) percentage points above the optimum moisture content. The subgrade shall be compacted to a minimum 95 percent of the maximum dry density determined in accordance with ASTM D 698.

10.0 OTHER CONSIDERATIONS

10.1 Drainage

Adequate perimeter drainage is essential for long-term performance of any pavement structure. Infiltration of surface water from unpaved areas surrounding the pavement should be minimized. We do not recommend the placement of landscape beds on the paved areas. Such design features provide a potential for water to enter into the pavement section and the underlying soil subgrade. This is especially true with time in paved areas that have limited traffic and lead to accelerated asphalt oxidation and thus cracking. Water intrusion will result in the deterioration of the pavement materials with time as vehicular traffic passes over affected areas. Above grade planter boxes with drainage discharge onto the top of the pavement or directed into storm sewers should be considered if landscape features are to be used.

10.2 Curb & Gutters

Base material under curb and gutters and curbs shall be compacted to the same requirements as other areas. It is recommended that the base shall be placed below the curb & gutter and extended past the back of the curb & gutter a minimum of one and a half (1 ½) feet. The thickness of the base below the curb & gutter shall be the required pavement base thickness less six (6) inches. An adequate seal should be provided at all concrete- asphalt interfaces. It is recommended that a crack sealant compatible to both asphalt and concrete be used.

10.3 Maintenance

A maintenance plan is recommended for the long-term performance of the paved areas. Asphaltic pavements have a tendency to strip and become oxidized with exposure to the elements. Thus, cracks may become present in the pavement. It is recommended that a maintenance schedule of crack sealing, fog seals and overlays be used over the life of the pavement.

11.0 PROJECT REVIEW AND QUALITY CONTROL

Each project site is unique and it is important that the appropriate design data, construction drawings, specifications, change orders and related documents be reviewed by the respective design and construction professionals participating in this project. The performance of foundations, construction building pads and/or parking areas for this project will depend on correct interpretation of our geotechnical engineering report and proper compliance of and adherence to our geotechnical recommendations and to the construction drawings and specifications.

It is important that **MEG** be provided the opportunity to review the final design and construction documents to check that our geotechnical recommendations are properly interpreted and incorporated in the design and construction documents. We cannot be responsible for misinterpretations of our geotechnical recommendations if we have not had the opportunity to review these documents. This review is an additional service and not part of our project scope.

MEG should be retained to provide construction materials testing and observation services during all phases of the construction process of this project. As the Geotechnical Engineer of Record, it is important to let our technical personnel provide these services to make certain that our recommendations are interpreted properly and to ensure that actual field conditions are those described in our geotechnical report. Since our personnel are familiar with this project, **MEG**'s participation during the construction phase of this project would help mitigate any problems resulting from variations or anomalies in subsurface conditions, which are among the most prevalent on construction projects and often lead to delays, changes, costs overruns, and disputes. If the client does not follow all of our recommendations presented in this report and/or addendums to this report, the client assumes the responsibility and liability of such actions and will hold our firm harmless and without responsibility and liability for client's actions.

A construction testing frequency plan and budget needs to be developed for the required construction materials engineering and testing services for this project. Before construction, we recommend that **MEG**, the project design team members and the project general contractor meet and jointly develop the testing plan and budget, as well as review the testing specifications as it pertains to this project. **A failure to implement a complete testing plan will negate the recommendations provided in this report.**

MEG looks forward to the opportunity to provide continued support on this project.

APPENDIX A
CUSTOM SOIL RESOURCE REPORT

MEG ENGINEERS Strong Leaders!
Geotechnical / Environmental / Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Map Unit Name—Hidalgo County, Texas
(01-19-29206 - Proposed El Tule Project)

Map Scale: 1:1,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Hidalgo-Urban land complex, 0 to 1 percent slopes
- Not rated or not available

Soil Rating Lines

- Hidalgo-Urban land complex, 0 to 1 percent slopes
- Not rated or not available

Soil Rating Points

- Hidalgo-Urban land complex, 0 to 1 percent slopes
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 18, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 20, 2015—Nov 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Name

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
31	Hidalgo-Urban land complex, 0 to 1 percent slopes	Hidalgo-Urban land complex, 0 to 1 percent slopes	7.0	100.0%
Totals for Area of Interest			**7.0**	**100.0%**

Description

A soil map unit is a collection of soil areas or nonsoil areas (miscellaneous areas) delineated in a soil survey. Each map unit is given a name that uniquely identifies the unit in a particular soil survey area.

Rating Options

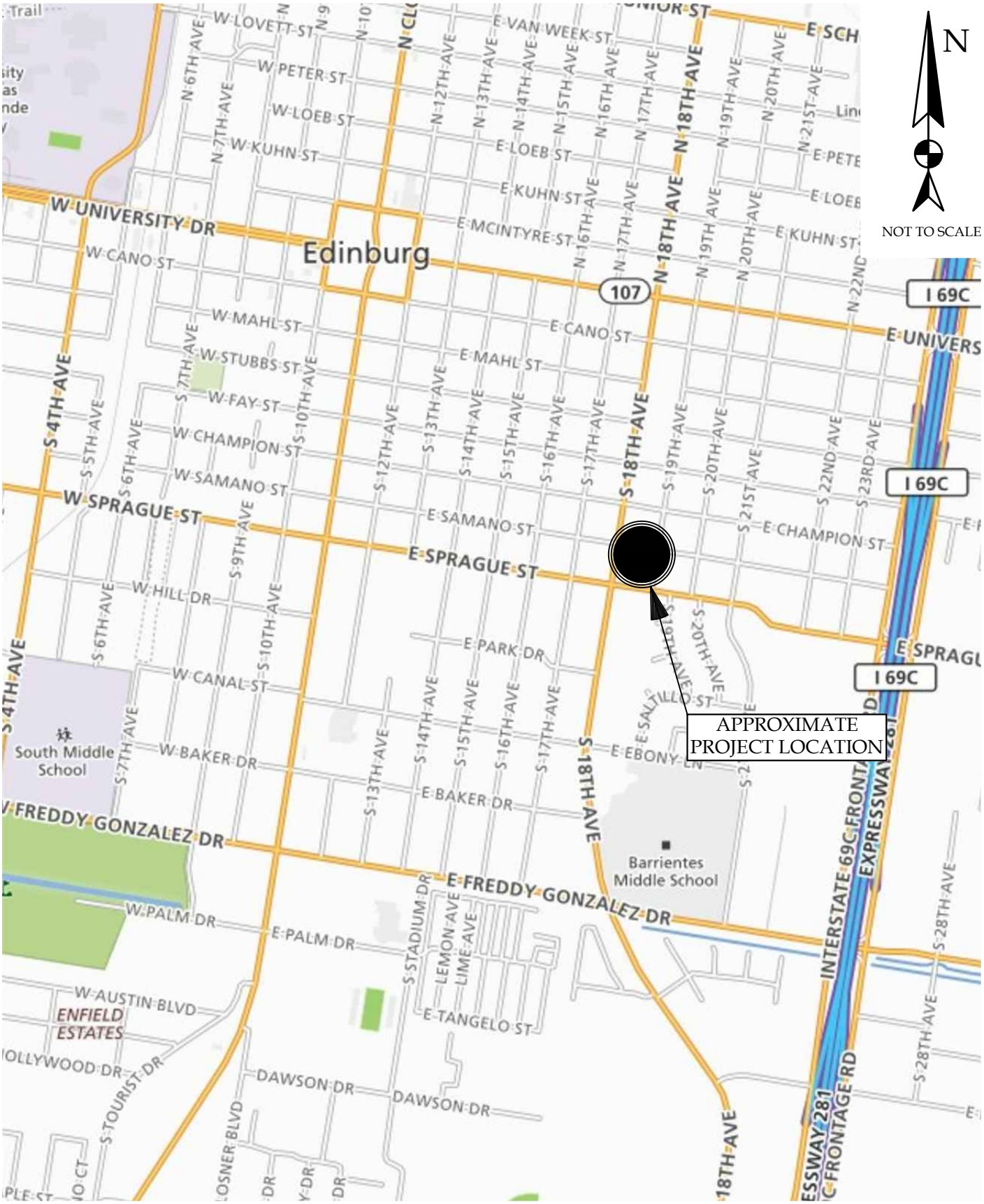
Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

APPENDIX B
PROJECT LOCATION, TOPOGRAPHIC AND BOREHOLE LOCATION MAPS

MEG ENGINEERS Strong Leaders!
Geotechnical / Environmental / Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140



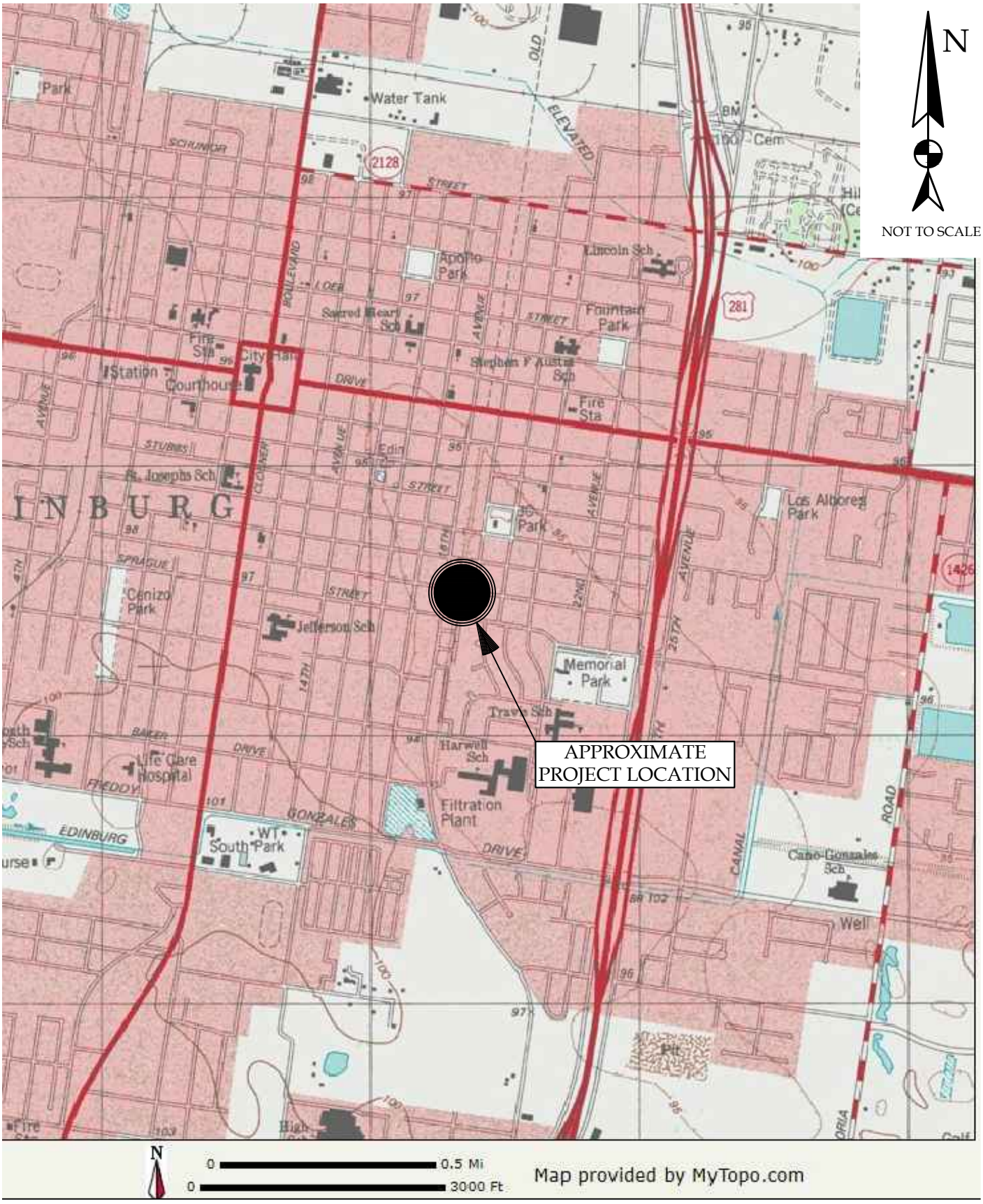
PROJECT SITE LOCATION MAP

PROPOSED
EL TULE PROJECT

EDINBURG, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 01-19-29222 / DATE: 11/20/2019 / APPROVED BY: A. PALMA / DRAWN BY: J. PALMA



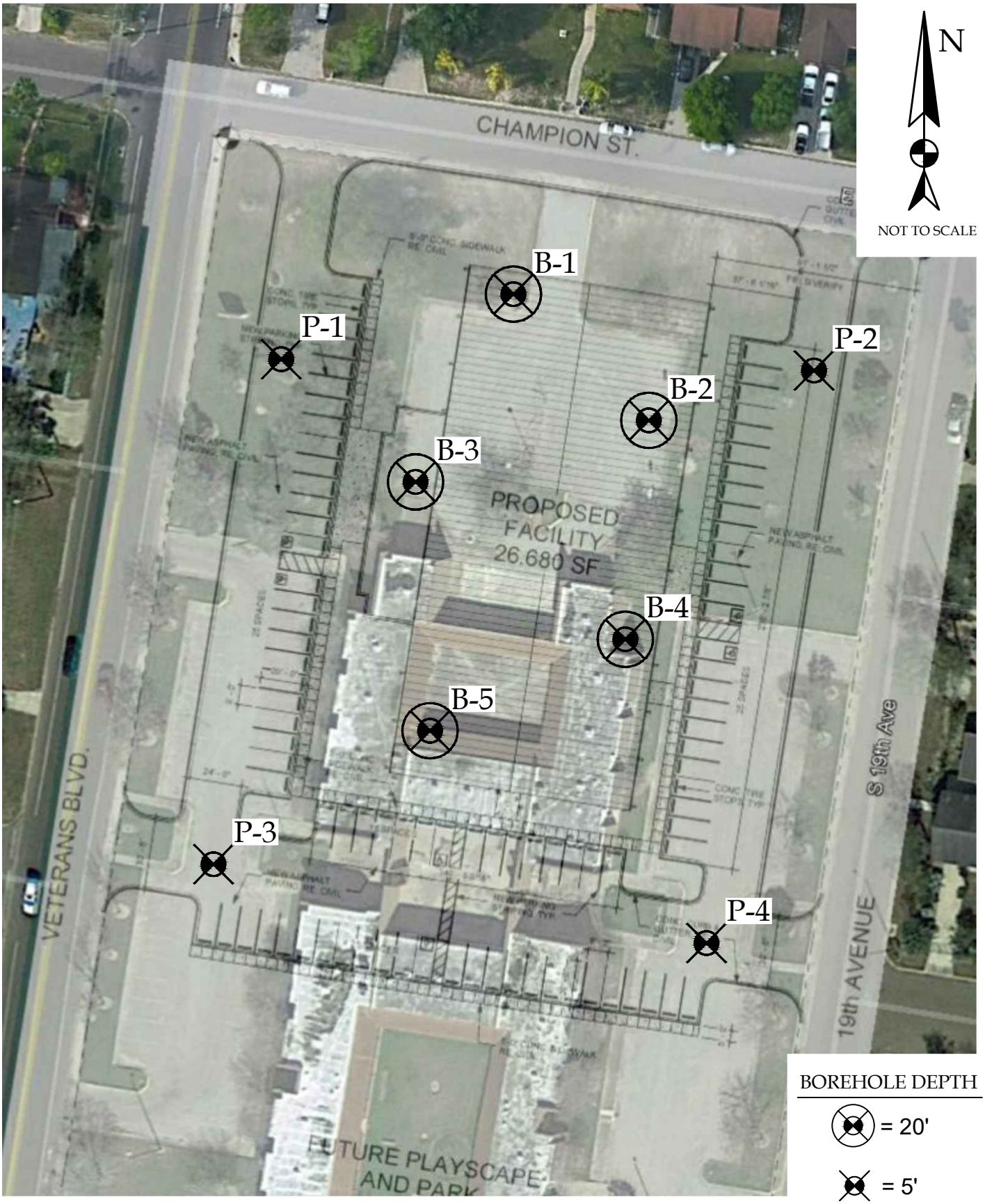
MEG PROJECT: 01-19-29222 / DATE: 11/20/2019 / APPROVED BY: A. PALMA / DRAWN BY: J. PALMA

PROJECT TOPOGRAPHY MAP

PROPOSED
EL TULE PROJECT

EDINBURG, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140



PROJECT BOREHOLE LOCATION MAP

PROPOSED
EL TULE PROJECT

EDINBURG, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 01-19-29222 / DATE: 11/20/2019 / APPROVED BY: A. PALMA / DRAWN BY: J. PALMA

APPENDIX C
PROJECT BORING LOGS AND PROFILE

MEG ENGINEERS Strong Leaders!
Geotechnical / Environmental / Testing

5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring B-1

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **17 feet ATD, 9 feet after 24 Hrs.**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0				CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			1	14				
			2	9				
95	5				CH		fat CLAY with sand, grey, dry, stiff to very stiff	
			3	14				
					CL-CH		lean CLAY with sand to fat CLAY with sand, brown, dry, stiff to very stiff	
			4	15				
					CH		fat CLAY with sand, light brown, dry, stiff to very stiff	
			5	13			@ 24 Hrs. ▼	
90	10							
			6	14				
85	15						@ ATD ▽	
					CL		lean CLAY with sand, tan, moist to wet, soft to stiff	
			7	14				
80	20						Bottom of Borehole	
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring B-2

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **17 feet ATD, 9 feet after 24 Hrs.**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0		1	9	CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			2	10				
95	5		3	20	CH		fat CLAY with sand, grey, dry, stiff to very stiff	
			4	22	CL-CH		lean CLAY with sand to fat CLAY with sand, brown, dry, stiff to very stiff	
			5	12	CH		fat CLAY with sand, light brown, dry, stiff to very stiff @ 24 Hrs. ▼	
90	10							
			6	17			@ ATD ▽	
85	15							
			7	4	CL		lean CLAY with sand, tan, moist to wet, soft to stiff	
80	20						Bottom of Borehole	
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring B-3

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **16 feet ATD**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0		1	11	CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			2	14				
95	5		3	16	CH		fat CLAY with sand, grey, dry, stiff to very stiff	
			4	20	CL-CH		lean CLAY with sand to fat CLAY with sand, brown, dry, stiff to very stiff	
			5	24	CH		fat CLAY with sand, light brown, dry, stiff to very stiff	
90	10							
			6	26			@ ATD ▽	
85	15				CL		lean CLAY with sand, tan, moist to wet, soft to stiff	
			7	6				
80	20						Bottom of Borehole	
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring B-4

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **17 feet ATD, 11 feet after 24 Hrs.**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0		1	11	CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			2	12				
95	5		3	19	CH		fat CLAY with sand, grey, dry, stiff to very stiff	
			4	25	CL-CH		lean CLAY with sand to fat CLAY with sand, brown, dry, stiff to very stiff	
			5	14	CH		fat CLAY with sand, light brown, dry, stiff to very stiff	
90	10						@ 24 Hrs. ▼	
			6	19				
85	15						@ ATD ▽	
			7	6	CL		lean CLAY with sand, tan, moist to wet, soft to stiff	
80	20						Bottom of Borehole	
75	25							
70	30							

Z:\MEG FILES\MEG Files\(2) Geotech Department\2019 Geotech - Pharr\01-19-29222 - El Tule Project\Report Files\BoringGS\Boring Logs.bgd[(master 0 lab).tpl]

Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring B-5

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **17 feet ATD, 11 feet after 24 Hrs.**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0		1	8	CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			2	12				
95	5		3	12	CH		fat CLAY with sand, grey, dry, stiff to very stiff	
			4	14	CL-CH		lean CLAY with sand to fat CLAY with sand, brown, dry, stiff to very stiff	
			5	13	CH		fat CLAY with sand, light brown, dry, stiff to very stiff	
90	10						@ 24 Hrs. ▼	
			6	18				
85	15						@ ATD ▽	
			7	6	CL		lean CLAY with sand, tan, moist to wet, soft to stiff	
80	20						Bottom of Borehole	
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring P-1

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **5 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0				CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			1	10				
			2	9				
95	5						Bottom of Borehole	
90	10							
85	15							
80	20							
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring P-2

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **5 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0				CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			1	12				
			2	13				
95	5						Bottom of Borehole	
90	10							
85	15							
80	20							
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring P-3

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **5 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0				CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			1	22				
			2	25				
95	5						Bottom of Borehole	
90	10							
85	15							
80	20							
75	25							
70	30							

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Project: **Proposed El Tule Project**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-19-29222**

Log of Boring P-4

Sheet 1 of 1

Date(s) Drilled **11/1/2019**	Logged By **J. Rivera**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **5 feet bgs**
Drill Rig Type **CME 45**	Drilling Contractor **MEG**	Approximate Surface Elevation **100.0 feet Natural Ground (assumed)**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, cathead**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
100	0				CL		sandy lean CLAY to lean CLAY with sand, light brown, dry to moist, stiff to very stiff	
			1	20				
			2	21				
95	5						Bottom of Borehole	
90	10							
85	15							
80	20							
75	25							
70	30							

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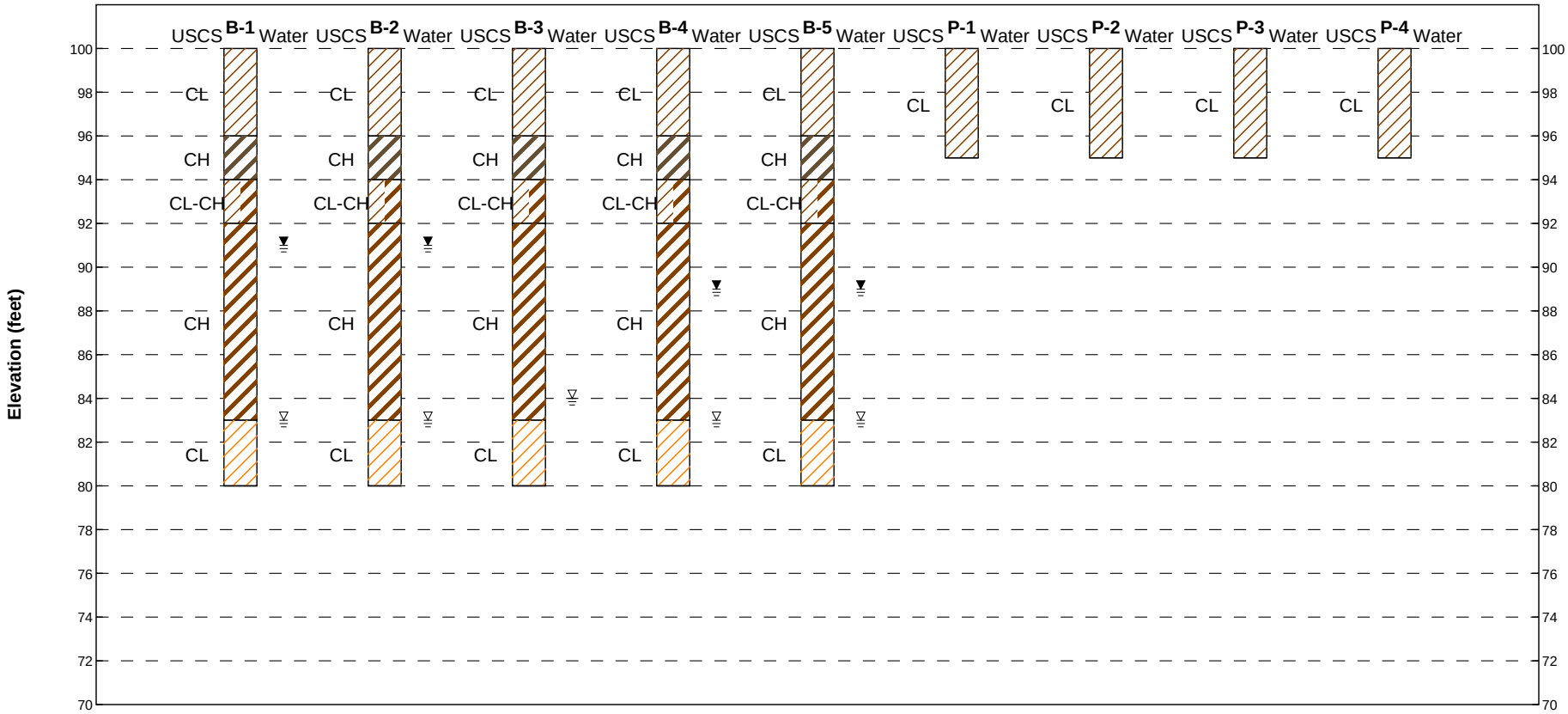

MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)

Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)

Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)

Millennium Engineers Group, Inc	
Proposed El Tule Project	
Project No.	**Figure No.**
01-19-29222	C-1

Project: **Proposed El Tule Project**
Project Location: **Edinburg, Hidalgo County, Texas**
Project Number: **01-19-29222**

Key to Log of Boring
Sheet 1 of 1

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9

COLUMN DESCRIPTIONS

1 Elevation (feet): Elevation (MSL, feet).
2 Depth (feet): Depth in feet below the ground surface.
3 Sample Type: Type of soil sample collected at the depth interval shown.
4 Sample Number: Sample identification number.
5 Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6 Material Type: Type of material encountered.
7 Graphic Log: Graphic depiction of the subsurface material encountered.
8 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9 REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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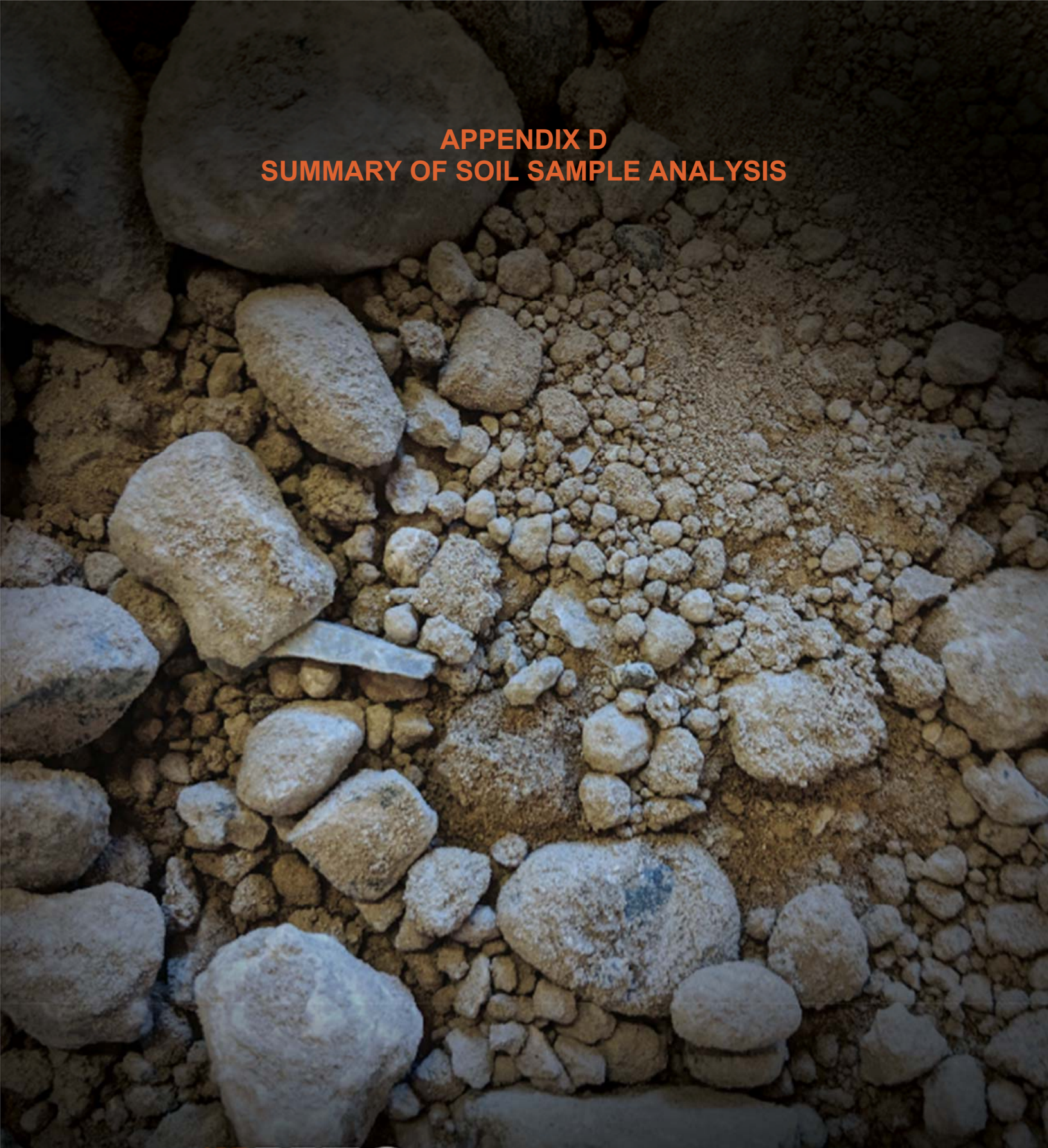
Figure B-1

APPENDIX D
SUMMARY OF SOIL SAMPLE ANALYSIS



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Summary of Soil Sample Analyses

Project Name: Proposed El Tule Project

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
B-1	.5 - 2	14	5	31	22	9				CL
	2.5 - 4	9	8				53			
	4.5 - 6	14	19							
	6.5 - 8	15	19	51	20	30				CH
	8.5 - 10	13	20	55	15	40				CH
	13.5 - 15	14	21							
	18.5 - 20	14	22				75			
B-2	.5 - 2	9	12	34	14	20				CL
	2.5 - 4	10	16	34	15	19				CL
	4.5 - 6	20	13				72			
	6.5 - 8	22	15							
	8.5 - 10	12	21				81			
	13.5 - 15	17	22	59	20	39				CH
	18.5 - 20	4	24							
B-3	.5 - 2	11	14	38	19	19	56			CL
	2.5 - 4	14	13							
	4.5 - 6	16	13							
	6.5 - 8	20	14	46	16	30				CL
	8.5 - 10	24	18							
	13.5 - 15	26	17				78			
	18.5 - 20	6	20	35	16	19				CL
B-4	.5 - 2	11	11	43	19	24				CL
	2.5 - 4	12	11				77			
	4.5 - 6	19	16	50	19	31				CH
	6.5 - 8	25	18				79			
	8.5 - 10	14	20	57	19	39				CH
	13.5 - 15	19	21							
	18.5 - 20	6	24							
B-5	.5 - 2	8	17	40	19	20				CL
	2.5 - 4	12	18				68			
	4.5 - 6	12	17							
	6.5 - 8	14	19	54	20	34				CH
	8.5 - 10	13	20							
	13.5 - 15	18	22	53	27	26				CH
	18.5 - 20	6	22				70			

Summary of Soil Sample Analyses

Project Name: Proposed El Tule Project

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
P-1	.5 - 2 2.5 - 4	10 9	18 16	49	22	27	60			CL
P-2	.5 - 2 2.5 - 4	12 13	9 17	39	21	18	76			CL
P-3	.5 - 2 2.5 - 4	22 25	12 9	42	18	24	52			CL
P-4	.5 - 2 2.5 - 4	20 21	13 9	41	17	25	73			CL

APPENDIX E
LABORATORY AND FIELD PROCEDURES

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Laboratory and Field Test Procedures

Soil Classification Per ASTM D2487-93:

This soil-testing standard was used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted in the attached boring logs.

Soil Water Content Per ASTM D2216-92:

This test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under **MC** in the attached boring logs.

Soil Liquid Limit Per ASTM D4318-93:

The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **LL** in the attached boring logs.

Soil Plastic Limit Per ASTM D4318-93:

The soil Plastic Limit identifies lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **PL** in the attached boring logs.

Plasticity Index Per ASTM D4318-93:

This is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively. The test results are listed under **PI** in the attached boring logs.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS) per ASTM D 1586:

This is the standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140-pound hammer in a prescribed manner.

Blow Counts (N) per ASTM D 1586:

This is the number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Shelby Tube (ST) per ASTM D 1587:

This procedure is for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of physical properties.

Dry Density (DD) per ASTM D 2937:

This procedure is for the determination of in-place density of soil. The test results are measured in pounds per cubic foot, pcf.

Unconfined Compression Test (Uc) per ASTM D 2166:

This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

Minus No. 200 Sieve per ASTM D 1140:

This test method covers determination of the amount of material finer than a Number 200 sieve by washing. The results are stated as a percent of the total dry weight of the sample.

Pocket Penetrometer (PP):

This test method is an accepted modification of ASTM D 1558 test method for establishing the moisture-penetration resistance relationships of fine-grained soils. The test results are measured in tons per square foot, tsf. The strength values provided by this method should be considered qualitatively.

Rock Quality Designation (RQD):

The measure of the quality of a rock mass defined by adding intact rock core pieces greater than four inches in length by the total length of core advance.

Recovery Ratio (REC):

The Recovery Ratio is equal to the total length of core recovered divided by the total length of core advance.

Boring Logs:

This is a summary of the above-described information at each boring location.

Millennium Engineers Group
MEG ENGINEERS
Consultants - Geotechnical - Testing

TBPE FIRM No. F-3913
www.megengineers.com

Area Offices

5804 N. Gumwood Ave.	Pharr, Texas 78577	956-702-8500
1221 E. Tyler Ave.	Harlingen, Texas 78550	956-454-8832
5918 McPherson Rd., Ste. 5	Laredo, Texas 78041	956-568-1664

Report On: Geotechnical Engineering Report Submittal

Lab No: 12241-1
Report No: 2-1

Project No: 01-20-29138 **Acct. No.:** EEDC2019

Client: Edinburg Economic Development Corp.
Ruben R. Ramirez
415 W. University Drive
Edinburg, TX 78541

Project: El Tule Building- Additional Soil Borings
Updated Site Plan

Location: Edinburg, Hidalgo County, Texas

Report Date: 05/19/2020
Sample Date: 04/20/2020
Sampled By: Juan Palma

Remarks: We are pleased to submit the attached geotechnical engineering report for the proposed El Tule Building in Edinburg, Hidalgo County, Texas. Please redistribute attached report as necessary. MEG appreciates your business and looks forward to continue working with you on upcoming projects. We emphasize that our report be reviewed to its fullest, and to arrange a conference call with one of our engineers for any questions about the report.

Respectfully Submitted,
Millennium Engineers Group, Inc.

Raul Palma, President

Millennium Engineers Group
MEG ENGINEERS
Consultants - Geotechnical - Testing

TBPE FIRM No. F-3913
www.megengineers.com

Area Offices

5804 N. Gumwood Ave.	Pharr, Texas 78577	956-702-8500
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Report On: Geotechnical Engineering Report Submittal

Lab No: 12241-1
Report No: 2-1

Project No: 01-20-29138 **Acct. No.:** EEDC2019

Client: Edinburg Economic Development Corp.
Ruben R. Ramirez
415 W. University Drive
Edinburg, TX 78541

Project: El Tule Building- Additional Soil Borings
Updated Site Plan

Location: Edinburg, Hidalgo County, Texas

Report Date: 05/19/2020
Sample Date: 04/20/2020
Sampled By: Juan Palma

Orig: Edinburg Economic Development Corp.
Attn: Ruben R. Ramirez (1-cc copy)
1-ec Edinburg Economic Development Corp.
Attn: Michael Rene Balderas
1-cc Millennium Engineers Group
Attn: Lucas Castillo
1-ec Millennium Engineers Group
Attn: Juan M. Borjon
1-ec Millennium Engineers Group
Attn: Humberto Palma
1-ec Millennium Engineers Group Attn: Juan Palma
1-ec Millennium Engineers Group Attn: Sergio Tovar
1-ec Millennium Engineers Group Attn: Marcos Gil
1-ec Millennium Engineers Group
Attn: Rose Hinojosa
1-ec Millennium Engineers Group
Attn: Victor Juarez
1-ec Millennium Engineers Group Attn: Amos Emerson
1-ec Millennium Engineers Group Attn: Andres Palma

Respectfully Submitted,
Millennium Engineers Group, Inc.

Raul Palma, President

MEG GEOTECHNICAL ENGINEERING REPORT

PROPOSED
EL TULE BUILDING
ADDITONAL SOIL BORINGS UPDATED SITE PLAN

EDINBURG, HIDALGO COUNTY, TEXAS

Geotechnical Engineering • Construction Materials Engineering & Testing
Environmental • Consulting • Forensics

GEOTECHNICAL ENGINEERING REPORT
FOUNDATION AND PAVEMENT RECOMMENDATIONS
PROPOSED EL TULE BUILDING – UPDATED SITE PLAN
EDINBURG, HIDALGO COUNTY, TEXAS

Prepared For
Michael Rene Balderas
Edinburg Economic Development Corporation

MEG Report No. 01-20-29138

May 18, 2020

MILLENNIUM ENGINEERS GROUP, INC.
TBPE FIRM NO. F-3913
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
TEL:956-702-8500
FAX:956-702-8140
WWW.MEGENGINEERS.COM

May 18, 2020

Michael Rene Balderas
Edinburg Economic Development Corporation
15 W. University Drive
Edinburg, TX 78539
(956)388-8204
michael@edinburgedc.com

Subject: **Geotechnical Engineering Report**
MEG Report No. 01-20-29138
Foundation and Pavement Recommendations
Proposed El Tule Building – Additional Soil Borings for Updated Site Plan
Edinburg, Hidalgo County, Texas

Dear Mr. Balderas (CLIENT):

Millennium Engineers Group, Inc. is pleased to submit the enclosed boring logs and soil testing data conducted due to the updated site plan of the project. This report addresses the procedures and findings of our geotechnical engineering study. **The recommendations from the original geotechnical engineering report (MEG Report No. 01-19-29222) can be utilized as is for the updated site plan as subsurface conditions encountered were consistent.**

We look forward to continuing our involvement in the project by providing construction monitoring in accordance with the report recommendations and materials testing services during construction. We strongly recommend that we be a part of the preconstruction meeting to address any specific issues that are pertinent to this project.

Thank you for the opportunity to be of service to you in this phase of the project and we would like the opportunity to assist you in the upcoming phases of the project. If you have any questions, please contact our office at the address, telephone, fax or electronic address listed below.

Cordially,
Millennium Engineers Group, Inc.
TBPE Firm No. F-3913

Raul Palma, P.E.
President

The seal appearing on this document was authorized by Raul Palma, P.E. 65656 on May 18, 2020. Alteration of a sealed document without proper notification to the responsible engineer is an offence under the Texas Engineering Practice Act

Cc: 1 Original and PDF Document

TABLE OF CONTENTS

APPENDIX

APPENDIX A
CUSTOM SOIL RESOURCE REPORT

MEG ENGINEERS Strong Leaders!
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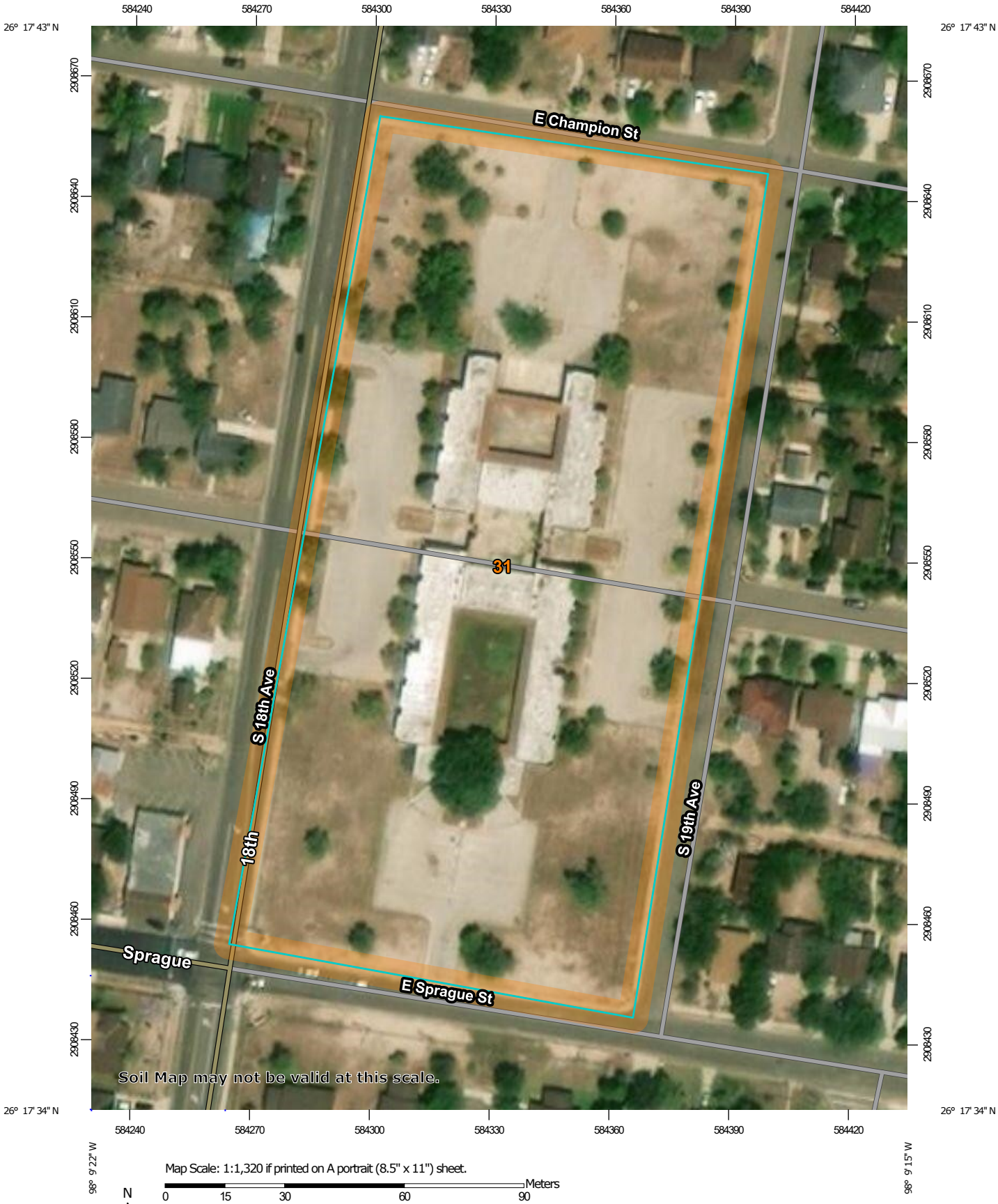
5840 N. Gumwood Avenue ■ Pharr, Texas 78577 ■ Tel: 956-702-8500 ■ Fax: 956-702-8140

Soil Map—Hidalgo County, Texas
(01-20-29138 proposed El Tule Building)



Map Scale: 1:1,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hidalgo County, Texas
Survey Area Data: Version 18, Sep 12, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

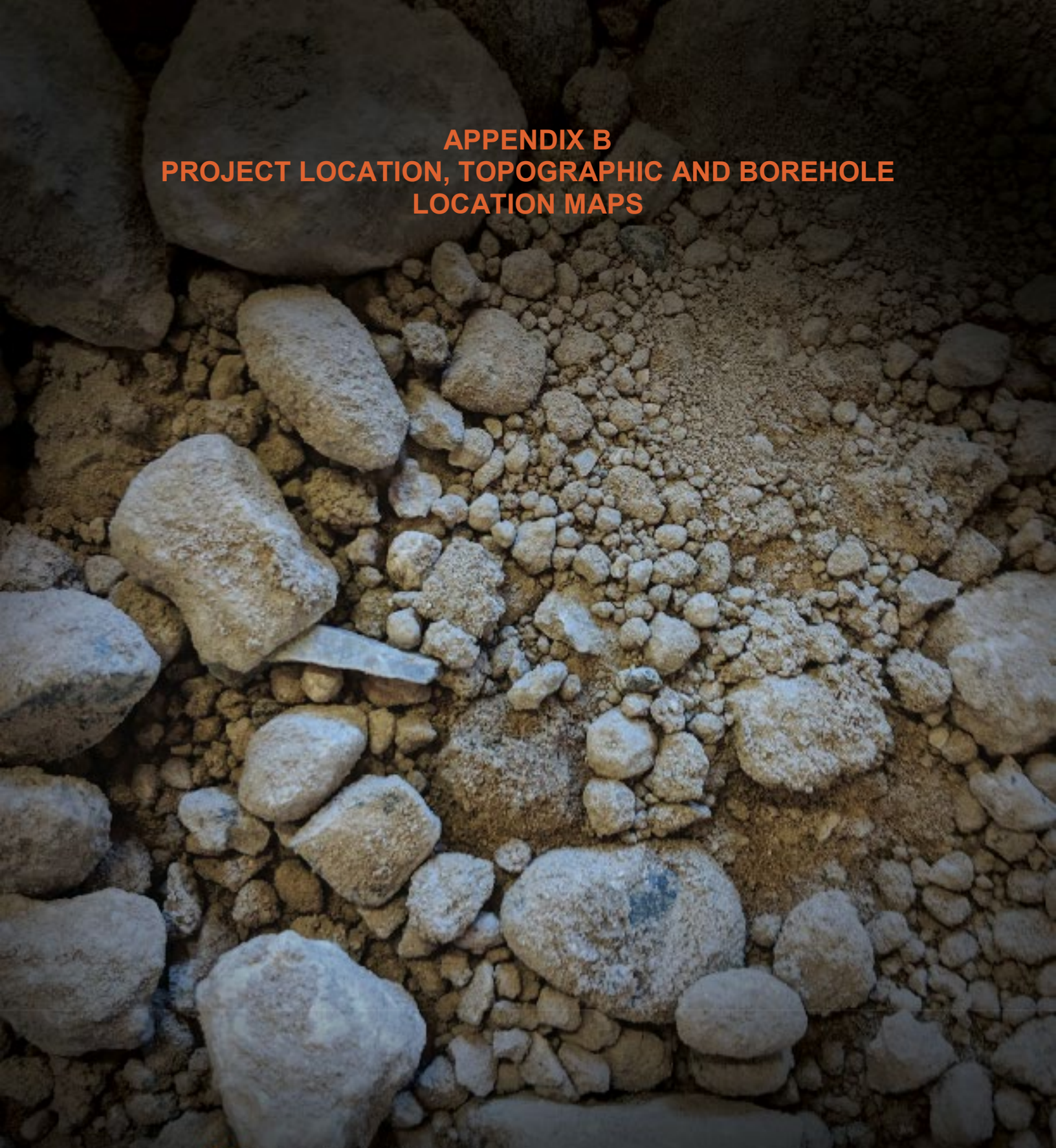
Date(s) aerial images were photographed: Sep 20, 2015—Nov 5, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
31	Hidalgo-Urban land complex, 0 to 1 percent slopes	5.3	100.0%
Totals for Area of Interest		**5.3**	**100.0%**

APPENDIX B
PROJECT LOCATION, TOPOGRAPHIC AND BOREHOLE LOCATION MAPS



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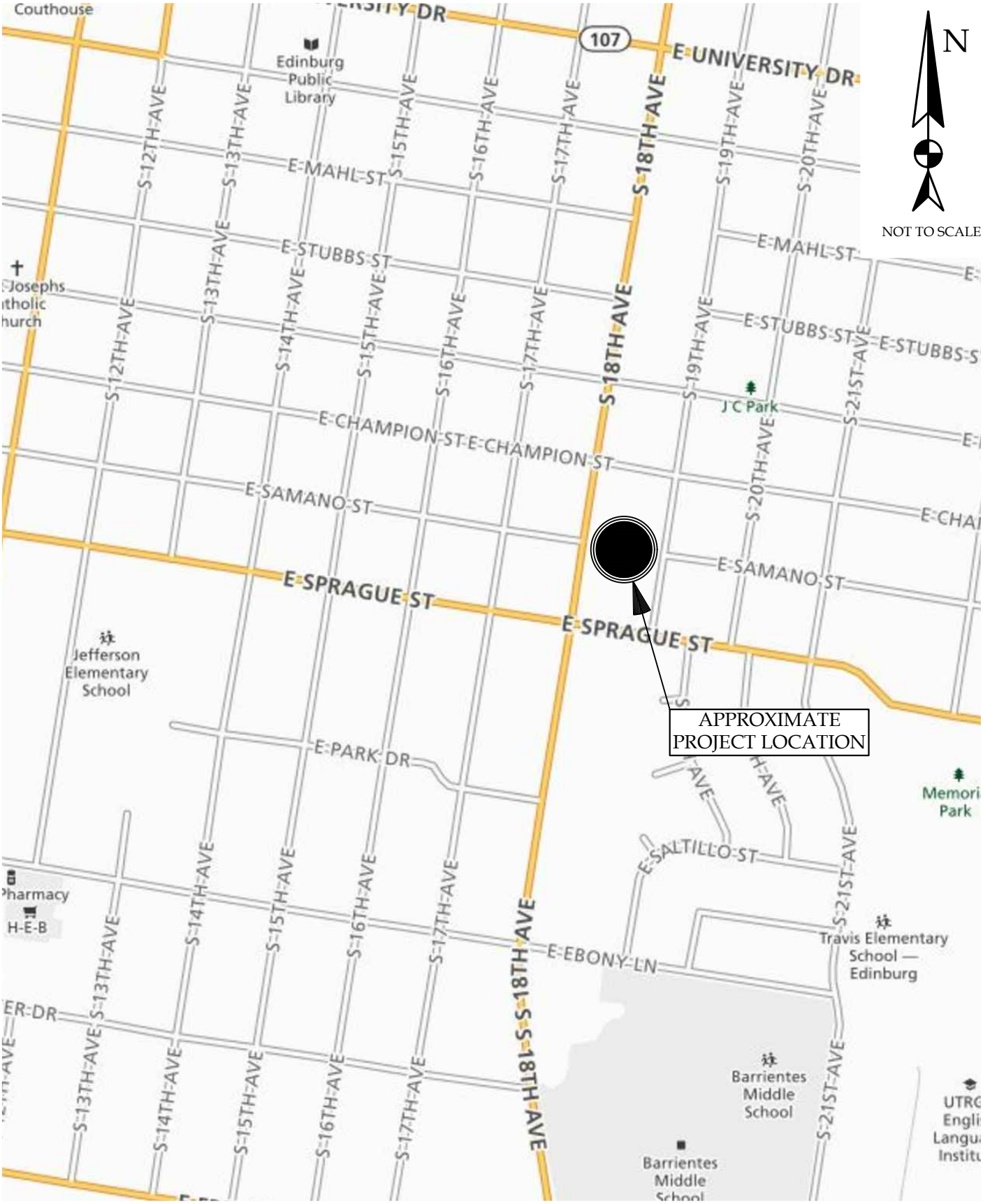
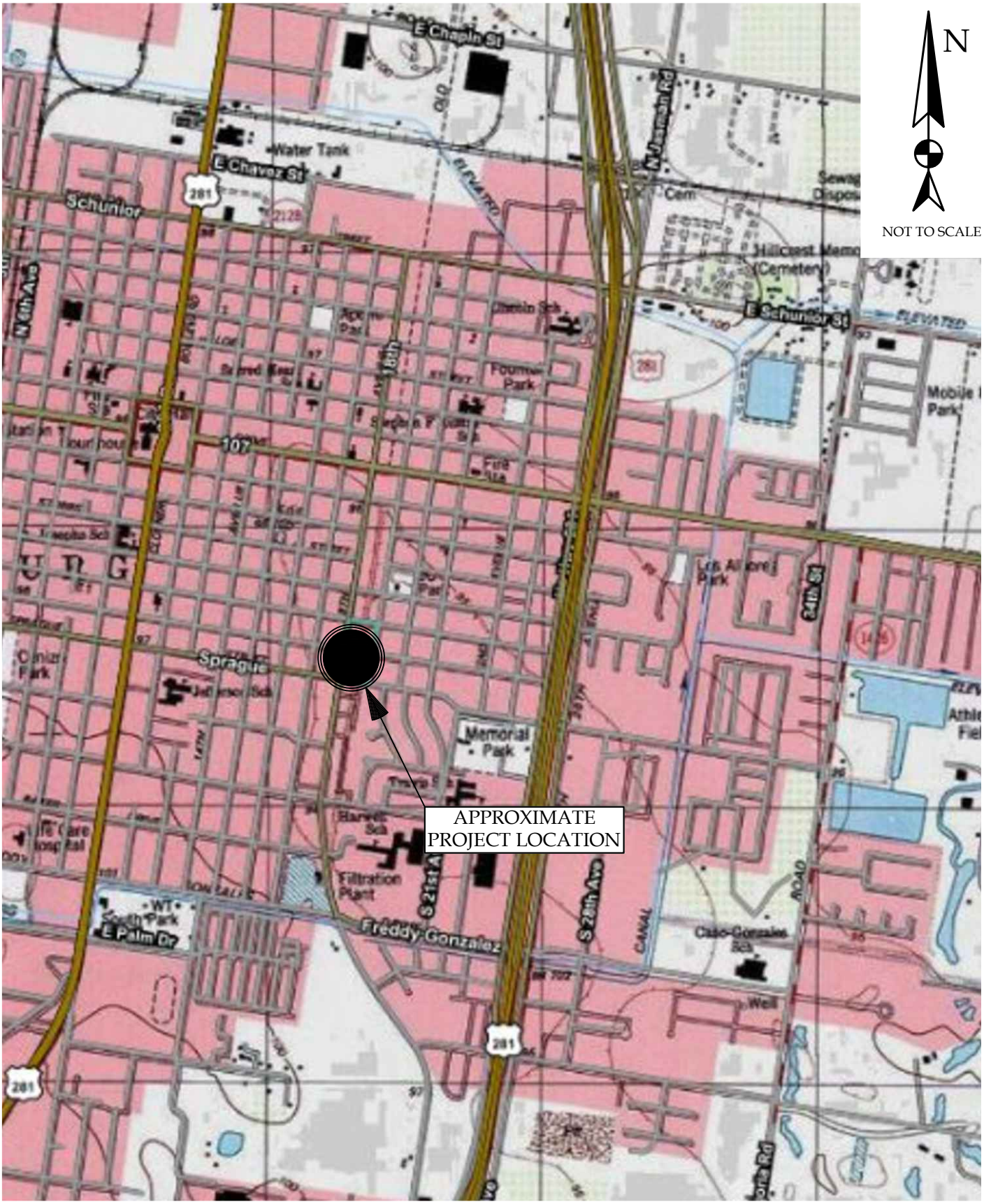


PROJECT SITE LOCATION MAP

PROPOSED
EL TULE BUILDING - ADDITIONAL SOIL BORING
UPDATED SITE PLAN
EDINBURG, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
PHARR, TEXAS 78577
WWW.MEGENGINEERS.COM
TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 01-20-29138 / DATE: 5/18/2020 / APPROVED BY: A. PALMA / DRAWN BY: S. MARTINEZ



MEG PROJECT: 01-20-29138 / DATE: 5/18/2020 / APPROVED BY: A. PALMA / DRAWN BY: S. MARTINEZ

PROJECT TOPOGRAPHY MAP

PROPOSED
EL TULE BUILDING - ADDITIONAL SOIL BORING
UPDATED SITE PLAN
EDINBURG, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
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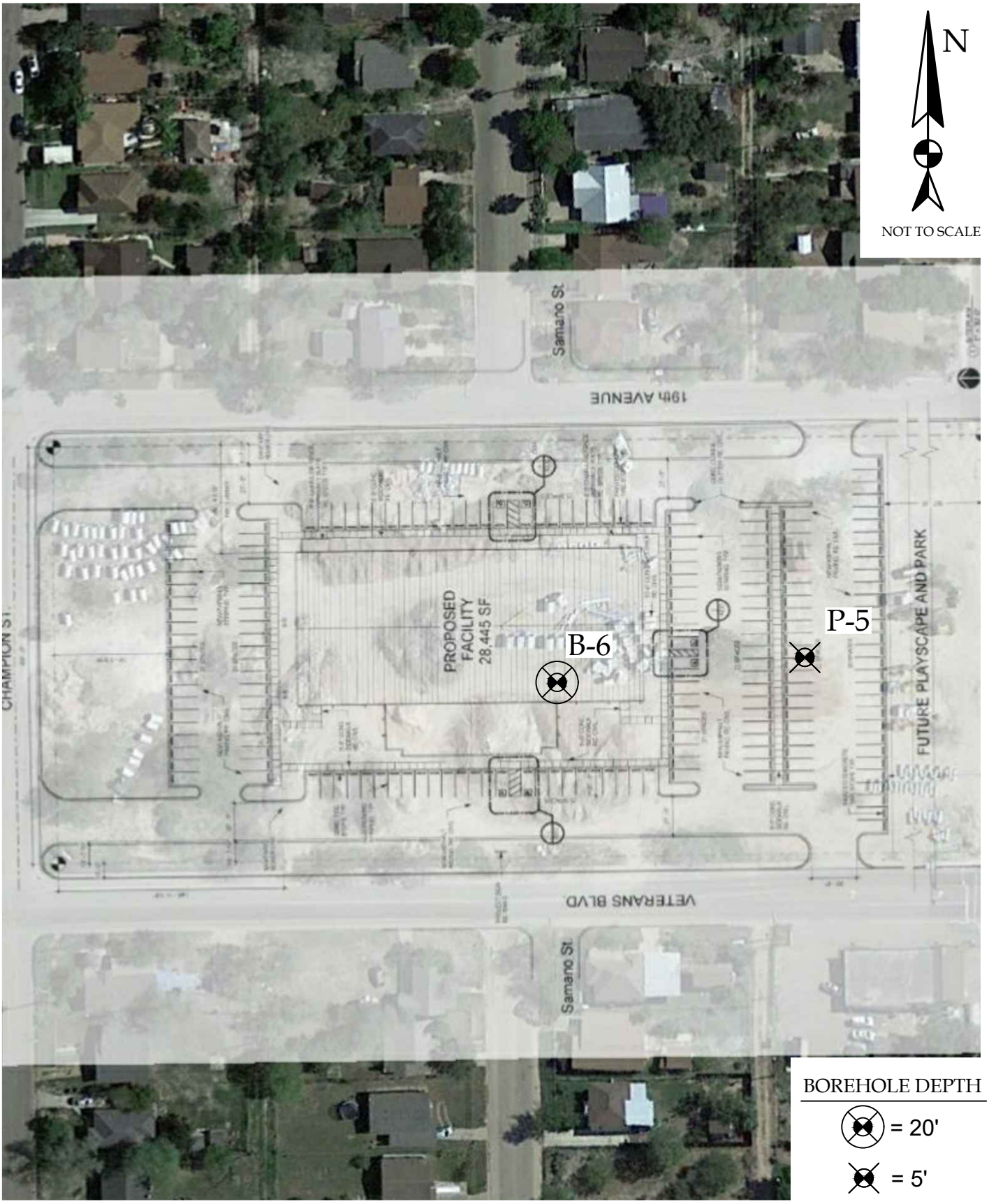

PROJECT BOREHOLE LOCATION MAP

PROPOSED
EL TULE BUILDING - ADDITIONAL SOIL BORING
UPDATED SITE PLAN
EDINBURG, HIDALGO COUNTY, TEXAS

MILLENNIUM ENGINEERS GROUP, INC.
5804 N. GUMWOOD AVENUE
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TEL: 956-702-8500
FAX: 956-702-8140

MEG PROJECT: 01-20-29138 / DATE: 5/18/2020 / APPROVED BY: A. PALMA / DRAWN BY: S. MARTINEZ

APPENDIX C
PROJECT BORING LOGS AND PROFILE

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Project: **Proposed El Tule Buillding - Additional Soil Borings Updated Site Plan** Project Location: **Edinburg, Hidalgo County, Texas** Project Number: **01-20-29138**	# Log of Boring B-6 **Sheet 1 of 1**

Date(s) Drilled **April 4, 2020**	Logged By **D. Juarez**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **20 feet bgs**
Drill Rig Type **Simco 2800**	Drilling Contractor **MEG**	Approximate Surface Elevation
Groundwater Level and Date Measured	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	REMARKS AND OTHER TESTS
	0				CL		sandy lean CLAY, dark brown to brown, dry, very stiff to stiff					
	1		1	17				13	37	20		
	2											
	3		2	14				12	31	14		
	4				CH		fat clay w/sand to fat clay, tan to reddish brown, dry to moist, sitff to very stiff					
	5		3	15				18			78	
	6											
	7		4	13				20				
	8											
	9		5	14				20	50	32		
	10											
	11											
	12											
	13											
	14		6	19				24				
	15				CL		sandy lean CLAY, tan, moist, med sitff					
	16											
	17											
	18											
	19		7	6				21			59	
	20						Bore Termination					
	21											
	22											
	23											
	24											
	25											
	26											
	27											

Project: **Proposed El Tule Buillding - Additional Soil Borings Updated Site Plan**	Log of Boring P-5
Project Location: **Edinburg, Hidalgo County, Texas**	**Sheet 1 of 1**
Project Number: **01-20-29138**	

Date(s) Drilled **April 4, 2020**	Logged By **D. Juarez**	Checked By **Raul Palma**
Drilling Method **Straight Flight**	Drill Bit Size/Type **4" soil bit**	Total Depth of Borehole **5 feet bgs**
Drill Rig Type **Simco 2800**	Drilling Contractor **MEG**	Approximate Surface Elevation
Groundwater Level and Date Measured	Sampling Method(s) **SPT**	Hammer Data **140 lb., 30 in. drop, auto trip**
Borehole Backfill **Subgrade Cuttings**	Location **See Boring Location Map**	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resistance, blows/ft	Material Type	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	LL, %	PI, %	Percent Fines	REMARKS AND OTHER TESTS
	0				CL		sandy lean CLAY, dark brown to light brown, dry, stiff					
	1		1	8				20	33	20		
	2											
	3											
	4		2	12				20			76	
	5						Bore Termination					
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											
	20											
	21											
	22											
	23											
	24											
	25											
	26											
	27											

Millennium Engineers Group
MEG ENGINEERS

Project: **Proposed El Tule Buillding - Additional Soil Borings Updated Site Plan**

Project Location: **Edinburg, Hidalgo County, Texas**

Project Number: **01-20-29138**

Key to Log of Boring

Sheet 1 of 1

1 Elevation (feet)	2 Depth (feet)	3 Sample Type	4 Sample Number	5 Sampling Resistance, blows/ft	6 Material Type	7 Graphic Log	8 MATERIAL DESCRIPTION	9 Water Content, %	10 LL, %	11 PI, %	12 Percent Fines	13 REMARKS AND OTHER TESTS

COLUMN DESCRIPTIONS

1. Elevation (feet): Elevation (MSL, feet).
2. Depth (feet): Depth in feet below the ground surface.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Sample Number: Sample identification number.
5. Sampling Resistance, blows/ft: Number of blows to advance driven sampler one foot (or distance shown) beyond seating interval using the hammer identified on the boring log.
6. Material Type: Type of material encountered.
7. Graphic Log: Graphic depiction of the subsurface material encountered.
8. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
9. Water Content, %: Water content of the soil sample, expressed as percentage of dry weight of sample.
10. LL, %: Liquid Limit, expressed as a water content.
11. PI, %: Plasticity Index, expressed as a water content.
12. Percent Fines: The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.
13. REMARKS AND OTHER TESTS: Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)

Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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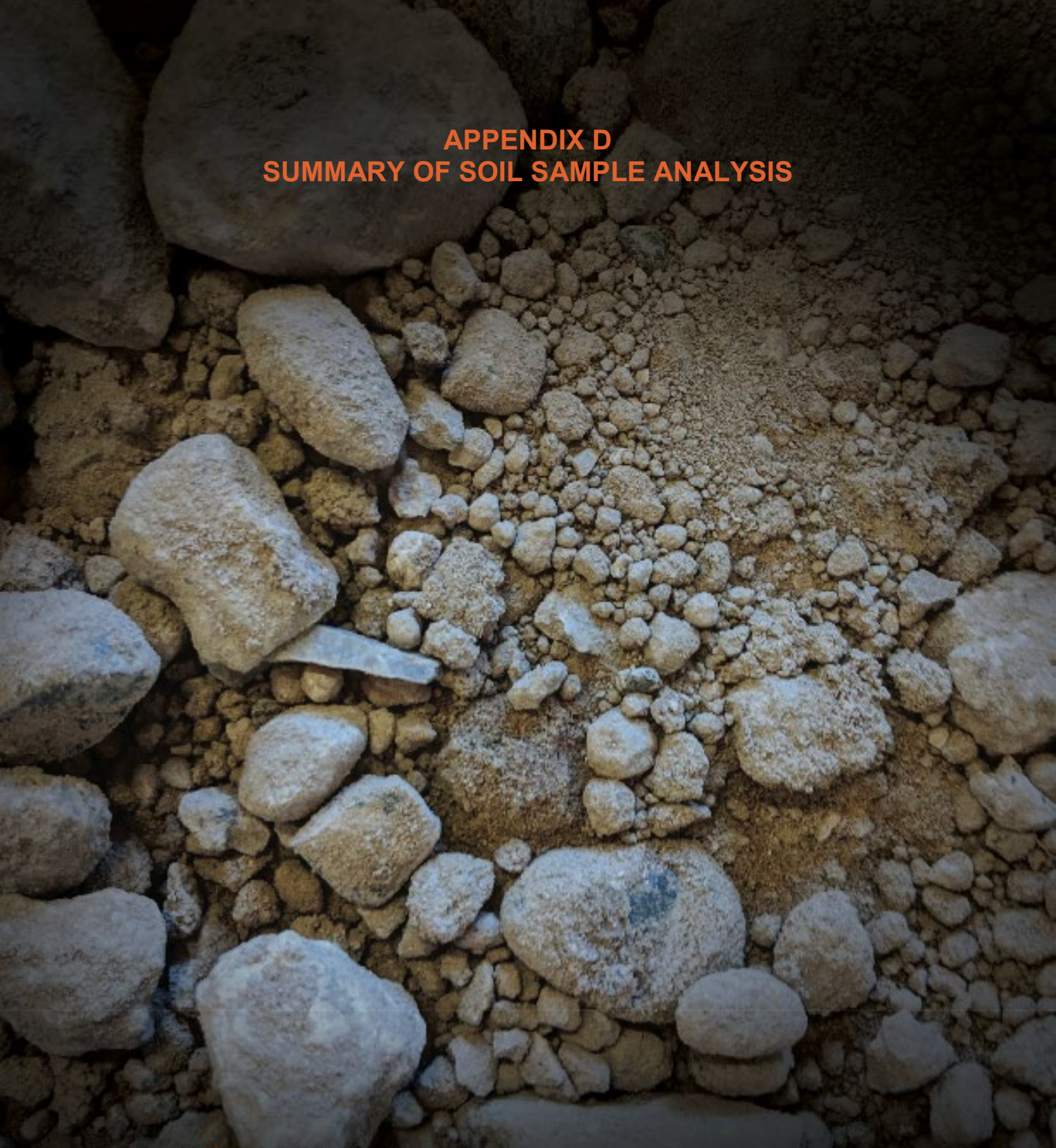
Figure B-1

APPENDIX D
SUMMARY OF SOIL SAMPLE ANALYSIS



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Summary of Soil Sample Analyses

Project Name: Proposed El Tule Building – Additional Soil Borings Updated Site Plan

Boring No.	Sample Depth (ft)	Blows Per (ft)	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index	-200% Sieve	Shear Strength (tsf)	Dry Unit Weight (pcf)	USCS
B-6	.5 - 2	17	13	37	17	20				CL
	2.5 - 4	14	12	31	16	14				CL
	4.5 - 6	15	18				78			
	6.5 - 8	13	20							
	8.5 - 10	14	20	50	18	32				CH
	13.5 - 15	19	24							
	18.5 - 20	6	21				59			
P-5	.5 - 2	8	20	33	14	20				CL
	3.5 - 5	12	20				76			

APPENDIX E
LABORATORY AND FIELD PROCEDURES

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Laboratory and Field Test Procedures

Soil Classification Per ASTM D2487-93:

This soil-testing standard was used for classifying soils according to the Unified Soil Classification System. The soil classifications of the earth materials encountered are as noted in the attached boring logs.

Soil Water Content Per ASTM D2216-92:

This test determines the water content of soil or rock expressed as a percentage of the solid mass of the soil. The test results are listed under **MC** in the attached boring logs.

Soil Liquid Limit Per ASTM D4318-93:

The soil Liquid Limit identifies the upper limit soil water content at which the soil changes from a moldable (plastic) physical state to a liquid state. The Liquid Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **LL** in the attached boring logs.

Soil Plastic Limit Per ASTM D4318-93:

The soil Plastic Limit identifies lower limit soil water content at which the soil changes from a moldable (plastic) physical state to a non-moldable (semi-solid) physical state. The Plastic Limit water content is expressed as a percentage of the solid mass of the soil. The test results are listed under **PL** in the attached boring logs.

Plasticity Index Per ASTM D4318-93:

This is the numeric difference between the Liquid Limit and Plastic Limit. This index also defines the range of water content over which the soil-water system acts as a moldable (plastic) material. Higher Plasticity Index (PI) values indicate that the soil has a greater ability to change in soil volume or shrink and swell with lower or higher water contents, respectively. The test results are listed under **PI** in the attached boring logs.

Standard Penetration Test (SPT) and Split Spoon Sampler (SS) per ASTM D 1586:

This is the standard test method for both the penetration test and split-barrel (spoon) sampling of soils. This sampling method is used for soils or rock too hard for sampling using Shelby Tubes. The method involves penetration of a split spoon sampler into the soil or rock through successive blows of a 140-pound hammer in a prescribed manner.

Blow Counts (N) per ASTM D 1586:

This is the number of blows required to drive a Split Spoon Sampler by means of a 140 pound hammer for a distance of 12 inches in accordance with the variables stated in the test procedures.

Shelby Tube (ST) per ASTM D 1587:

This procedure is for using a thin-walled metal tube to recover relatively undisturbed soil samples suitable for laboratory tests of physical properties.

Dry Density (DD) per ASTM D 2937:

This procedure is for the determination of in-place density of soil. The test results are measured in pounds per cubic foot, pcf.

Unconfined Compression Test (Uc) per ASTM D 2166:

This test method covers the determination of the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load.

Minus No. 200 Sieve per ASTM D 1140:

This test method covers determination of the amount of material finer than a Number 200 sieve by washing. The results are stated as a percent of the total dry weight of the sample.

Pocket Penetrometer (PP):

This test method is an accepted modification of ASTM D 1558 test method for establishing the moisture-penetration resistance relationships of fine-grained soils. The test results are measured in tons per square foot, tsf. The strength values provided by this method should be considered qualitatively.

Rock Quality Designation (RQD):

The measure of the quality of a rock mass defined by adding intact rock core pieces greater than four inches in length by the total length of core advance.

Recovery Ratio (REC):

The Recovery Ratio is equal to the total length of core recovered divided by the total length of core advance.

Boring Logs:

This is a summary of the above-described information at each boring location.

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 UNIT PRICES

A. Changes to the Work incorporating Unit Prices will be made by Change Order.

1.3 CONTRACT MODIFICATION PROCEDURES

A. On Owner's approval of a proposal from Contractor, Architect will issue a Change Order on AIA Document G701, for all changes to Contract Sum or Contract Time.

B. When Owner and Contractor disagree on the terms of a proposal, Architect may issue a Construction Change Directive on AIA Document G714, instructing Contractor to proceed with the change. Construction Change Directive will contain a description of the change and designate the method to be followed to determine changes to Contract Sum or Contract Time.

1.4 PAYMENT PROCEDURES

A. Submit a Schedule of Values **at least 10 days before** the first Application for Payment. In Schedule of Values, break down Contract Sum into at least one line item for each Specification Section, showing both material and labor. Correlate the Schedule of Values with Contractor's Construction Schedule.

B. Submit 3 copies of each application for payment on AIA Document G702/703, according to the schedule established in Owner/Contractor Agreement.

1. For the second Application for Payment through the Application for Payment submitted at Substantial Completion, submit partial releases of liens from each subcontractor or supplier for whom amounts were requisitioned in the previous Application for Payment.
2. Contractor shall submit along with each Application for Payment, any proposed delay days, rain/weather days, additional general conditions incurred and an updated construction schedule.
3. The Architect will not review or consider approval of any proposed delay days or additional general conditions incurred that are not submitted within **ten (10) calendar days** of said event(s) taking place.

4. Submit final Application for Payment after completion of Project closeout procedures with release of liens and supporting documentation. Include consent of surety to final payment and insurance certificates.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 21 00 — ALLOWANCES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

A. Section 01 20 00 – Price and Payment Procedures.

1.3 CONTINGENCY ALLOWANCE

A. Include in the Contract, a stipulated sum of **One Hundred Seventy-Five Thousand Dollars, ($175,000.00)** for use upon Architect's instruction.

B. Include in the Contract, the structural allowances as stipulated in the structural drawings.

1.4 PROCEDURES FOR MANAGING ALLOWANCES

A. Contractor's costs for Products, delivery, installation, labor, payroll and equipment rental will be included in Construction Change Directives authorizing expenditure of funds from Allowances.

B. Funds will be drawn from Allowances only by Construction Change Directives.

C. At closeout of Contract, funds remaining in Allowances will be credited to Owner by Change Order.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 25 00 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUBSTITUTION REQUIREMENTS

A. When material, article, or method is specified using name of proprietary product manufacturer, vendor, or method followed by phrase "or equal," specific item mentioned establishes basis upon which projects are to be built.

1. Other manufacturers' materials, articles, and methods not named will be considered as substitutions provided required information is submitted on “SUBSTITUTION REQUEST FORM” and will not require substantial revisions of Contract Documents.

2. This applies to specific construction methods when required by Contract Documents.

3. Substitution Requests must be filled out on enclosed “Substitution Request Form”.

B. Whenever material, article, or method is specified or described without phrase "or equal," no substitutions will be allowed.

C. Costs for redesigns due to substituted items are responsibility of Applicant.

D. In making request for substitution, Applicant/Contractor represents that he:

1. Has personally investigated proposed product or method and determined that it is equal in all respects to that specified.

2. Will provide same guarantee for substitution as for product or method specified.

3. Will coordinate installation of accepted substitution into work, making design and construction changes to complete work in all respects following the Contract Documents.

1.3 SUBMITTAL OF DATA FOR PROPOSED SUBSTITUTIONS

A. In order for substitutions that do not change design intent to be considered, submit no later than 10 days prior to bid date deadline, 3 copies of complete data set forth herein to permit complete analysis of proposed substitutions listed on submitted “SUBSTITUTION REQUEST FORM”.

1. For Products:
    a. Identification including manufacturer's name and address.
    b. Manufacturer's literature, including but not necessarily limited to:
        1) Product description, performance, and test data.
        2) Reference standards.
    c. Samples where appropriate.
    d. Name and address of similar projects on which product was used and dates of installation with contact name and telephone number.

2. For Construction Methods:
    a. Detailed description of proposed method.
    b. Drawings illustrating methods.
    c. Name and address of similar projects on which method was used and dates of use with contact name and telephone number.

3. Comparison of proposed substitution with product or method specified

4. Data relating to impact on construction schedule by proposed substitution.

5. Impact on other contracts.

1.4 APPROVAL OF SUBSTITUTION

A. Architect's decision regarding evaluation of substitutions will be final and binding.

B. All approved substitutions will be incorporated into the Contract Documents by Addendum.

PART 2 - PRODUCTS
NOT USED

PART 3 - EXECUTION
NOT USED

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01340 Submittals
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01340 Submittals
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 PROJECT MANAGEMENT AND COORDINATION

A. Verify layout information shown on Drawings, in relation to property survey and existing benchmarks, before laying out the Work.

B. Coordinate construction to ensure efficient and orderly execution of each part of the Work.

C. Progress meetings will be held at Project site every two weeks. Notify Owner and Architect of meeting dates. Each subcontractor or other entity concerned with current progress or involved with planning or coordination of future activities, shall attend. The Contractor shall:

1. Prepare a progress meeting agenda.

2. Prepare a sign in sheet for each progress meeting.

3. Prepare minutes of each meeting and distribute to parties present.

1.3 CONSTRUCTION SCHEDULE

A. Prepare a horizontal bar-chart construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first workday of each week. Use same breakdown of Work indicated in the Schedule of Values. As Work progresses, mark each bar to indicate actual completion.

1. Submit within ten (10) days after date established for Commencement of the Work.
2. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
3. Indicate Substantial Completion and allow time for Architect's procedures necessary for certifying Substantial Completion.
4. Schedule Distribution: Distribute copies to Owner, Architect, subcontractors, and parties required to comply with dates.

5. Updating: Revise the schedule after each meeting or activity where revisions have been made. Distribute revised copies to Owner, Architect, subcontractors, and parties required to comply with dates.

1.4 SUBMITTAL PROCEDURES

A. Coordinate submittal preparation with construction schedule, fabrication lead-times, other submittals, and activities that require sequential operations.

1. No extension of Contract Time will be authorized due to failure to transmit submittals in time to permit processing sufficiently in advance of when materials are required in the Work.
2. Architect will not accept submittals from sources other than Contractor.

B. Prepare submittals by placing a permanent label on each for identification. Provide a 4 by 5 inch space on the label or beside title block to record review and approval markings and action taken. Include the following information on the label:

1. Project name.
2. Date.
3. Name and address of Contractor.
4. Name and address of subcontractor or supplier.
5. Number and title of appropriate Specification Section.
6. Contractor's certification that materials comply with specified requirements.

C. Coordinate each submittal with other submittals and with work that does not require submittals.

D. Product Data: Mark each copy to show applicable choices and options. Include the following:

1. Data indicating compliance with specified standards and requirements.
2. Notation of coordination requirements.
3. For equipment data, include rated capacities, dimensions, weights, required clearances, and furnished specialties and accessories.

E. Shop Drawings: Submit newly prepared information drawn to scale. Do not reproduce Contract Documents or copy standard information. Submit 1 reproducible print and 1 blue- or black-line print on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Architect will return the reproducible print. Include the following:

1. Dimensions, profiles, methods of attachment, coordination with adjoining work, large scale details, and other information, as appropriate for the Work.
2. Identification of products and materials.
3. Notation of coordination requirements.
4. Notation of dimensions established by field measurement.
5. Identification of deviations from Contract Documents.

F. Samples: Submit Samples finished as specified and identical with the material proposed. Where variations are inherent in the material, submit sufficient units to show limits of the variations. Include product name or name of the manufacturer.

G. Architect will review each submittal, mark as appropriate to indicate action taken, and return copies less those retained. Compliance with specified requirements remains Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 33 00 - SUBMITTALS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide shop drawings, product data, physical samples and color samples as indicated herein and in each technical section of these specifications.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Additional submittal requirements specific to the particular section of the specifications.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS

A. Prepare shop drawings using competent draftsmen, clearly and precisely showing the following:
   1. The size and gage of members.
   2. The method of anchoring and securing members of parts together.
   3. The quantity and location of each item.
   4. Other pertinent data necessary to show the Work to be done and where and how it is to be done.

B. Prepare Drawings to scale, including full size details as required to fix and illustrate the Work required. Do not use Contract Documents or reproductions thereof as shop drawing submittals.

C. Each sheet of Drawings shall be 30 x 40 inches maximum size with borders. Provide a title block in the lower right hand corner with the following information:
   1. Title of the sheet.
   2. Name and location of Project.
   3. Names of:
      a. Architect/Engineer.
      b. General Contractor.
      c. Manufacturer of the specified materials and equipment.

4. The date of the Submittal.
5. The date of each correction or revision.
6. **Submittal number including Division No.** (such as submittal no. 3 under Division 11 is numbered "11-03").

D. Fold drawings to 8-1/2x11 inch dimensions with title block exposed to top.

E. Check the Drawings and add any corrections of field measurements needed. Stamp and sign the Contractor's approval, checker's signature, and date of approval before submitting to the Architect. Shop Drawings which do not bear the Contractor's stamp or have not been reviewed by the Contractor, will be returned by the Architect without review or approval.

F. Number Shop Drawings consecutively. Indicate working and erection dimensions, arrangements, sectional views, necessary details including complete information for making connections with other Work, kinds of materials, and finishes.

G. Provide a transmittal letter in duplicate, pointing out any deviations from items, methods or named manufacturers included in the Specifications or on the Drawings. Note submittal file number including Division.

H. Submit **six (6)** blue line prints of each Shop Drawing sheet.

I. Make such corrections, changes, resubmit bound sets of Shop Drawings prints, as required herein, until approved is obtained. Any corrections or changes indicated on Shop Drawings shall not be considered as an extra work order.

2.2 PHYSICAL SAMPLES

A. Provide duplicate samples of items as specified. Samples shall be 12 inches square or 12 inches long unless noted otherwise. Minimum liquid samples shall be 1 pint. Installed materials shall match approved samples.

B. For Architect's permanent files provide one (1) 6" x 6" sample of all interior finishes, colors and materials (aluminum finish, glazing, plastic laminate, paint finish flooring materials, ceiling finish, etc.)

C. Provide a transmittal letter with each sample, listing the following:
1. Specification section title and paragraph specifying the material.
2. Name and location of Project.
3. Names of:
   a. Architect/Engineer.
   b. General Contractor.
   c. Manufacturer of the specified materials and equipment.
4. The date of the Submittal.
5. Submittal file number including Division.

D. If samples are not acceptable they will be returned directly to the Contractor for modification and resubmission.

E. If samples are acceptable, notification will be sent directly to the Contractor, and the sample retained for comparison with the complete Work.

2.3 MANUFACTURER'S PRODUCT DATA

A. Provide **six (6)** copies of pre-printed Product Data of items as specified. Carefully mark out all items not applicable to the specified item.

B. Standard catalogs, brochures, etc. including information not applicable to the project and not marked through, will be returned without review or approval.

C. Provide a transmittal letter with the Product Data from each manufacturer, listing the following information:
   1. Name and location of Project.
   2. Names of:
      a. Architect/Engineer.
      b. General Contractor.
      c. Manufacturer of the specified materials and equipment.
   3. The date of the Submittal.
   4. Submittal file number including Division.

D. If Product Data is not approved, one copy will be marked and returned directly to the Contractor for modification and resubmission.

E. If Product Data is approved, notification and one copy of the acceptable Product Data will be sent directly to the Contractor.

F. When requested by the Architect, provide six (6) copies of each ASTM Federal Specification, or other applicable documents referenced in the material Section.

PART 3 - EXECUTION

3.1 REVIEW PROCEDURE

A. Submittals will be reviewed with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Architect shall be allowed a review period of **fifteen (15)** calendar days. The review of a separate item shall not indicate a review of an assembly in which the item functions. Submittals that contain excessive errors or that are incomplete will be returned without review and approval and any delay caused thereby shall be the responsibility of the Contractor.

B. If any submittals are not approved as submitted, all copies will be returned directly to the Contractor for revision. The reviewed submittals will be returned to the Contractor as soon as practicable.

C. The Contractor shall make all revisions as noted and shall resubmit the required number of corrected copies of submittals, until no exceptions are taken. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than those requested on previous submissions.

D. The review of submittals shall not relieve the Contractor of responsibility for deviations from the requirements of the Contract Documents unless the Contractor has submitted, in writing, such deviations and written approval has been given to each specific deviation. The review shall not relieve the Contractor from responsibility for errors and omissions in the Shop Drawings and samples.

E. No portion of the Work requiring a submittal shall commence until the submittal has been approved as designated in the Conditions of the Contract. All such portions of the Work shall be in accordance with the submittal that has been stamped with final "Reviewed Without Exceptions" note, or "Approved" note.

F. Materials and equipment specified or approved prior to beginning the Work are required to be used on the Project. Any proposed substitution resulting from no availability of specified items must be proven "better than" by the Contractor and approved in writing by the Architect. Substitutions included in submittals shall be so noted and brought to the Architect's attention in the submittal and on the transmittal. Failure to follow this procedure will render the substitution as not acceptable whether or not reviewed by the Architect.

G. The Contractor shall have the approved shop drawings at the site at all times for use in the construction of the Work. Failure of the Contractor to supply such drawings will be deemed sufficient cause to delay the Work until such drawings are available for field use and reference.

H. For submittals that will be reviewed by one of the Architect's consultants, these submittals shall be delivered directly to the Architect. The Architect will then be responsible to provide the Consultant with a copy of the submittal.

I. For submittals that will be reviewed by one of the Architect's consultants, do not send to the Consultant as part of the package any items which will be reviewed by the Architect. As an example, do not provide a single submittal package combining Structural Steel and Miscellaneous Metal Fabrications.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION REQUIREMENTS

A. Quality-control services include inspections, tests, and related actions including reports. Quality-control services are further specified in other Sections of these Specifications and shall be performed by independent testing agencies provided by Contractor or Owner, as specified.

1. Unless otherwise indicated, quality-control services required by authorities having jurisdiction will be provided by Owner.

B. Contractor is responsible for scheduling inspections and tests.

C. Retesting: Contractor shall pay for retesting where results of inspections and tests prove unsatisfactory and indicate noncompliance with requirements.

D. Auxiliary Services: Cooperate with agencies performing inspections and tests. Provide auxiliary services as requested. Notify agency in advance of operations requiring tests or inspections, to permit assignment of personnel. Auxiliary services include the following:

1. Access to the Work.
2. Incidental labor and facilities to assist inspections and tests.
3. Adequate quantities of materials that require testing, and assisting in taking samples.
4. Facilities for storage and curing of test samples.
5. Security and protection of samples and test equipment.

E. Duties of Testing Agency: Testing agency shall cooperate with Architect and Contractor in performing its duties. Agency shall provide qualified personnel to perform inspections and tests.

1. Agency shall promptly notify Architect and Contractor of irregularities or deficiencies observed in the Work during performance of its services.
2. Agency shall not release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. Agency shall not perform duties of Contractor.

F. Submittals: Testing agency shall submit a certified written report of each inspection and test to the following:

1. Owner.
2. Architect.
3. Contractor.
4. Structural engineer.
5. Authorities having jurisdiction, when authorities so direct.

G. Report Data: Reports of each inspection, test, or similar service shall include at least the following:

1. Name, address, and telephone number of testing agency.
2. Project title and testing agency's project number.
3. Designation (number) and date of report.
4. Dates and locations where samples were taken or inspections and field tests made.
5. Names of individuals taking the sample or making the inspection or test.
6. Designation of the product and test method.
7. Complete inspection or test data including an interpretation of test results.
8. Ambient conditions at the time of sample taking and testing.
9. Comments or professional opinion on whether inspected or tested Work complies with requirements.
10. Recommendations on retesting or reinspection.
11. Name and signature of laboratory inspector.

H. Testing Agency Qualifications: Engage inspection and testing agencies that are prequalified as complying with the American Council of Independent Laboratories' "Quality Assurance Manual" and that specialize in the types of inspections and tests to be performed.

1. Each testing agency shall be authorized by authorities having jurisdiction to operate in the state where Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 50 00 — TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone and fax service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, project signage and temporary buildings.

1.3 TEMPORARY ELECTRICITY

A. Cost: By General Contractor. Extend temporary outlets in NEC and OSHA approved manner to facilitate construction.

B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

C. Provide main service disconnect and over correct protection at convenient location.

D. Provide sufficient and adequate distribution equipment, wiring, and outlets to ensure unimpeded progress of the Work.

E. Permanent convenience receptacles may be utilized during construction.

1.4 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Permanent building lighting may be utilized during construction.

E. Maintain lighting and provide routine repairs.

1.5 TEMPORARY HEAT

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

B. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in product sections.

1.6 TEMPORARY COOLING

A. If required for the proper installation of particular materials, systems, or equipment, provide and pay for cooling devices and cooling as needed to maintain specified conditions.

1.7 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidify, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Utilize existing ventilation equipment if approved by Owner. Extend and supplement equipment with temporary fan units as required to maintain clear air for construction operations.

1.8 TELEPHONE SERVICE

A. Provide, maintain and pay for telephone service to field office.

1.9 FACSIMILE SERVICE

A. Provide, maintain and pay for separate telephone line to be used solely for fax service to field office.

1.10 TEMPORARY WATER SERVICE

A. Cost: By General Contractor.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing as required.

1.11 TEMPORARY SANITARY

A. Provide and maintain required facilities and enclosures. Existing facility use is **not** permitted. Provide at time of project mobilization.

1.12 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas to protect existing facilities and adjacent properties from damage from construction operations and demolition. Barriers must isolate occupied use from construction activities. If and when needed, barriers must be capable of attenuating sound.

B. Provide protection for existing plant life and landscaped. Maintain plant life and landscaped areas as necessary during construction operations. Replace damaged plant life.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

D. Barrier plan and method subject to approval by the Architect and the Owner.

1.13 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site, equip with vehicular and pedestrian gates with locks. Fence must be capable of restricting entry by on-site facility users.

1.14 WATER CONTROL

A. Grade site to drain where additions are undertaken. Maintain excavations free of water. Provide, operate, and maintain pumping equipment and/or any other means, methods or techniques necessary to maintain excavation and site free of water.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.15 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protect for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

B. Provide temporary protection of existing wall cavities, substrates, and surfaces exposed to weather during cutting and minor demolition operations to prevent entrapment of moisture and development of mildew.

1.16 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection to prohibit damage and where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic in all landscaped areas.

1.17 SECURITY

A. Provide security and facilities to protect Work and existing facilities from unauthorized entry, vandalism, or theft.

B. Coordinate project security program with Owner's existing security operations at project mobilization.

C. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.

D. Restrict entrance of persons and vehicles into Project site and existing facilities, allowing entrance only to authorized persons and persons identified by the Contract Document and/or the Architect or Owner as authorized to visit Project site.

1.18 ACCESS

A. Provide and maintain temporary roads accessing public thoroughfares to serve construction area.

B. Extend and relocate as work progress requires. Provide detours necessary for unimpeded traffic flow.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Existing on-site roads may be used for construction traffic.

1.19 PARKING

A. Provide temporary surface parking areas to accommodate construction personnel. Existing site areas may be used if approved in advance by the Owner.

B. Contractor to propose plan for Owner concurrence and approval.

1.20 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.21 PROJECT IDENTIFICATION

A. Provide project sign. Refer to drawings for size and content.

B. Erect on site at location established by Architect.

C. No other signs are allowed without Owner permission except those required by law.

1.22 FIELD OFFICES AND SHEDS

A. Office: Weather tight with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack, and drawing display table, phone and fax.

B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

C. Provide storage sheds and facilities to accommodate Work. Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 25 00.

D. Designated existing covered and uncovered hard paved areas and facilities may be used for field storage areas. Protect and secure existing areas used for storage. Upon completion of Work, clean, repair, and restore all existing areas used for storage and restore to acceptable condition.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials prior to Substantial Completion.

B. Remove underground installation to a minimum depth of 2 feet. Grade site to drain.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction

photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. All concrete work, including sidewalks, exterior ramps, steps, miscellaneous concrete.

B. All form work.

C. Reinforcing steel.

D. Installation of sleeves which are furnished by plumbing, heating and electrical contractors.

E. Equipment bases are shown on architectural, mechanical, plumbing and electrical drawings.

F. Provide and install waterstop material at below grade joints.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Testing Laboratory services.

B. Excavation and fill.

C. Concrete paving, curbs, sidewalks and site concrete.

1.4 DRAWING REFERENCES: See drawings for reinforcing sizes and placement.

1.5 Submittals:

A. DESIGN MIX: Submit six (6) copies directly to the project Architect the proposed concrete mix(es). Include cement brand and type, aggregate identification, admixtures, proportions and anticipated strengths.

B. PLASTIC CHAIR SUPPORTS: Submit manufacturer's literature indicating dimensions, configurations and performance data. Submit sample for approval by the Architect. Space at a maximum of 45" centers each way. Provide closer spacing where required to prevent excessive sag, where indicated on the drawings, or to support the weight of concrete pump hose.

C. ADMIXTURES: Submit manufacturer's product data describing material and mix proportions.

D. WATERSTOPS: Submit manufacturer's product data describing material and installation procedures.

E. CURING COMPOUND: Submit Manufacturer's literature indicating composition and recommended application procedures.

F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.6 SAMPLES

A. Plastic chair support.

1.7 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.8 QUALITY ASSURANCE

A. Cast-in-place concrete shall be installed by technicians specially trained in the proper handling, placing and protection of concrete and reinforcing steel. If required by the Architect, installer shall submit for approval a list of similar installations successfully completed.

B. Comply with ASTM C 94; ACI 301, "Specification for Structural Concrete"; ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"; and CRSI's "Manual of Standard Practice."

C. Engage a qualified independent testing agency to design concrete mixes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL: All materials used in the Work shall be stored or handled in a manner that will prevent deterioration; any materials that have been damaged shall be immediately and completely removed from the Work. All manufactured materials, such as cement, shall be delivered and stored in their original packages that show marks or other evidence of damage shal be wholly rejected.

B. Deformed Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

C. Plain Steel Wire: ASTM A 82, as drawn.

D. Steel Welded-Wire Fabric: ASTM A 185, flat sheets not rolls. Use mesh for sidewalks and equipment pads, as indicated on the drawings.

E. Portland Cement: ASTM C 150, Type I, latest edition.

F. The use of Fly Ash in the concrete mix is not acceptable.

G. Aggregates: ASTM C 33, uniformly graded.

H. Fiber Reinforcement: ASTM C 1116, Type III, synthetic fibers, 1/2 to 1 inch.

I. Air-Entraining Admixture: ASTM C 260.

J. Chemical Admixtures:
1. General: All admixtures shall be added only at the plant during mixing and must be prior approved by the Testing Laboratory. Admixtures shall comply with the requirements of ASTM C260 and C-494. Admixtures containing calcium chloride are not acceptable. Do not use admixtures in footings or seal slabs.

K. Water Stops: Flat dumbbell or center-bulb type, of either rubber (CRD C 513) or PVC (CRD C 572).

L. **Vapor Barrier: Reference Spec Section 07 26 16 Under Slab Vapor Barrier.**

M. Liquid Membrane-Forming Curing Compound: ASTM C 309, clear, Type I, Class A or B, solvent borne, wax free.

N. Liquid Membrane-Forming Curing and Sealing Compound: ASTM C 1315, clear, Type I, Class A, solvent borne.

O. Slip-Resistive Aggregate: Factory-produced, rustproof, nonglazing, fused aluminum-oxide granules or crushed emery, unaffected by freezing, moisture, and cleaning materials.

P. Joint-Filler Strips: ASTM D 1751, cellulosic fiber, or ASTM D 1752, cork.

Q. Repair Underlayment: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling underlayment with minimum 28-day compressive strength of 4100 psi (29 MPa).

R. Repair Topping: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling traffic-bearing topping with minimum 28-day compressive strength of 5700 psi (39 MPa).

2.2 MIXES

A. Proportion normal-weight concrete mixes to provide the following properties:

1. Compressive Strength:
   a. Ramps and sidewalks: 3000 psi at 28 days.
2. Slump Limit: 5 inches at point of placement.
3. Air Content: 5.5 to 7.0 percent for concrete exposed to freezing and thawing, 2 to 4 percent elsewhere.

2.3 FORMWORK

A. GENERAL: Forms shall conform to the shapes, lines, grade and dimensions of the concrete as indicated in the drawings. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and shall be free of loose knots or other defects. Lumber once used in forms shall be thoroughly cleaned before another usage. Form **full depth** of outside face of perimeter grade beams without horizontal joints or

cracks. Forms shall be substantial and sufficiently tight to prevent leakage. They shall be properly shored, braced or otherwise tied or supported to maintain the desired position and shape during and after placement of concrete. Use no formwork which may stain exposed concrete surfaces.

B. FORM LINING: For exposed concrete the final finish shall be smooth, even and free of defects.

C. FORM REMOVAL: Forms shall remain in place sufficient time for the concrete to obtain necessary strength to support its own weight and construction load.

PART 3 - EXECUTION

3.1 CONCRETING

A. Construct formwork and maintain tolerances and surface irregularities within ACI 117 limits of Class A for concrete exposed to view and Class C for other concrete surfaces.

B. Set water stops where indicated to ensure joint water tightness.

C. Place vapor retarder on prepared subgrade, with joints lapped 6 inches (150 mm) and sealed.

D. Accurately position, support, and secure reinforcement.

E. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.

F. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.

G. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.

H. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.

I. Slab Finishes: Float finish for ramps and surfaces to receive waterproofing or other direct-applied material. Trowel and fine-broom finish for surfaces to receive thin-set tile. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.

J. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over initially floated surfaces; tamp and float. Expose nonslip aggregate after curing.

K. Uniformly spread 100 lb/100 sq. ft. (49 kg/10 sq. m) of mineral dry-shake floor hardener over initially floated surfaces, repeat float finishing to embed each application, and then apply a trowel finish.

L. Cure formed surfaces by moist curing for at least seven days.

M. Begin curing concrete slabs after finishing.

N. Owner will engage a testing agency to perform field tests and to submit test reports.

O. Protect concrete from damage. Repair surface defects in formed concrete and slabs.

P. Repair slabs not meeting surface tolerances by grinding high areas and by applying a repair underlayment to low areas receiving floor coverings and a repair topping to low areas to remain exposed.

3.2 CLEANING AND PROTECTION

A. CLEANING: Slabs are to be kept free of any foreign substances (wax, oil, paint, etc.) or surface irregularities that may affect the final appearance of the completed installation.

B. Unless otherwise approved by the Architect, no vehicular traffic will be allowed on any concrete until after the 7 day concrete tests have been made by the laboratory indicating that the concrete has attained 3,000 psi compressive strength.

C. Contractor shall coordinate with Architect and Owner to determine a suitable on-site “wash-out” area for concrete trucks. Contractor shall be responsible for clean-up of the area.

D. Contractor shall keep clean all adjacent public streets and rights of way. Wash down daily or more often as needed to remove mud and maintain a safe condition at entrances/exits to job site.

END OF SECTION

SECTION 04 05 13 — MORTAR

PART 1 - GENERAL

1.01 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 SCOPE:

A. Perform all work required to furnish the Masonry Mortar indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

B. The requirements of Division 0 – "Bidding and Contract Requirements" and Division 1 – "General Requirements" of this Project Manual shall apply to all Work required for this Section.

1.03 SUBMITTALS:

A. Submit product data on all mortar and admixtures.

B. Submit certification that mortar and grout material meet ASTM standards.

1.04 PRODUCT DELIVERY AND STORAGE:

A. Delivery: Delivery materials to Project site dry and in unbroken containers.

B. Storage: Store materials above ground in waterproof shelters.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Material manufactured by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.

1. PORTLAND CEMENT:
   a. Capitol — Lone Star
   b. Trinity — Texas Industries
   c. Universal Atlas Cement

2. LIME:

a. Gibsonburg Lime Products Co., Tiger Limes
b. Texas Lime Company
c. United States Gypsum Company
d. National Gypsum Company

3. WATER PROOFING ADMIXTURE:
a. Blocktite Mortar Admixture by Euclid Chemical
b. Sonneborn Building Products-Hydracide
c. W.R. Grace-Hydratite Plus

4. MORTAR COLOR:
a. Gray.

5. DRY BLOCK-One pound per cubic foot of cementitious material, ½ sack per sack of 2 sacks of cement fluted, split –face CMU for warranty purposes

B. Refer to Section 01 25 00 - Substitutions Procedures for manufacturers not listed above.

2.02 MATERIALS:

A.	Portland Cement:	ASTM C150, TYPE I.
B.	Hydrated Lime:	ASTM C207, TYPE S.
C.	Fine Aggregate:	ASTM C144,
D.	Coarse Aggregate:	ASTM C404, Size No. 8
E.	Water:	Clean and free of deleterious acids, alkalies, or organic matter.
F.	Waterproofing Admixture:	Blocktite Mortar Admixture, manufactured by Euclid Chemical Co.
G.	Masonry Admixture:	“EUCON Blocktite” by the Euclid Chemical Co.

2.03 PROPORTIONS AND MIXING:

A. Meet requirements of ASTM C270 and proportion mortar types as specified.

B. Meet requirements of ASTM C476 for masonry grout and proportion grout type as specified.

C. Proportion material accurately and mix thoroughly by machine to a uniform consistency and color. Mix mortars with the maximum amount of water consistent with workability. Provide waterproofing mortar admixture as specified above.

D. Do not use mortar that has begun to set. Retemper mortar by adding water if mortar begins to stiffen from evaporation or absorption of a part of the mixing water. Use and place mortar in final position within 2-1/2 hours after mixing.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. See specific section of Masonry Materials for installation instructions.

3.02 MORTAR SCHEDULE:

A. Exterior Masonry Walls:
   1. Mortar-Type S, ASTM C270.
   2. Waterproofing Admixture-***dry block required to provide warranty.***

B. Interior Masonry Partitions:
   1. Mortar-Type N, ASTM C270.

C. Interior Paving Tile:
   1. Mortar-Type S, ASTM C270.

D. Exterior Paving Tile:
   1. Mortar-Type M, ASTM C270.

3.03 GROUT SCHEDULE:

A. Paving Tile:
   1. Portland Cement-one part.
   2. Fine Aggregate-three parts.
   3. No lime.
   4. Sealer

END OF SECTION

SECTION 04 22 00 - CONCRETE MASONRY UNIT

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 SCOPE:

A. Perform all Work required to complete the Concrete Unit Masonry indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual shall apply to all Work required for this Section.

1.03 PRODUCTS INSTALLED UNDER THIS SECTION BUT SPECIFIED ELSEWHERE:

A. Section 04 05 13 – Mortar.

B. Section 07 92 00 – Sealants and Caulking.

1.04 SUBMITTALS:

A. Submit technical data for each type wall reinforcement, anchors and ties.

B. Submit 12” long sample of control joint filler. Submit various samples for split face cmu.

C. Submit certificate that masonry units conform to ASTM and NBFU standards specified.

1.05 STORAGE AND HANDLING:

A. Handle materials in a manner to prevent breakage and chipping. Store materials on platforms raised free of ground and protect materials with stainproof tarpaulin covers.

1.06 ENVIRONMENTAL CONDITIONS:

A. Lay no masonry when the temperature of the air is 40°F. twenty-four (24) hours after laying. Do not build on frozen work.

B. Store masonry units on the job so that they are kept off the ground and protected from rain.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Material manufactured by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.

1. REINFORCEMENT, ANCHORS AND TIES:

Duro-O-Wal	AA Wire Products Company
Heckman Build Products, Inc.	Hohmann and Barnard, Inc.
Masonry Reinforcing Corp. of America	National Wire Products Corp.

2. INTEGRAL WATER REPELLENT MASONRY ADMIXTURES:
"EUCON BLOCKTITE" by the Euclid Chemical Co.

3. CONCRETE MASONRY UNIT DRAINAGE SYSTEM:
Mortar Net Solutions, 6575 Daniel Burnham Drive, Suite G. Portage, IN 46368
Telephone:(800) 664-6638 Fax: (219) 787-5088 Email: info@mortarnet.com

2.02 MATERIALS:

A. UNITS:
1. Hollow Concrete Masonry: ASTM C90, medium weight, Grade N-1
2. **Split Face CMU: Integrated color (exterior).** ASTM C90, medium weight, Grade N-1
3. Split Face CMU Lintels: Integrated color, re: structural for additional information.

B. REINFORCEMENT:
1. Block Wall Joint Reinforcement:
ASTM A82, AA Wire Products Co., "BLOK-TRUS", AA600 two wire, width 2" less than wall thickness, standard weight galvanized ASTM A116, Class 1.
2. Lintel and Bond Beam Reinforcement: Domestic, ASTM A615, or ASTM A616, deformations ASTM A305. Unless otherwise shown on drawings provide 2-#4 Ø cont. lap 30 dias.

C. WATER: Clean and free of deleterious acids, alkalies or organic material.

D. INTEGRAL WATER REPELLENT MASONRY ADMIXTURE:
1. Containing no added chlorides.
2. Manufacturer shall have ISO 9001 Quality Certification.
3. To ensure compatibility all admixtures shall be from the same manufacturer.

E. CONCRETE MASONRY UNIT DRAINAGE SYSTEM:
1. Provide "BlockFlash" as manufactured by Mortar Net Solutions.

F. Bullnose edge at all masonry corners for interior walls.

PART 3 - EXECUTION

3.01 CONDITION OF SURFACES:

A. Do not commence with masonry work until foundation has properly cured a minimum of seven (7) days and reinforcing steel that is dowelled for masonry units has been approved.

B. Consult other trades and make provisions to permit installation of their work to avoid cutting and patching. Before closing up any pipe chase, or similar inaccessible spaces, remove all rubbish and sweep out areas to be enclosed.

3.02 PREPARATION:

A. Provide, install and maintain all scaffolding, staging and forms of protection necessary for execution of the work; substantially constructed, maintained, moved and dismantled as required to properly follow the sequence of operation.

B. Provide and install all shores and centering for the work, constructed true to require shape, size and form; well-braced and made rigid in all parts, and capable of supporting and sustaining the loads to which subjected.

C. Leave all shores and centering in place until the masonry has sufficiently set to safely carry its own weight and the added loads of construction. Shore free-standing walls to prevent windstorm damage until walls are protected.

D. Examine surfaces to receive masonry and report any discrepancies before commencing work. Accept no former measurements, but lay work according to the plans and dimensions thereon.

3.03 LAYING CONCRETE MASONRY UNITS:

A. Do not dampen units before laying, and do not lay units which have surface water or contain frost. Lay units plumb, level, and true to a line in running bond, or as indicated. Align on exposed face or as indicated.

B. Lay first course of masonry in full bed of mortar. Lay all other hollow units in a full mortar bed on shell surface and at ends.

C. Lay hollow units with the thicker edge of the face shell up and make all joints 3/8” thick. Lay corners prior to laying mid-portion of wall. Rock closures into place with the head joints shoved against the two adjacent units in place.

D. Cut units with power saw through the unit to insure straight, evenly cut edges. Do not use fractional parts of masonry units in the work where whole units can be used.

E. Avoid over-plumbing and pounding of the corners and jambs to fit stretcher units after setting in place. Remove mortar and replace with fresh mortar where adjustment must be made after initial settings.

F. Do not use masonry units having cracks, chipped edges, broken corners or other defects in exposed faces. Build walls full thickness as shown. Blocks with open cells exposed will not be permitted.

G. Provide all special precast lintels, fillers, closers, control joint units, trough tile, etc., required to form all corners, returns, openings, jambs, offsets, etc., to maintain a proper bond throughout all masonry work.

H. Protect all sills, ledges, off-sets, etc., from droppings of mortar and protect door jambs and corners from damage during construction.

I. Stop off longitudinal run of masonry only where absolutely necessary by racking one-half block length in each course. Remove loose mortar before new work is started.

J. Cover tops of walls at end of day's work and when rain is imminent, with waterproof membrane. Overhang two feet on each side of wall and anchor securely. Protect masonry from weather or construction damage.

3.04 JOINTS:

A. Mortar joints shall be straight, clean and uniform in thickness. Tool joints of all walls to produce a dense surface well bonded to the edges. Joints which are not tight at the time of tooling shall be raked out, pointed, and then tooled.

B. Tool when the mortar is partially set but still sufficiently plastic to bond. Use a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

C. Finish joints that will remain exposed with a tool slightly larger than the width of the joint to form a concave surface. Tool vertical joint first. Finish flush, joint that will not remain exposed.

D. Unless otherwise specified the horizontal and vertical mortar joints shall be 3/8" thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled with grout.

E. Vertical head joints shall be buttered well for a thickness equal to the face shell of the unit and these joints shall be shoved tightly so that the mortar bonds with both units. Joints shall be solidly filled from the face of the block to at least the depth of the face shell.

3.05 REINFORCING:

A. Install continuous joint reinforcing 16" on centers for running bond. Install joint reinforcing in the first and second bed joint above and below openings extending 24" beyond each side of opening.

B. Lap splices a minimum of 6" and install prefabricated corners and tees at such locations. Do not extend reforcing through expansion joints. Center reinforcing in joint with 5/8" minimum mortar coverage on the exterior face and ½" minimum mortar coverage on the interior face.

C. Do not extend reinforcing through control joints when anchorage is provided on each side of joint. If no anchorage is provided at joint, extend reinforcing through control joint at 48" on center.

D. Reinforce bond beams and lintels as indicated with continuous bars placed as the work progresses. Maintain ½" minimum clear distance between masonry units and reinforcement.

3.06 ANCHORING:

A. Anchor interior partitions to abutting or intersecting walls by common bond or with prefabricated reinforcing tees.

B. Anchor interior load bearing partitions laterally a maximum of 12'-0" o.c. by either an intersecting partition or anchorage to foundation with 4-#4Ø dowels and continuous 4 #4Ø bars to top of wall. Grout fill cells to top of wall.

C. Do not attach construction supports to wall except where specifically permitted by the Architect.

D. Intersecting load bearing masonry walls and partitions shall be bonded by the use of rigid steel anchors at twenty-four (24) inches o.c. maximum. Corners shall have a standard masonry bond by overlapping units and shall be solid grouted.

3.07 CONTROL JOINTS:

A. Locate 3/8" wide control joints as indicated but do not exceed 30 feet on centers. Keep vertical joints straight, true and continuous from top to bottom of masonry.

B. Use sash units to form control joints and install continuous control joint filler with sash units tightly butted to compress neoprene flanges and completely seal joint. Where masonry abuts structural concrete or steel and control joint filler cannot be used, keep joint clean of mortar as work progresses or use expansion joint spacer.

C. Locate building expansion joints as indicated and install expansion joint spacer properly recessed back from face to allow for sealant.

3.08 EMBEDDED ITEMS:

A. Build in flashing, sleeves, anchors, clips, mechanical and electrical items, and accessories as work progresses. Accurately cut units to fit all plumbing, ducts, openings and electrical work with all holes neatly patched.

B. Install loose lintels, as indicated in full beds of mortar. Fill voids at metal frames with mortar and build in frame anchors.

3.09 GROUTING:

A. Fill with grout, vertical cells, bond beams, lintels and other structural members having reinforcement. Secure in place and inspect reinforcing before grouting. Keep mortar droppings out of grout space and puddle or vibrate all grout in place.

B. Provide solid bearing under structural members at least 8" vertically and at least 16" horizontally. Bearing shall be hollow units reinforced with 2#4Ø bars U.N.O. and filled with concrete grout.

C. Build masonry in filled cell construction to preserve the unobstructed vertical continuity of the cells to be filled. Fully bed all walls and cross webs forming such cells to prevent leakage of grout and strike cell joints smooth. Maintain a continuous vertical alignment of cells so the unobstructed cell area is not less than 2" x 3".

D. Grout vertical cells in lifts not to exceed 4'-0". Stop grout where necessary at mid-point but not over openings, when filling trough unit and provide suitable dam to retain grout. Stop grout one and one half inches below the top of the last course when filling vertical cells to form key for next pour.

E. Grout from inside face of masonry and prevent grout from staining masonry face. Protect projecting surfaces from droppings and clean immediately any grout which comes in contact with face of masonry.

3.010 CMU DRAINAGE SYSTEM:

A. Install CMU cell flashing pans with built in adjoining bridge made from recycled polypropylene with chemical stabilizers that prevent UV degradation. Flashing pans shall have a sloped design to direct moisture to the integrated weep spout. Shall be designed to be built into mortar bed joints to expel moisture (unimpeded by mortar droppings) to the exterior of CMU walls. Drainage Mats and Insect Guards shall be included.

3.011 CLEANING:

A. Keep face of blockwork free from excess mortar while laying blocks. Clean blockwork that will remain exposed, promptly, with fiber brushes and clear water. Use of wire brushes or acid permitted only with specific approval.

B. Repair and repoint defective work and pin line holes to match adjacent similar work. Replace broken or damaged blocks.

END OF SECTION

SECTION 05 12 00 — STRUCTURAL STEEL

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Furnish and erect all structural steel.

B. All cutting and fitting, welding and bolting of structural steel members.

C. Loose linters and linters supported from structural members.

D. Shop coat of paint on structural steel members and field touch-up.

E. Temporary bracing of structural steel during erection.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Steel joists.

B. Miscellaneous metals.

1.4 SUBMITTALS

A. Six (6) blueline prints of each sheet of shop drawings required. Contractor shall submit shop drawings directly to the project Architect.
   1. Indicate size, material, and strength of members.
   2. Show locations and installation procedures.
   3. Include details of shear heads, collar channels, camber, shop coats, joints, attachments, and clearances.
   4. Prepare setting Drawings, templates, and procedures indicating locations of structural bolts, and fastening holes for other Work.

B. Submit mill certificates direct to Structural Engineer with shop drawings.

C. Submit welder's qualification records.

D. Miscellaneous metals shall be issued as a separate submittal directly to the Architect and not as part of the structural steel submittal.

E. Where required submit proof of city approval for fabricator and erector.

F. Submit written certification of domestic origin for bolts.

G. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in metals and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the Project.

1.6 QUALITY ASSURANCE

A. Fabrication and erection of structural steel shall meet or exceed the minimum current requirements of the following standards except where more stringent requirements are indicated in the drawings or specifications:
   1. AISC "Code of Standard practice for Steel Buildings and Bridges".
   2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary of the AISC Specification", Eighth Edition.
   3. AWS Dl.1, "Structural Welding Code Dl.l".
   4. ASTM A-6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use".
   5. ASTM A-36, Specification for Structural Steel.
   6. ASTM A-123, Specification for Zinc (Hot-Dip Galvanized Coatings on Iron and Steel Products.
   7. ASTM A-307, Specification for Carbon Steel Externally Threaded Standard Fasteners.
   8. ASTM A-325, Specification for High-Strength Bolts for Structural Steel Joints.
   9. ASTM A-436, Specification for Hardened Steel Washers.
   10. ASTM A-500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   11. ASTM A-563, Specification for Carbon and Alloy Steel Nuts.

B. Fabricators shall be currently approved by the local code authority for erection of steel structures. Contractor shall submit evidence of city approval with the list of proposed subcontractors for the project.

C. Each welder performing work on this Project shall be qualified in accordance with American Welding Society Structural Welding Code, AWS Dl.1 within 12 months of the commencement of welding on this Project. Welders shall be certified for the position of weld which they are performing. Welding shall be tested as specified under Testing Laboratory Control below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL:
   1. All materials shall be new, clean and straight within allowable tolerances. Members damaged, warped or stressed prior to or after erection shall be replaced with new material.
   2. All structural steel shall conform to the Standard Specifications of the ASTM for Steel for Bridges and Buildings, A-36 (or ASTM A-500, grade B for square or rectangular tube shapes), unless otherwise indicated on the drawings.
   3. Purlins shall be precision roll-formed of 14 ga. or 16 ga. steel wity a minimum yield of 55,000 psi. Size and spacing of purlins shall be as indicated on the drawings.

B. WELDING ELECTRODES: #E60 Series Submerged Arc Grade SA-1, #E70 Series Submerged Arc Grade SA-2.

C. BOLTS: Comply@ASTMA-307for standard bolts and ASTMA-325 for high-strength bolts, sizes as indicated in the drawings and structural notes. Furnish certification that bolts are domestic origin.

D. ANCHOR BOLTS:
1. Furnish to the General Contractor all anchor bolts, setting templates and drawings required for complete and accurate installation.
2. Coordinate delivery of anchor bolts for installation by other trades.

E. GROUT: Premixed, non-shrink, non-metallic type providing a minimum compressive strength of 7,000 psi at 28 days and a maximum initial set time of one hour at 73 degrees F. "Masterflow 713" as manufactured by Master Builders or equivalent by Cormix Construction Chemicals or Sauereisen Cements Co.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate the various parts of the steel frame from the materials specified using welded shop connections and bolted field connections. Shop drawings shall be prepared accordingly.

B. Splicing of members is prohibited without prior approval of the project structural engineer. A member having splice not specifically approved on the shop drawings will be rejected. Spliced members will not be permitted where steel is exposed in finished areas.

C. Provide holes @ maximum 36" o.c. for 3/8" diameter bolts in all steel where wood nailers occur, unless closer spacing is indicated in the drawings or notations.

D. All workmanship shall be in accordance with the requirements of the AISC. The workmanship in exposed rigid frames shall be in accordance with the AISC requirements for Architecturally Exposed Structural Steel.

3.2 GALVANIZING

A. Hot dip galvanize all steel sections which are fully or partially exposed to weather or indicated in the drawings to be galvanized.
B. All galvanizing shall be done after fabrication of members.
C. Comply with requirements of ASTM A-384 to protect against warping.
D. Do not apply silicone protective coating to galvanized steel.

3.3 SHOP PAINTING

A. Structural steel shall be given one shop coat of the specified paint. Do not shop coat the following members when scheduled to receive sprayed fireproofing:
1. Beam with flange width exceeding 12 inches.
2. Column with flange width exceeding 16 inches.
3. Beam or column with web depth exceeding 16 inches.

B. Verify with the fireproofing manufacturer the compatibility of the specific proposed primer with the fireproofing material.

C. All surfaces shall be clean, dry and free from mill scale or rust.
D. Fabricator shall exercise special care in painting those portions of structural steel which *will* be exposed to view when the building is complete. Sags, run, crawls, and other defects will not be permitted.

3.4 DELIVERY AND HANDLING

A. Contractor shall inspect all material when delivered and store on platforms or racks to keep material off the ground. Keep structural steel clean of dirt and other foreign matter.

B. Clean all contact and bearing surfaces thoroughly before erection.

3.5 ERECTION

A. The structure shall be erected, plumbed and leveled to the lines and grades indicated on the drawings before final connections are made. Base plates shall be grouted using specified nonshrink grout in accordance with manufacturer's printed directions.

B. If exposed to View, erection angles, seats, tags shall be removed, etc., plugged, welded and ground smooth.

C. All welding shall be performed by experienced mechanics and in accordance with the requirements of the American Welding Society Code (A.W.S.).

D. For cantilever beams, allowance shall be made for deflection when final loads are applied.

E. No field cuts or holes shall be flame cut. Necessary field holes shall be punched or drilled and slotted. All field steel modifications shall be inspected and approved by the project structural engineer and cost of such modifications shall be the responsibility of the Contractor.

F. No structural members shall be erected which have been bent or deformed in transit to the site or by storage and handling on the site.

G. Installed work shall comply with AISC allowable tolerances.

3.6 TEMPORARY BRACING

A. Structural steel shall be temporarily braced as required to resist all wind loads and construction loading for which the structure has been designed.

B. Structural steel shall be braced as the structure is erected and structure shall not be left overnight without adequate bracing.

3.7 WELDING

A. All welds and the adjacent spattered areas shall be cleaned by sandblasting, wire brushing, chipping or other non-damaging means for removal of excess weld metal. Exposed welds shall be ground smooth. Welds in galvanized material shall be touched up after cleaning with "ZRC" cold galvanizing.

B. Meet requirements of American Welding Society, "Code for Arc and Gas Welding in Building Construction".

C. Meet requirements of American Welding Society, "Qualifications of Welding Procedures and Operators".

D. Meet requirements of American Safety of Testing Materials, "Specifications for Iron and Steel Arc Welding Electrodes", A233-43T.

3.8 TESTING LABORATORY CONTROL

A. GENERAL:
1. Three copies of mill certificates attesting to the physical and chemical characteristics of the steel shall be transmitted to the Owner's independent testing laboratory upon request. In the event that mill certificates are not submitted, the Owner's testing laboratory shall perform physical and chemical tests in accordance with ASTM requirements, all at the Contractor's expense.

2. Contractor shall submit to the Owner's testing laboratory the certificates from an independent testing laboratory attesting to each welders' qualifications in accordance with A.W.S. requirements.
3. Where structural steel is fabricated outside of the greater Houston area, fabricator shall pay the travel and daily subsistence expense of the Owner's laboratory technician.

4. The Owner’s independent testing laboratory shall be the sole judge as to whether materials and erection of structural steel meets the requirements of these specifications. Materials and installation not meeting specified requirements shall be removed and replaced at the Contractor's expense.

B. TESTING OF WELDS:
1. Shop Welds:
   (a) An independent testing laboratory retained by the steel fabricator shall perform a visual inspection of a minimum of 10% of all structural steel shop welds. Any additional testing required by the Contractor shall be paid for by the Contractor. Any additional testing required by the fabricator shall be paid for by the fabricator.
   (b) Where the structural drawings indicate shop welded connections to be tested, 100%of such welds shall be tested by the fabricators independent testing laboratory using ultrasonic or radiographic methods.
   (c) Structural steel shall not be shipped until the laboratory testing reports have been reviewed by the structural engineer.
   (d) Inspection of shop welding of bar joists is at the fabricator's option.

2. Field Welds:
   (a) All field welds to be tested shall be tested by the Owner's independent testing laboratory using ultrasonic or radiographic methods. Such testing shall be paid from the Testing Allowance.
   (b) Test 100% of all field welds of the types indicated on the structural drawings to be tested.
   (c) 100% of the following types of field welds shall be tested whether or not indicated on the drawings to be tested: full moment connections in rigid frames, welded beam splices, and welded column splices.
   (d) 15%-20% of all other types of structural steel field welds shall be visually inspected by the Owner’s testing laboratory. Any additional testing required by the Contractor shall be paid for by the Contractor.
   (e) All field welds which are indicated on the Structural Drawings to be tested shall be identified with the welder's initials in chalk or wax crayon.

3. Retesting:
   (a) All welds rejected after testing shall be repaired and retested at the Contractors expense, whether shop welds or field welds. Shop weld retesting shall be performed by the fabricators independent testing laboratory and field weld retesting shall be performed by the Owner's independent testing laboratory.
   (b) If more than 10% of the required numbers of tested shop welds fail testing, an additional 20% of the welds shall be tested. If more than 1 0% of these welds fail, another 20% of the welds shall be tested. This procedure shall continue until either all welds are tested, or less tan 10% of the welds fail in the last 20% tested.

3.9 FIELD TOUCHUP

A. After erection, all structural steel shall be cleaned of rust and touched up with the specified shop coat paint.

B. Steel shall be touched up wherever the shop coat has been damaged by handling, or during erection or by welding.

C. All erection nuts and bolts shall be wire brushed and painted.

D. Upon completion of this erection, any exposed structural steel shall be made ready for finish painting.

END OF SECTION

SECTION 05 21 00 — STEEL JOISTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Furnish and erect open web high strength steel joists, K-series, and long span joists produced of either cold formed or hot rolled sections as indicated in the drawings and as specified herein.

B. Provide ceiling extensions where required, top and/or bottom chord extensions as detailed, top and bottom chord reinforcing as detailed, and all spacers, bridging, anchors, etc. required for complete installation.

C. Provide shop primer coat on all steel joists and field touchup.

D. Erection of all steel joists, all welding, boiling, cleaning and priming of welded areas, and all materials incidental to erection, including welding electrodes, temporary bracing, guy wires, bolts, washers, etc. as required for a complete installation.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Steel floor and roof deck, cementitious wood fiber deck.
B. Structural steel.
C. Miscellaneous metals.

1.4 SUBMITTALS

A. One (1) each reproducible sepia and four (4) blueline prints which include steel grades, weld size and grades for all steel joists. Contractor shall submit shop drawings directly to the project structural engineer.

B. Submit mill certificates direct to Structural Engineer with shop drawings.
   1. Indicate size, material and strength of members.
   2. Show locations and installation procedures.
   3. Prepare templates and indicate locations of fastening holes for other work.

C. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the Project.

1.6 QUALITY ASSURANCE

A. Design, fabrication and erection of steel joists shall meet or exceed the minimum standards of the Steel Joist Institute except where more stringent requirements are indicated in the drawings or specifications:

B. Each welder performing work at the site shall be qualified in accordance with America Welding Society Structural Welding Code, AWSD1.1 within 12months of the commencement of welding on this Project.

C. Fabricators shall be currently approved by the local code authority for fabrication and erection of steel structures.

PART TWO - PRODUCTS

2.1 MATERIALS

A. The steel used in the manufacturer of chord and web sections shall conform to ASTM Specifications for Structural Steel, A-36, modified to eliminate the upper limit of tensile strength.
B. Steel for spacers, bridging, bearing plates, anchors, etc., shall conform to ASTM A-7.
C. Shop coat paint shall be primer meeting requirements of Federal Specification TT-P-636C.
D. Members damaged, warped or stressed prior to or after erection shall be replaced with new material.
E. Joist manufacturer shall review all U.L. designs as indicated in the drawings or specifications and comply wity all size and weight requirements stipulated. Reference Architectural drawings and Structural drawings for U.L. design indications.

PART THREE - EXECUTION

3.1 FABRICATION

A. Steel joists shall be fabricated in accordance with Standards of the Steel Joist Institute.
B. Punching of chord members shall not be permitted.
C. Steel joists shall be symmetrical about the Y-Y axis.
D. Splicing of members may occur at any point in chord or web members, and shall be designed in accordance with Standards of the Steel Joist Institute. Spliced members will not be permitted where joists are exposed in finished areas.

3.2 SHOP PAINTING

A. All joists shall receive one shop coat of primer except where scheduled to receive sprayed fireproofing.

B. All surfaces shall be clean, dry and free from mill scale or rust.

C. During and after erection clean and touch-up scratches and welds with specified primer.

3.3 DELIVERY AND HANDLING

A. Contractor shall inspect all material when delivered and store on platforms or racks to keep all material off the ground. Clean all dirt, rust and other foreign matter from joists before erection.

3.4 ERECTION

A. Joists shall be set level and plumb or sloped as indicated on the drawings. Joists shall be welded to their steel supporting members and bridging shall be welded in place as soon as joists are set. Construction loads shall not be applied to the joists until they are permanently secured at bearing points and the bridging installed. Extend joist ends a minimum of 2-1/2" over steel supports.

B. Erect steel joists in accordance with AISC S326. Hoist by top chord only between third and quarter points.

C. No joist shall be erected which has been bent or deformed from its original shape. Replace with new members.

D. Install horizontal or diagonal bridging as indicated in the drawings and in accordance with SJI, AISC.

E. No field cuts or holes shall be flame cut. Necessary field holes shall be drilled. All proposed field modifications must be approved by the Project Structural Engineer.

3.5 FIELD WELDING OF JOISTS

A. All welds and the adjacent spattered areas shall be cleaned by sandblasting, wire brushing, chipping or other non-damaging means for removal of excess weld metal. Exposed welds shall be ground smooth. Welds in galvanized material shall be touched up after cleaning with "ZRC cold galvanizing".

B. Meet requirements of American Welding Society, "Code for Arc and Gas Welding in Building Construction".

C. Meet requirements of American Welding Society, "Qualifications of Welding Procedures and Operators".

D. Meet requirements of American Safety of Testing Materials, "Specifications for Iron and Steel Arc Welding Electrodes", A233-43T.

E. Shop welds shall be done in accordance with the Standards of the Steel Joist Institute.

3.6 FIELD TOUCHUP

A. After erection, all steel joists shall be cleaned of rust and touched up with the specified shop coat paint.

B. Steel shall be touched up wherever the shop coat has been damaged by handling, or during erection or by welding.

C. Coat any surfaces to be in contact with mortar, concrete, masonry or aluminum with bituminous paint.

D. Upon completion of this erection, any exposed steel joists shall be made ready for finish painting.

3.7 TESTING LABORATORY CONTROL

A. A laboratory designated by the Owner will perform testing and inspection services in the shop and in the field. Contractor shall notify Testing Laboratory a minimum of 48 hours prior to beginning fabrication of members.

B. Where defective work, or work not in accordance with these specifications is determined, the Contractor shall pay for correction of the work, re-testing and re-inspection of the work, and for X-ray testing of additional weldments.

C. Three copies of mill certificates attesting to the physical and chemical characteristics of the steel shall be transmitted to the testing laboratory upon request. In the event that mill certificates are not submitted, the Owner's testing laboratory shall perform physical and chemical tests in accordance with ASTM requirements, all at the Contractor's expense.

D. Contractor shall submit to the Owners testing laboratory for approval, certificates from an independent testing laboratory attesting to the welders qualifications in accordance with A.W.S. requirements. All welds shall be identifiable by the welder's mark.

E. Where steel joists are fabricated outside of the greater Houston area, fabricator shall pay the travel and daily subsistence expense of the laboratory's technician.

F. The Owners testing laboratory shall be the sole judge as to whether materials and erection of steel joists meets the requirements of these specifications. Materials and installation not meeting specified requirements shall be removed and replaced at the Contractors expense.

END OF SECTION

SECTION 05 31 00 — STEEL FORM FLOOR DECK AND STRUCTURAL ROOF DECK

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide all labor, materials, equipment, and services necessary for the furnishing and installation of steel form floor and structural roof deck at above grade floors. For the purposes of this specification section, Structural Roof Deck is defined as any metal roof decking not integral with lightweight insulating concrete fill.

B. Provide additional requirements as may be indicated on the structural drawings and notations.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Light gauge metal roofing deck (less than 22 gauge) at insulating concrete fill.

B. Concrete and reinforcing.

C. Structural steel and steel joists.

D. Miscellaneous metals – supplementary framing.

1.4 SUBMITTALS

A. Submit manufacturer’s printed literature indicating material properties, loading criteria, and installation procedures.

B. Submit drawings or printed illustrations showing deck profile and configuration.

C. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 DRAWING REFERENCES

A. Reference structural drawings and notes for gauge, depth and other requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wheeling

B. Bowman

C. Merco

D. Roll Form

E. Vulcraft

2.2 MATERIALS

A. The steel floor deck and structural units shall be as manufactured by Roll Form Products, Inc., or equivalent by specified manufacturer. Type, finish, section modulus and gauge as shown on the structural drawings.

B. The Units shall be formed from steel sheets conforming to ASTM A-611 Grade C or ASTM A446 Grade A with a minimum yield strength of 33 KSI, and shall be listed by Underwriter's Laboratories.

C. Deformations shall be formed to provide a mechanical lock between concrete and steel.

D. Unless noted otherwise, floor deck shall be galvanized to conform to ASTM A-525, G60. Provide field touch-up with "ZRC" zinc-rich primer at welds and where galvanizing is damaged.

E. ACCESSORIES:
1. Weld Washers: Mild steel, uncoated, 5/8 inch outside diameter, 1/8 inch thick. Use for light gauge non-composite decks.
2. Where metal closure strips, wet concrete stops, and related accessories are required, but not indicated in the drawings, provide and install 22 gauge galvanized sheet steel of profile and size required.

PART 3 - EXECUTION

3.1 ERECTION

A. Panels shall be secured to the steel framework at ends and at intermediate supports by welds spaced 12" o.c. and not less than ¾" diameter welds. Use welding washers at light gauge non composite decks. Side laps shall be nested and button punched 3'-0" maximum on centers. The erection of composite floor units shall be performed in accordance with manufacturer's printed instructions and approved erection drawings.

B. Install sheet metal closures at ends of runs, penetrations and columns.

END OF SECTION

SECTION 05 41 00 — LIGHT GAGE METAL FRAMING SYSTEMS AND GYPSUM SHEATHING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Furnish and install exterior metal stud framing as shown on the drawings and specified herein.

B. Furnish and install water resistant gypsum board sheathing at exterior face of exterior metal studs.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Masonry.

B. Interior drywall systems.

C. Wall Insulation.

D. Dampproofing and Waterproofing.

E. Exterior plaster (stucco).

1.4 SUBMITTALS

A. Submit manufacturer’s product data describing all materials.

B. Submit manufacturer’s certification of structural properties, only for products to be used in the project.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.

B. Damaged or deteriorated materials shall be removed from the premises.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. STUDS AND FRAMING: Unimast, Clark Dietrich, Maverick Steel Co., Dale Industries, Delta Metals, Bostwick, American Studco Inc.

B. GYPSUM BOARD SHEATHING: United States Gypsum Co., National Gypsum Co., Georgia Pacific, Temple Inland.

2.2 MATERIALS

A. STRUCTURAL STUDS AND RUNNERS: Galvanized "Cee" studs in sizes and gauges as indicated in the drawings. Unless otherwise indicated in the drawings, minimum gauge shall be 16 gauge and the following structural properties shall apply:

SIZE	**ABOUT MAJOR AXIS X-X**			**ABOUT MINOR AXIS Y-Y**		
	Ix	**Sx**	**rx**	**Iy**	**Sy**	**ry**
3-5/8"	.906	.500	1.430	.139	.142	.614
4"	1.145	.572	1.566	.147	.143	.615
6"	3.016	1.005	2.262	.180	.149	.595
8"	6.071	1.518	2.923	.201	.152	.565

B. SHEATHING FASTENERS: Unimast self-drilling screw fasteners (bugle head).

C. SHEATHING: Fire resistant gypsum board with treated water resistant gypsum core surfaced with water repellant paper both faces –1/2" x 4' x 8' with tongue and groove joint design at long edges. Meet requirements of ASTM C-79. Provide 5/8" thick rated X core where specifically indicated on the drawings.

D. All metal studs, track, and bridging shall be formed from ASTM A-446 commercial grade steel having a minimum yield of 33,000 psi for 18 gauge and lighter members and 50,000 psi for 16 gauge and heavier members.

E. All framing components shall be galvanized. Tracks, runners, bridging and bracing shall match grade and gauge of studs.

PART 3 - EXECUTION

3.1 GENERAL

A. Install studs plumb and in plane, without twist. System installation shall be in accordance with AISI Design Manual for “Light Gauge Cold Formed Steel”.

B. All framing components shall be cut tight against abutting members. Members shall be held firmly in position until properly fastened.

C. All attachments of axial loaded framing components shall be welded in accordance with the American Welding Society’s “Recommended Practices for Resistance Welding” and shall transfer the imposed load into the adjoining member. Use no splices in axial loaded members.

D. Attachments of framing components not subject to axial loads may be welded or screw fastened.

E. Members shall be braced as required to resist all wind loads and construction loading for which the system has been designed. System shall be braced as erected and shall not be left overnight without adequate bracing.

F. Framing components used to frame openings shall be of a size and type to transfer any load imposed on the opening into the members adjacent to the opening. Additional framing shall be provided adjacent to the opening to carry the load imposed.

G. Welds in galvanized material shall be coated with “ZRC” cold galvanizing after wire brushing.

3.2 ERECTION

A. TRACK FASTENING: Secure metal floor track to concrete floor slab with Type “A” or “B” fasteners spaced as scheduled in the table below. For determining unbraced wall height, ceiling does not qualify as bracing.
   1. Type “A” fastener – minimum 5/32” diameter x 1-1/4” long powder actuated fasteners. Hilti #DS32P10 or Ramset #2335.
   2. Type “B” fastener – minimum 1/4" diameter x 2” long drilled sleeve anchor. Hilti sleeve anchor or Ramset “Thunder Nail”.
   3. Demonstrate to the Architect that fasteners can be driven full length into concrete slab tight to stud track.
   4. Use similar fasteners (and spacing) suitable for steel at overhead track or weld track to overhead steel at 12” o.c.
   5. At track splices use anchored channel inserts or fully weld.

Spacing Schedule for Type A & B Fasteners

MAX. SPACING OF FASTENERS	***MAX. UNBRACED WALL HEIGHT**	
	TYPE A	TYPE B
24”	7.4 FT.	8.3 FT.
16”	11.1 FT.	12.4 FT.
12”	14.8 FT.	16.5 FT.
8”	24.9 FT.	24.9 FT.
6”	29.7 FT.	33.2 FT.

*NOTE: Ceiling at wall does not reduce unbraced wall height.

B. STUD FASTENING: Each stud shall be fastened to top and bottom track (prior to gypsum board sheathing or interior wall finish) using one of the following two methods:
   1. Screw fastening: One self-drilling screw at the front and back faces of the top and bottom tracks for each stud (4 fasteners per stud.)
   2. Welding: One weld at the front face of the top and bottom tracks for each stud (2 welds per stud).
   3. Additional: The above minimum fasteners are required regardless of any additional bracing or intermediate fastening which may be indicated in the drawings or required.

C. BRIDGING: Provide bridging at all exterior stud walls whether or not indicated in the drawings. Unless more stringent requirements are indicated in the drawings provide the following:
   1. Wind loading resistance only: Provide multiple bridging rows spaced 5'-0" o.c. vertically maximum.
   2. Axial loaded members: For stud lengths less than 10 feet, provide 2 rows of bridging at third points. For stud lengths 10 feet and grater, provide multiple bridging rows spaced 42" o.c. vertically maximum.

D. SHEATHING INSTALLATION: Apply sheathing panels horizontally with the "v" edge turned up. Install with joints and penetrations tight and neatly fit. Stagger end joints over studs with screws spaced at maximum 12" centers at each stud and at 12" o.c. along top and bottom runners.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Work under this section shall include all labor, materials, equipment, and accessories necessary for the fabrication and installation of all miscellaneous metal work as indicated in the drawings and as specified herein.

B. The items listed herein are not necessarily inclusive of all items required to be furnished.

1.3 SECTION REQUIREMENTS

A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

A. GENERAL: For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled or stamped trade names, and rough edges or finish.
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
   3. Rolled Steel Floor Plate: ASTM A 786/A 786M.
   4. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
   5. Round steel tubing and pipe are sized differently. Tubing is designated by OD and wall thickness. Pipe is designated by NPS and weight or schedule number.
   6. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.
   7. Shop Primer:
      a. Typical: Red Oxide or Zinc Chromate Primer conforming to Federal Specification TT-P-664C (no lead). Verify compatibility with specified finish paint.

8. Galvanizing: Hot-dip process per ASTM A-123.
9. Bolts: Comply with ASTM A-307 for standard bolts and ASTM A-325 for high strength bolts. Furnish certification that bolts are domestic orgin.
10. Pipe: Conform to ASTM A-53, Schedule 40 for steel pipe and ASTM B-429, Schedule 40 for aluminum pipe.

B. FABRICATED ITEMS: Items listed below represent principal items of miscellaneous metal fabrications required for the project. Contractor shall furnish items listed and all miscellaneous metal items indicated in the drawings or required for a complete installation.
1. Steel Pipe Railings: Schedule 40 x 1-1/2" diameter steel pipe. Provide smooth radiused bends without deformation. Provide end caps at all wall returns. Grind all welds smooth. Provide top rails in continuous lengths. Provide shop primer coat of paint compatible with schedule finish coat. Provide with cast steel wall brackets as manufactured by Julius Blum & Co. or approved equivalent.

2.2 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.3 FABRICATION

A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

C. Fabricate steel pipe columns with steel base and top plates drilled for anchor and connection bolts and welded to pipe with continuous fillet weld same size as pipe wall thickness.

1. Provide 1/2-inch (12-mm) base plates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6-mm) top plates.

2.4 STEEL AND IRON FINISHES

A. Hot-dip galvanized steel fabrications at exterior locations.

B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a rust-inhibitive primer complying with performance requirements of FS TT-P-664.

2.5 PAINT AND FINISHES

A. Shop prime all metal fabrications, except aluminum or stainless steel items. Shop prime galvanized items only where scheduled for finish paint. Remove rust, scale, oil, grease and other deleterious materials before application of shop paint. Provide a uniform minimum dry film thickness of 2.0 mils. Provide full coverage of joints, corners, and edges.

B. Separate dissimilar metals to protect against electrolysis. Apply a bituminous coating o approximately 30 dry mils thickness, tape or other suitable permanent separator on concealed contact surfaces of dissimilar metals.

PART 3 - EXECUTION

3.1 GENERAL: Install all items as indicated in the drawings and approved shop drawings. Coordinate installation with all affected trades. Attach members firmly in proper position that is level, plumb, and parallel to adjoining construction (except where slope is indicated).

3.2 EXPANSION JOINT COVERS: Where void is constructed in concrete slab for installation of joint cover assembly, provide reinforcing projecting from vertical walls of void into grout fill to prevent separation between concrete void and grout.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install all rough carpentry, formwork, wood framing, blocking, wood furring, hardboard and related fasteners as indicated in the drawings or as required to complete the indicated construction.

B. Install all related hardware and fasteners. Provide and install wood furring and/or trim for acoustical panels.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Cast-in place concrete

B. Painting

C. Finish hardware

1.4 SECTION REQUIREMENTS

A. Submittals manufacturer’s printed literature describing wood preservatives treatment system and certifying that system meets all current requirements for applicable Federal, State and local governing agencies.

B. Submittals manufacturer’s printed literature describing fire retardant treatment system, any structural or usage limitations, and certifying that system meets all current requirements for applicable Federal, State and local governing agencies.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 DELIVERY AND STORAGE

A. Deliver and store lumber, plywood and hardwood on sills and cover for protection.

1.7 QUALITY ASSURANCE

A. All lumber and plywood shall be grade marked by Southern Pine Inspection Bureau, West Coast Lumber Inspection Bureau, American Plywood Association, or Western Wood Products Association.

B. All lumber and plywood shall be marked with producing manufacturer’s trademark.

C. Certificate of inspection issued by grading association for bundled lumber and plywood may substitute for individual piece marking.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Dressed lumber, S4S, 15 percent maximum moisture content for 2-inch (38-mm) thickness or less, marked with grade stamp of inspection agency.

2.2 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA C2 lumber and AWPA C9 plywood, labeled by an inspection agency approved by ALSC's Board of Review. After treatment, kiln-dry lumber and plywood to 19 and 15 percent moisture content, respectively. Treat indicated items and the following:

1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

B. Fire-Retardant-Treated Materials: AWPA C20 lumber and AWPA C27 plywood, interior Type A treatment, labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treated lumber and plywood with bending strength, stiffness, and fastener-holding capacities that are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions.

2.3 LUMBER

A. Miscellaneous Lumber: No. 3 or Standard grade of any species for nailers, blocking, and similar members as indicated on drawings.

2.4 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

1. Power-Driven Fasteners: CABO NER-272.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Hot-dip galvanized steel of structural capacity, type, and size indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. COORDINATION: Coordinate work with other trades and provide cutting and patching required to accommodate the work. Verify all dimensions by taking field measurements to ensure proper fit. Accurately cut framing and blocking, and fit true to line and level, avoiding shims and wedges.

B. Fit rough carpentry to other construction; scribe and cope for accurate fit. Correlate location of furring, blocking, and similar supports to allow attachment of other construction.

C. ANCHORING AND FASTENTING: Use largest practicable fasteners for each type of work. Bolt nailers and blocking to steel, masonry or concrete members using bolts of proportionate strength to members attached. Unless otherwise noted in the drawings use ¾” diameter bolts at maximum 4’-0” centers. Use concealed fasteners in finish work, set nails and use flathead countersunk screws.

D. WOOD BLOCKING: Install fire-retardant tread wood blocking between metal studs where wall-supported drinking fountains, casework, railings, and other equipment is attached. Install between studs for toilet partitions systems and toilet accessories where anchored to wall. Use minimum 2 x 4 dimension where not indicated otherwise in the drawings.

END OF SECTION

SECTION 06 16 43 - GYPSUM SHEATHING

PART 1 GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SUMMARY

A. Section Includes: Fiberglass-mat faced, moisture and mold resistant gypsum sheathing.

B. Related Sections:
1. Section 05 41 00 Structural Metal Stud Framing.
2. Section 06 10 00 Rough Carpentry.
3. Section 09 21 16 Gypsum Board Assemblies.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM C473 Standard Test Methods for Physical Testing of Gypsum Panel Products.
2. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
4. ASTM C1177 Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
5. ASTM C1280 Standard Specification for Application of Gypsum Sheathing.
6. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
7. ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
8. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
9. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.
10. ASTM C1396 Standard Specification for Gypsum Board

B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and installation instructions for each product specified.

1.04 WARRANTY

A. Provide products that offer twelve months of coverage against in-place exposure damage (delamination, deterioration and decay) commencing with the date of installation of the product in such structure.

B. Manufacturer's Warranty:
   1. Five years against manufacturing defects from the date of purchase of the product for installation
   2. 12 years against manufacturing defects when used as a substrate in architecturally specified EIFS.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC:
   1. Fiberglass-Mat Faced Gypsum Sheathing: DensGlass Sheathing.
   2. Fiberglass-Mat Faced Gypsum Sheathing, Type X for Fire Rated Designs: DensGlass Fireguard Sheathing.

B. Size:
   1. Thickness: 5/8 inch.
   2. Width: 4 feet.
   3. Length: 8 feet.
   4. R-Value: (ASTM C518) 0.67

C. Substitutions will be in accordance with Section 01 25 00.

2.02 ACCESSORIES

A. Screws: ASTM C1002, corrosion resistant treated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Inspection: Verify that project conditions and substrates are acceptable, to the installer, to begin installation of work of this section.

3.02 INSTALLATION

A. General: In accordance with GA-253, ASTM C1280 and the manufacturer's recommendations.

   1. Manufacturer's Recommendations:
      a. Current "Product Catalog", Georgia-Pacific Gypsum.

3.03 PROTECTION

A. Protect gypsum board installations from damage and deterioration until date of Substantial Completion.

END OF SECTION

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1- GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim and rails.
2. Wood cabinets (casework).
3. Laminate clad cabinets (plastic-covered casework).
4. Cabinet tops (countertops) and plastic-covered chair rails.
5. Flush wood paneling.
6. Interior door frames (jambs).

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 6 Section ‘Rough Carpentry’ for furring, blocking, and other carpentry work that is not exposed to view.
2. Division 6 Section ‘Finish Carpentry” for carpentry exposed to view that is not specified in this section.
3. Division 6 Section ‘Exterior Architectural Woodwork’ for exterior woodwork.
4. Division 8 Section “Flush Wood Doors” for doors specified by reference to architectural woodwork standards.
5. Division 9 Section “Painting” for final finishing of installed painted finish architectural woodwork.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.

D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

E. Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminate (standard and premium selections).

F. Samples for verification purposes of the following:

1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.
3. Wood veneer faced panel products;, with or for transparent finish, 8-1/2 inches by 11 inches, for each species and cut with one half of exposed surface finished, with separate samples of unfaced panel product used for core.
4. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.
5. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
6. Corner pieces as follows:
   a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.
7. Exposed cabinet hardware, one unit of each type and finish.

G. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

H. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Single-Source Responsibility: Arrange for production by a single firm of architectural woodwork with sequence matched wood veneers.

1. Include the veneering of wood doors in the single-firm production, where veneer matching extends across wood doors.

C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

E. AWI Quality Standard Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

F. Hardware Coordination Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section "Door Hardware" to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in 'Project Conditions.'

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Obtain and comply with Woodwork Manufacturer's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2- PRODUCTS

2.01 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates (standard and premium selections) which may be incorporated in the work include:

1. Formica Corp.
2. Nevamar Corp.
3. WilsonArt

2.02 MATERIALS

A. General: Provide materials that comply with requirements of the AWl woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of

woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

1. Hardboard ANSI/AHA A135.4
2. High Pressure Laminate: NEMA LD 3.
3. Medium Density Fiberboard: ANSI A208.2.
4. Particleboard ANSI A208.1
5. Softwood Plywood PS 1.

B. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:

1. Particleboard: NPA 8.
2. Medium Density Fiberboard: NPA 9.
3. Hardwood Plywood: HPMA FE.

C. Fire-Retardant Particleboard: Where indicated, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM B 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. For 45-lb-density panels and thicknesses of 3/4 inch and less, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of elasticity and screw-holding capacity on face and edge shall be 300,000 psi, 250 lb, and 225 lb, respectively.
2. For 44-lb-density panels and thicknesses of 13/16 inch to 1-1/4 inch, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of rupture, modulus of elasticity, internal bond, linear expansion, and screw-holding capacity on face and edge shall be 1300 psi, 250,000 psi, 60 psi, 0.50 percent, 250 lb, and 175 lb, respectively.
3. Product: Subject to compliance with requirements, provide “Duraflake FR” by Duraflake Div.; Willamette Industries, Inc.

2.03 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
2. Edges of rails and similar members more than 1 inch in nomina1 thickness: 1/8 inch.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to minimum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.04 FIRE-RETARDANT-TREATED LUMBER

A. General: Where indicated, pressure impregnate lumber with fire-retardant chemicals of formulation indicated to produce materials with fire performance characteristics specified.

B. Fire-Retardant Chemicals: Use chemical formulations specified that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated lumber from untreated lumber.

1. Organic Resin-Based Formulation: Exterior type per AWPA C20 consisting of organic-resin solution, relatively insoluble in water, thermally set in wood by kiln drying.
2. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.

C. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with c1assification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.

1. Surface Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion.

a. Flame Spread: 25.
b. Smoke Developed: 50.

D. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting organization.

E. Mill lumber before treatment and implement special procedures during treatment and drying processes that are needed to prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

F. Kiln-dry woodwork after treatment to levels required for untreated woodwork. Maintain moisture content required by kiln drying before and after treatment.

G. Discard treated lumber that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.

H. Products: Subject to compliance with requirements, provide one of the following:

1. Low-Hygroscopic Formulation (Type A):

a. “Flameproof LHC”; Osmose Wood Preserving, Inc.
b. “Dricon”; Hickson Corporation.

2.05 STANDING AND RUNNING TRIM AND RAILS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

C. Assemble casings in plant except where limitations of access to place of installation require field assembly.

D. Grade: Premium.

E. Lumber Species: Birdseye Maple, half round.

2.06 STANDING AND RUNNING TRIM AND RAILS FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: Premium.

C. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

D. Assemble casing in plant except where limitations of access to place of installation require field assembly.

E. Lumber Species: Any dosed-grain hardwood listed in referenced woodworking standard.

2.07 WOOD CABINETS (CASEWORK) FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 400 and its Division 400A Wood Cabinets."

B. Grade: Premium.

C. AWI Type of Cabinet Construction: Flush overlay.

D. Wood Species for Exposed Surfaces: Maple, rotary cut veneer.

1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.
2. Matching of Veneer Leaves: Slip match.
3. Veneer Matching Within Panel Face: Balance match.

E. Wood Species for Semiexposed Surfaces: Match species and cut indicated for exposed surfaces.

2.08 LAMINATE CLAD CABINETS (PLASTLC.COVERED CASEWORK)

A. Quality Standard. Comply with AWI Section 400 and its Division 400B 'Laminate Clad Cabinets."

B. Grade: Premium.

C. AWI Type of Cabinet Construction: Flush overlay, unless otherwise indicated.

D. Laminate Cladding High pressure decorative laminate complying with the following requirements:

1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a. Provide selections made by Architect from laminate manufacturer's full range of standard and premium colors and finishes in the following categories:

(1) Solid colors.
(2) Patterns.

2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.

a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
b. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
c. Edges: GP-50 (0.050-inch nominal thickness).

3. Semiexposed Surfaces: Provide surface materials indicated below:

a. High pressure laminate, GP-28.

2.09 CABINET HARDWARE AND ACCESSORY MATERIAI.8

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section 'Door Hardware.'

B. Cabinet Hardware and Miscellaneous Item Schedule:

1. Adjustable Shelf Standard.

a. Manufacturer/Model No.: Knape & Vogt/No. 255.
b. Size/Type: 5/8" wide x 3/16" deep, recessed.
c. Finish: Bright zinc plate.
d. Remarks: 1/2" vertical adjustment.

2. Adjustable Shelf Support:

a. Manufacturer/Model No.: Knape & Vogt/No. 256.
b. Finish: Bright zinc plate.
c. Remarks: For use with No. 255 standard.

3. Slotted Shelf Standard:

a. Manufacturer/Model No.: Knape & Vogt/No. 51.
b. Size/Type: 3/4" x 3/8" x length shown, surface mount, heavy duty.
c. Finish: Bright nickel plate.
d. Remarks: 1-5/8" vertical adjustment.

4. Adjustable Shelf Bracket:

a. Manufacturer/Model No.: Knape & Vogt/No. 52.
b. Size/Type: 112" wide x shelf depth.
c. Finish: Bright nickel plate.
d. Remarks: For use with No.51 standard.

5. Drawer Slide: (Typical)

a. Manufacturer/Model No.: Grant/No. 329.
b. Size/Type: Full extension, length to suit drawer.
c. Finish: Zinc plate.
d. Remarks: 100 lb. rating.

6. Drawer Slide: (To 4-1/2" drawer depth)

a. Manufacturer/Model No.: Grant/No. 328.
b. Size/Type: Full extension, length to suit drawer.
c. Finish: Zinc plate.
d. Remarks: 50 lb. rating.

7. Knobs (at Suites Level):

    a. Forms + Surfaces Model No. HC430 Series, sizes as selected by Architect from manufacturers standards.
    b. Finish: Anodized black matte.

8. Wire Pulls:

    a. Manufacturer/Model No.: Stanley/No. 4483112
    b. Size/Type: 3-1/2" center wire pulls.
    c. Finish: US 28D.

9. Concealed Hinges:

    a. Manufacturer/Model No.: Stanley/No. 1510.

10. Continuous Hinges:

    a. Manufacturer/Model No.: Stanley/No. STS311-1/4.
    b. Size/Type: 1-1/2" wide x height of door.
    c. Finish: US 32.
    d. Remarks: Provide matching countersunk screws, 2" o.c., both sides.

11. Door Catch (Magnetic type)

    a. Manufacturer/Model No.: Stanley/No. SP4L
    b. Size/Type: 2" x 1-1/4" case size.
    c. Finish: Aluminum.
    d. Remarks: One per leaf to 48", two per leaf to 84".

12. Cabinet Lock

    a. Manufacturer/Modal No.: National/No. C-8053.
    b. Size/Type: Disc tumbler cam lock.
    c. Finish: US 26D or US 32D.
    d. Remarks: Furnish two keys per lock; keyed to Building Standard.

13. Sliding Glass Door Locks: K&V 965NP, keyed to building system.
14. Track, Upper Guide & Sheaves: Stylmark Model No. 810005 Assembly, 204-Ri clear anodized finish.

C. Hardware Standard Comply with ANSI/BEMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BIIMA numbers or referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

1. Dark Oxidized Satin Bronze, Oil Rubbed, on Bronze Base: BHMA 613 and matching Architect's sample.
2. Satin Chromium Plated, Brass or Bronze Base: BHMA 626.
3. Satin Chromium Plated, Steel Base: BHMA 652.
4. Satin Stainless Steel, Stainless Steel Base: BHMA 630.

E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSJ/BHMA A156.9.

F. Clear Tempered Float Glass for Shelves: ASTM C 1048, Condition A, style I, type I, quality q3, class 1, seamed at edges before tempering, 1/4-inch thick unless otherwise indicated.

2.10 ARCHITECTURAL CABINET TOPS (COUNTERTOPS) AND CHAIR RAILS:

A. Quality Standard: Comply with AWI Section 400 and its Division 400C.

B. Type of Top and Chair Rail: High pressure decorative laminate complying with the following:

1. Grade: Custom.
2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:

a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

(1) Provide selections made by Architect from manufacturer's full range of standard and premium colors and finishes in the following categories:

(a) Solid colors.
(b) Patterns.

b. Grade: GP-50 (0.050-inch nominal thickness).
c. Edge Treatments:

(1) Plastic Laminate Edge Treatment: Same as laminate cladding on horizontal surfaces.
(2) Wood Edge Treatment: Lumber edge for transparent finish, with matching wood species and cut to be determined.

2.11 FLUSH WOOD PANELING FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 500 and its Division 500A.

B. Grade: Premium.

C. Veneer Species: Birdseye Maple half round.

D. Matching of Adjacent Veneer Leaves: Slip match.

E. Veneer Matching Within Panel Face: Best match.

F. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.

1. Flame Spread: 75 or less.
2. Smoke Developed: 40 or less.

2.12 INTERIOR DOOR FRAMES FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 900B.

B. Grade: Premium.

C. Lumber Species: Maple, rotary cut veneer.

2.13 CLOSET AND UTILITY SHELVING:

A. Quality Standard: Comply with AWI Section 600.

B. Shelving for Painted Finish (By Section 09 91 00): Comply with the following requirements:

1. Grade: Economy.
2. Shelving Material: Maple faced veneer core plywood.
3. Lumber: Ponderosa Pine or Poplar.

2.14 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.15 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.

B. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.

1. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning, and polishing until after installation. Painted finish by Section 09 91 00 except prime coat.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and simi1ar preparations for finishing of architectural woodwork, as applicable to each unit of work.

D. Transparent Finish for Closed-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen.

1. Grade: Premium.
2. AWI Finish System #5: Catalyzed polyurethane.
3. Staining for Cherry Only: Match approved sample for color.
4. Effect: Open grain (not filled).
5. Sheen: Dull satin 15-20 deg.

E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen:

1. Grade: Premium.

2. AWI Finish System #11: Catalyzed polyurethane.
3. Color: Match Architect's sample.
4. Sheen: Medium-gloss rubbed effect 35-45 deg.

2.16 MISCELLANEOUS ACCESSORIES

A. Steel Countertop Support Bracket: provide prefinished steel bracket supports at locations as shown on drawings. Brackets shall be by A&M Hardware (888) 647-0200 info@aandmhardware.com Other equal products may be provided if and as specifically approved by Architect by substitution request during bidding period.

PART 3- EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

B. Quality Standard. Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

C. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 118 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

D. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood. Handle, store, and install fire- retardant-treated wood to comply with recommendations of chemical treatment manufacturer including those for adhesives where are used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

G. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.

H. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish

I. Tops: Anchor securely to base units and other support systems as indicated.

J. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.

K. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

L. Refer to the Division 9 sections for finishing of painted architectural woodwork.

3.03 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 61 16 - SOLID SURFACING

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section Includes:
1. Gibraltar Solid Surface Material.
2. Earthstone Solid Surface Material.

B. Related Sections:
1. Finish Carpentry: Section 06 10 00.
2. Architectural Woodwork: Section 06 40 23.
3. Sealants: Section 07 92 00.
4. Door Thresholds at Ceramic Tile: Section 09 30 13.

1.2 SYSTEM DESCRIPTION

A. Gibraltar Solid Surface Sheet: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

B. Earthstone Solid Surface Sheet: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

1.3 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Product Data:
1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.

C. Shop Drawings: Installation details including location and layout of each type of fabrication and accessory.

D. Samples: Full range of standard colors and patterns.

E. Contract Closeout Submittals: Comply with Contract Documents.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Wilsonart certified solid surface fabricator/installer.

B. Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.

1. Acceptable to or licensed by manufacturer.

C. Source Limitations: Obtain materials and products from single source.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabrications appropriately wrapped in protective materials.

B. Protect fabrications from damage.

1.6 PROJECT CONDITIONS

A. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 degrees Fahrenheit for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.7 WARRANTY

A. Furnish manufacturer's limited 10 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Wilsonart International, (800) 433-3222, www.wilsonart.com.
1. Gibraltar Solid Surface, Type 051.
2. Earthstone Solid Surface, Type 051.

B. Substitutions: Permitted, in accordance with Section 01 25 00 Substitution Procedures.

2.2 GIBRALTAR SOLID SURFACE SHEET

A. Nominal sheet thickness: 0.50 inch (13 mm)
B. Surface burning characteristics in accordance with ASTM E 84: Class I or A, and as follows:
1. Flame spread: < 25.
2. Smoke developed: <25.
C. Liquid Absorption, ISO 4586-2, for 1/2 inch material thickness: 0.4 percent after 2 hour period.
D. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.
E. Tensile Modulus, ASTM D 638 Nominal: 1.2 million pounds per square inch.
F. Thermal Expansion, ASTM D 696: 0.000018 inch per inch per degree F, maximum.
G. Hardness, ASTM D 2583, Barcol Impressor: 57.
H. Flexural Toughness, ASTM D 790: 3 (in.-lb,/in^3).
I. Deflection Temperature under load, ASTM D 648: 90 degrees C.
J. Stain Resistance, ANSI Z-124.3 Modified; 3.4: No effect.

K. Boiling Water Resistance, NEMA LD 3-3.05: No effect.
L. High Temperature Resistance, NEMA LD 3-3.06: No effect.
M. Radiant Heat Resistance, NEMA LD 3-3.10: No effect.
N. Light Resistance, NEMA LD 3-3.03: No effect.
O. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.
P. Specific Gravity (Density ASTM D792): 1.60 grams per cubic centimeter.
Q. Approximate weight: 4.20 pounds per square foot.
R. Weatherability, ASTM D 2565: Pass.
S. Fungus Resistance, ASTM G 21: Pass.
T. Bacterial Resistance, ASTM G 22: Pass.
U. Pittsburgh Protocol Toxicity: 66.9 grams.
V. Patterns and Finishes: Selected from manufacturer's full range of available selections (*standard*) by Architect.

2.3 EARTHSTONE SOLID SURFACE SHEET

A. Nominal sheet thickness: 0.50 inch (13 mm).
B. Surface burning characteristics in accordance with ASTM E 84: Class II or B, and as follows:
   1. Flame spread: < 26.
   2. Smoke developed: < 35.
C. Liquid Absorption, ISO 4586-2, for 1/2 inch material thickness: 0.4 percent after 2 hour period.
D. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.
E. Tensile Modulus, ASTM D 638 Nominal: 1.1 million pounds per square inch.
F. Thermal Expansion, ASTM D 696: 0.00002 inch per inch per degree F, maximum.
G. Hardness, ASTM D 2583, Barcol Impressor: 57.
H. Flexural Toughness, ASTM D 790: 5 (in.-lb,/in^3).
I. Deflection Temperature under load, ASTM D 648: 90 degrees C.
J. Stain Resistance, ANSI Z-124.3 Modified; 3.4: No effect.
K. Boiling Water Resistance, NEMA LD 3-3.05: No effect.
L. High Temperature Resistance, NEMA LD 3-3.06: No effect.
M. Radiant Heat Resistance, NEMA LD 3-3.10: No effect.
N. Light Resistance, NEMA LD 3-3.03: No effect.
O. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.

P. Specific Gravity (Density ASTM D792): 1.56 grams per cubic centimeter.
Q. Approximate weight: 4.10 pounds per square foot.
R. Fungus Resistance, ASTM G 21: Pass.
S. Bacterial Resistance, ASTM G 22: Pass.
T. Pittsburgh Protocol Toxicity: 65.4 grams.
U. Patterns and Finish: Selected from manufacturer's full range of available selections (*standard)* by Architect.

2.4 ACCESSORY MATERIALS

A. Joint adhesive: Manufacturer’s standard adhesive to create inconspicuous, nonporous joints, with a chemical bond (WA8215).

B. Sealant: Standard mildew resistant, FDA/UL recognized silicone sealant in color matched or clear formulations.

2.5 FABRICATION

A. Fabrication to be performed by a Wilsonart certified solid surface fabricator/installer.
B. Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with approved shop drawing and Wilsonart published requirements.

C. Wilsonart Solid Surface Fabrication Manual (SS0319)
D. Form joints between components using manufacture's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 4" (100mm) wide Gibraltar/Earthstone reinforcing strip under joints required by Deck Seam Section of the Wilsonart Solid Surface Fabrication Manual (SS0319).
E. Provide holes and cutouts for plumbing and bath accessories as indicated on shop drawings.
F. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts then sand all edges smooth. Repair or reject defective or inaccurate work.
G. Finish: Surfaces shall have a uniform finish.

1. Matte: Standard finish for high traffic areas, requires the least amount of maintenance.
2. Satin: Standard finish for darker Gibraltar and Earthstone patterns, requires minimal maintenance.
3. Semi-gloss: Higher sheen with greater reflectance, suggested for lower traffic areas, requires increased maintenance
4. Gloss: Maximum sheen and reflectance, recommended for light traffic areas or vertical applications.

H. Thermoforming (optional): Comply with forming data from manufacturer.
1. Construct matching molds to form components shape.
2. Form pieces to shape prior to seaming and joining.
3. Cut pieces larger than finished dimensions, sand edges, remove all nicks and scratches.
4. Heat entire component uniformly between 280°–325°F during forming.
5. Prevent blistering, whitening or cracking of Gibraltar/Earthstone during forming.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

3.2 PREPARATION

A. Precondition Wilsonart Solid Surfacing in accordance with manufacturer's printed installation instructions.

3.3 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings, project installation details and manufacturer's printed instructions.
B. Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.
C. Adhere undermount sinks/bowls to countertop using manufacturer's recommended joint adhesive.
D. Adhere top mount sinks/bowls to countertop using manufacturer's recommended adhesive/silicone sealant.
E. Provide backsplashes and end splashes as indicated on the drawings. Adhere to countertops using manufacturer's recommended silicone sealant.
F. Remove excessive adhesive and sealants. Components shall be clean on Date of Substantial Completion.
G. Coordinate plumbing installation with Division 22.

3.4 PROTECTION

A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged components that cannot be repaired to architect's satisfaction.

B. Fabricator/Installer to provide the Wilsonart Care and Maintenance kit, review maintenance procedures and the Wilsonart warranty with Owner maintenance upon completion of project.

END OF SECTION

SECTION 07 10 00 — DAMPPROOFING AND WATERPROOFING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and apply damp proofing at all interior cmu walls as indicated in the drawings and specified herein.

B. Provide and apply damp proofing and joint taping on weather side of gypsum board sheathing.

C. Provide and install below-grade waterproofing.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Unit masonry.

B. Gypsum sheathing.

C. Flashing at roof.

D. Plastic membrane under slab-on-grade.

E. Waterstops.

F. Metal thru-wall flashing.

1.4 SUBMITTALS

A. Submit manufacturer’s printed literature describing each material, restrictions, and manufacturer’s recommended procedures. Submit samples of each material.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the Work under this section for a period of one year after the date of Substantial Completion of the Project.

1.6 QUALITY ASSURANCE

A. Waterproofing company shall have a minimum of 3 years experience in the dampproofing and waterproofing of building structures of similar size and scope as this project.

B. Retain at the job site a properly calibrated gauge for use by the Architect to verify applied thickness of materials.

PART 2 - PRODUCTS

2.1 WALL MATERIALS

A. MEMBRANE FLASHING: 40 mil thick polyethylene backed SBS modified bitumen self-adhering black membrane; “Protecto Flash” as manufactured by Protecto Wrap Co. or “Perm-A-Barrier” as manufactured by W.R. Grace and Co. or “Blueskin SA” as manufactured by Henry Company. Membrane shall comply with the following:

1. Tensile Strength: ASTM D412; 1400 psi.
2. Elongation: ASTM D412; 200% min.
3. Water Absorption: ASTM D570; 0.1% max.

B. DAMPPROOFING: Non-asbestos emulsion type coating **“Sonoshield Hydrocide 600”** as manufactured by Sonneborn. Comply with ASTM D1227, Type 1.

C. SHEATHING TAPE: 4” wide glass fabric scrim complying with ASTM D1668 or 40 mil thick polyethylene backed SBS modified bitumen self-adhering tape as manufactured by Protecto Wrap Co. or equivalent by W.R. Grace and Co or Henry Company. Verify compatibility of tape with proposed dampproofing.

2.2 BELOW GRADE WATERPROOFING:

A. SLABS: “Hydrocide Liquid Membrane, HLM 5000” Cold Applied Seamless Elastomeric, Modified Urethane for use between concrete seal slab and concrete slab-on-grade as manufactured by Sonneborn or approved equivalent by Toch Bros. or Tremco or Henry Company.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor shall inspect interior face of all masonry cavity walls to ensure that all penetrations and joints are completely filled prior to dampproofing operations beginning.

3.2 MEMBRANE FLASHING

A. Prime concrete and masonry surfaces scheduled to receive membrane flashing using flashing manufacturer's recommended primer to ensure good adhesion.

B. WALL FLASHINGS: Shall be installed above all openings occurring in an exterior wall, at base of exterior wall, and at wall interruptions by columns, beams, slabs, spandrels and other locations as indicated in the drawings. Flashing shall extend to within 1" of outside face of wall, shall be continuous and shall extend through cavity and be turned up to the top first course above finish floor on face of inner wythe, and to extend 1" minimum into back up or inner wythe. End laps to be 9" and side laps 6".

C. STEEL STRUCTURE: Cover all steel columns or beams in exterior walls not protected by dampproofed concrete block or sheathing. Cover steel completely with membrane flashing lap 6" on to masonry on each side of columns. Conform and adhere to steel shapes not fireproofed. Cover all protruding angles or miscellaneous steel.

D. FRAMES: Install at exterior window and door frames and other locations as indicated in the drawings.

E. SHEATHING: Wrap all corners of gypsum board sheathing. See drawings for other details.

3.3 SHEATHING TAPE: Use one of the following systems:

A. Imbed and cover glass fabric scrim tape in dampproofing mastic at all joints, cracks and penetrations at gypsum board sheathing.

B. Apply specified self-adhering tape continuously over all joints, cracks and penetrations prior to beginning dampproofing operations.

3.4 DAMPPROOFING

A. Spray or brush apply damp proofing coating to interior side of all masonry walls in accordance with the following:
1. Primer: Minimum ½ gallon material per 100 sq. ft. of wall surface.
2. Coating: Minimum 2/32" (62.5mils) dry film thickness and minimum 5 gallons material per 100 sq. ft.

B. Cover all corners and work thoroughly into all joints, cracks, or crevices. Finished coating shall be monolithic and free of pin holes or cracks. Seal cracks, voids and joints at dissimilar materials with glass fabric embedded in dampproofing coating.

C. Seal around penetrations including all masonry anchors.

D. Dampproofing shall be applied only when temperature is at 50 degrees F. and rising or above, and when no rain is forecast for the 24 hour period following application. No dampproofing shall be covered by masonry prior to observation by the Architect. All dampproofing shall dry for a minimum of 24 hours prior to being covered by finish masonry.

3.5 BELOW GRADE WATERPROOFING

A. LIQUID MEMBRANE:
1. Install liquid membrane systems at earth side of all below grade walls, between sub-slab ("mud-slab") and structural slab.. Allow concrete work to cure a minimum of 14 days. All surfaces shall be smooth, dry, sound and free of honeycombs. Concrete shall be free of curing and parting compounds, wax or other foreign materials.

2. Static joints or cracks less than 1/8" wide shall be sealed with "HLM" as manufactured by waterproofing manufacturer. Material shall fill and over-lap the edges of the joint to a width of 4" on both sides and shall have a minimum surface thickness of 55 (+5) mils.
3. Immediately prior to application of membrane, remove all dust and dirt by use of high-pressure air, by brushing with a soft broom or vacuum cleaning.
4. Apply material at a rate of 4 gallons per 100 square feet of surface to produce a membrane of 55 (+5) mil thick. Carefully control application to avoid runs and sags of fresh material.
5. Apply membrane to prestripped areas at cracks, joints, intersections, penetrations, etc., to provide a minimum total thickness of 110 mils over these areas. Mask any membrane edge exposed to view to provide a straight clean edge.
6. Before the membrane attains a final set, verify the applied thickness by use of a mil-thickness gauge. Where readings indicate a thickness less than specified, immediately apply additional membrane to produce required thickness.
7. Following the application of the membrane, place protection boards over the membrane waterproofing at walls receiving backfill. Use membrane material as required to adhere protection boards. Boards shall be firmly in place with joints closely butted and sealed with gusset tape before backfilling is started.
8. Protect membrane during construction. Any punctures or cuts in the membrane shall be patched and sealed in the manner described above for sealing joints in the sheeting.

END OF SECTION

SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. This Section includes the following:

1. Fiberglass roll or batt insulation

B. Related Sections include the following:

1. Section 09 21 16.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

D. Research/Evaluation Reports: For foam-plastic insulation.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. Batt or Roll Insulation:

1. Johns Manville
2. Owens Corning
3. Certainteed

General: Insulation shall be fine fiber, flexible, resilient glass fiber blanket. Moisture absorption shall be less than .2% by volume.

1. Interior Stud Walls: 3 5/8” x 16” wide x 96” sound attenuation batts “R” factor 11. Unfaced.
2. Interior Stud Walls: 6” x 16” wide x 96” sound attenuation batts “R” factor 19. Unfaced.

AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless steel screens (inside) where openings must be maintained for drainage or ventilation.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturers written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Apply spray foam insulation in strict compliance with insulation manufacturers' written recommendations by manufacturer approved applicator only. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it even with studs by using method recommended by insulation manufacturer.

END OF SECTION

SECTION 07 21 10 – FOIL FACED RIGID INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following:

1. Foil-faced polyisocyanurate rigid foam thermal insulation for exterior wall assemblies.

1.2 RELATED WORK

A. Section 05 40 00 - Cold-Formed Metal Framing.

B. Section 07 60 00 - Flashing and Sheet Metal

1.3 REFERENCES

A. ASTM International:

1. ASTM C 203 - Standard Test Methods for Breaking Load and Flexural Properties of Block Type Thermal Insulation.
2. ASTM C 209 - Standard Test Methods for Cellulosic Fiber Insulating Board.
3. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
4. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
5. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
6. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
7. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
8. ASTM E 84 - Standard Test Method for Surface Burning Characteristics.
9. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
10. ASTM E 2178 - Standard Test Method for Air Permeance of Building Materials.
11. ASTM E 2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

B. Canadian Test Methods and Specifications:
1. CAN/ULC-S704-11.
2. CCMC Listing 13104-L.
3. CAN/ULC-S102-M88.

C. International Code Council - Evaluation Service:
1. ICC-ES AC12 - Acceptance Criteria for Foam Plastic Insulation
2. ICC-ES AC71 - Foam Plastic Sheathing Panels Used as Weather-Resistive Barriers.
3. ICC-ES Evaluation Report ESR-3398 - Johns Manville AP Foil-Faced Sheathing.

D. National Fire Protection Association (NFPA):
1. NFPA 259 - Standard Test Method for Potential Heat of Building.
2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation

E. Underwriters Laboratories (UL and ULC): Audit manual - File R10167.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data sheets including the following:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. ICC-ES Evaluation Report: Submit current ESR-3398, Johns Manville AP Foil-Faced Sheathing.

C. Samples: Submit 12 inch square insulation panel.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by insulation system manufacturer to install manufacturer's product.

B. Manufacturer Qualifications: A qualified manufacturer that has ASTM C 1289, NFPA 285, and ASTM E84 listing for continuous insulation system identical to that used for this Project.

C. Preconstruction Meeting: Before installation, conduct conference at Project site. Comply with requirements for pre-installation conferences in Division 01 Section "Project Management and Coordination." Review methods and procedures related to continuous insulation construction and including the following:

1. Meet with Owner, Architect, Installer, manufacturer's representative, and installers that interface with or affect the installation of continuous insulation sheathing.
2. Review metal wall framing assemblies for potential interference and conflicts.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review continuous insulation sheathing guidelines as required by Manufacturer's installation manual.
5. Review governing regulations and requirements for insurance and certificates if applicable.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation materials to Project site with original packaging unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and installing with other components.

B. Store materials in clean, dry area in manufacturer's unopened packaging until ready for installation and in accordance with manufacturer's instructions and temperature recommendations. Packaging shall be intact with no exposed foam or loose flaps, labels and feet/legs must be securely affixed.

C. Handle and store insulation materials in a manner to avoid damaging materials.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit system to be installed according to manufacturer's written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 POLYISOCYNAURATE FOAM INSULATION

A. Polyisocyanurate Board Insulation: AP Foil-Faced Rigid Foam Sheathing, manufactured by Johns Manville, complying with the following:
   1. Description: Foil-faced, rigid foam insulating sheathing product recommended for concealed uses in commercial construction, complying with ASTM C 1289, Type 1, Class 1.
   2. Construction: Foam bonded on both sides in the manufacturing process to foil facers. One side has a printed reflective foil facer and the other side has a printed non-reflective foil facer.
   3. Foam: Closed cell polyisocyanurate, CFC- and HCFC-free.
   4. Service Temperature: -100 degrees F to 250 degrees F (-73 degrees C to 122 degrees C).
   5. Physical Properties:
      a. Thermal Resistance, 1 Inch, ASTM C 518: 6.0 degrees F per square foot per hour per BTU.
      b. Compressive Strength, ASTM D 1621: 16 psi or greater.
      c. Flexural Strength, ASTM C 203: 40 psi or greater.
      d. Water Absorption, ASTM C 209: 0.1 percent by volume.
      e. Water Vapor Permeance, ASTM E 96, 0.05 perms.
      f. Surface Burning Characteristics, ASTM E84, foam core 25 or less flame spread, 450 or less smoke developed.

B. Size: 48 inches wide by 96 inches long;

   1. Nominal Thickness: 3/4 inch, R-value 4.4.

C. Compliance: Third party quality control agency follow-up service requirements:
   1. Underwriters Laboratories: Must comply with current UL File R10167 audit manual at manufacturing locations.
   2. Factory Mutual: Tested per ASTM E84 Test Method for Surface Burning Characteristics.
   3. Intertek: Complies with ASTM C1289, ASTM E84, NFPA 259, and NFPA 285 requirements.
   4. AATCC Test Method 127: Accepted; weathered specimens do not exhibit water leakage on the underside of any specimen tested.
   5. ASTM Test Methods and Specifications:
      a. ASTM D 2126 (Dimensional Stability): 2 percent maximum linear change at minus 40degF/amb R.H. and at 158degF/97percent R.H, 4 percent maximum linear change @ 200°F/amb R.H.
      b. ASTM E 2178: Air permeance average, with differential pressure of 75 Pa (1.57 lbs./sq.ft), resulting in calculated air flow of 0.0007 L/second sq.m (0.00013 cfm/sq.ft.).
      c. ASTM E 2357: Air leakage rating of 0.00426 liters per second square meter, with the specified design value of Qsub10 greater than 0.20 kPa.
   6. ICC-ES AC71: Foam plastic sheathing panels used as weather-resistive barriers.
      a. Section 3.1 - Foam Insulation - Water Resistance (Modified): No water observed on underside of specimens after aging.
      b. Section 3.4.1.5: - Wall Assembly Water Penetration Resistance Testing: No water observed penetrating to the unexposed face of the wall assembly.
   7. Canadian Test Methods and Specifications:
      a. CAN/ULC-S704-11: Type 1, Class 1.
      b. CCMC Listing: 13104-L: Type 1, Class 1.
   8. Air Barrier Association of America (ABAA): ABAA approved material.

D. Accessories:
   1. Insulation Flashing Tape: JM UltraFast® Flashing Tape, 3M All Weather Flashing Tape 8067, or equivalent.
   2. Wall Penetration Sealant: Tremco Spectrem 1, or equivalent.

3. Insulation Fasteners: JM UltraFast CI Plates and JM Ultrafast CI Phillips screws, or equivalent.
4. Fasteners: Brick Facing Anchors, Heckman Building Products Wing Nut POS-I-TIE anchors, zinc barrel and wing nut, Hohmann & Barnard, Inc. BL-607, or equivalent.

E. Substitutions in accordance with Section 01 25 00.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2 INSTALLATION

A. Installation over Exterior Sheathing: Install products in strict accordance with manufacturer's recommendations and written instructions, including the following:
1. Begin installation after structural steel, exterior framing and bracing, and structural sheathing is complete.
2. Install boards horizontally (preferred) over exterior sheathing staggered joints relative to exterior sheathing. The reflective side of the board should be oriented to the exterior, and the non-reflective white side should be oriented to the interior.
3. Use maximum board lengths to minimize number of joints. Locate joints square to framing members. Center end joints over framing. Provide additional framing as necessary. Stagger each course at least one stud space to minimize continuous vertical seams. Boards may be installed vertically if less seam sealing results.
4. Butt board edges together tightly, and carefully fit around openings and penetrations.
5. Fasten insulation boards to the exterior face of the stud framing using sheathing manufacturer's recommended fasteners.
6. Space fasteners 16 inches on center at the board perimeter, or consistent with framing spacing, but not greater than 24 inches on center. Space fasteners 24 inches on center in the field, or consistent with framing spacing. One fastener/plate can bridge between a maximum of two adjoining board edges. Drive fasteners so the stress plate is tight and flush with the board surface, but do not countersink.
7. Install exterior cladding ties as applicable.
8. To create an air/water-resistive barrier, **tape all seams**, edge and end joints, and thru-wall penetrations with sheathing manufacturer's recommended flashing tape. Install flashing shingle-style with a minimum 4 inch overlap, and follow the tape manufacturer's application instructions. Seal fastener penetrations by applying a minimum 4-inch by 4-inch piece of tape over each plate, smoothing tape edges to create an air-tight seal between the tape and the insulation board. Create continuous air/water barrier at roof and foundation wall interface using peel-and-stick membrane, or other approved barrier, following manufacturer's application instructions.
9. Seal penetrations and panel defects with sheathing manufacturer's recommended sealant.
10. Repair any boards damaged during installation. Patch holes less than 1 inch across with flashing tape. Patch holes greater than 1 inch across with matching board material and then seal with flashing tape.
11. As applicable, the wall is now ready for stud cavity insulation and exterior veneer.

B. Installation Direct to Exterior Metal Studs: Install products in strict accordance with manufacturer's recommendations and written instructions, including the following:
1. Begin installation after structural steel and exterior framing and bracing are complete.
2. Install boards horizontally (preferred) using maximum board length to minimize the number of joints. The reflective side of the board shall be oriented to the exterior, and the non-

reflective white side shall be oriented to the interior. Locate joints parallel to framing flange. Stagger each course at least one stud space to minimize continuous vertical seams. Boards may be installed vertically if less seam sealing results.

3. Fasten insulation boards to the exterior face of the stud framing using sheathing manufacturer's recommended fasteners.
4. Space fasteners 16 inches on center at the board perimeter, and 16 inches on center in the field of the board. One fastener/plate can bridge between a maximum of two adjoining board edges. Drive fasteners so the stress plate is tight and flush with the board surface, but do not countersink.
5. Install exterior cladding ties as applicable.
6. To create an air/water-resistive barrier, tape all seams, edge and end joints, and thru-wall penetrations with sheathing manufacturer's recommended flashing tape. Install flashing shingle-style with a minimum 4 inch overlap, and follow the tape manufacturer's application instructions. Seal fastener penetrations by applying a minimum 4-inch by 4-inch piece of tape over each plate, smoothing tape edges to create an air-tight seal between the tape and the insulation board. Create continuous air/water barrier at roof and foundation wall interface using peel-and-stick membrane, or other approved barrier, following manufacturer's application instructions.
7. Seal penetrations and panel defects with sheathing manufacturer's recommended sealant.
8. Repair boards damaged during installation. Patch holes less than 1 inch across with flashing tape. Patch holes greater than 1 inch across with matching board material and then seal with flashing tape.
9. As applicable, the wall is now ready for stud cavity insulation and exterior veneer.

3.3 PROTECTION AND CLEANING

A. Protect materials from damage during installation and subsequent construction. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 21 19 - FOAMED-IN-PLACE MASONRY WALL INSULATION

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SUMMARY

A. Extent of insulation work is shown on drawings and indicated by provisions of this section.

B. Applications of insulation specified in this section include the following:
1. Foamed-In-Place masonry insulation for thermal, sound and fire resistance values.
2. Provide only **open cell** foam insulation.

1.02 SUBMITTALS

A. Product and technical presentation as provided by the manufacturer.

B. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.

C. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.03 QUALITY ASSURANCE

A. Manufacturing Standards: Provide insulation produced by a single and approved manufacturer. The product must come from the manufacturer pre-mixed to ensure consistency.

B. Installer Qualifications for Foamed-In-Place Masonry Insulation: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and
which has not less than three years direct experience in the installation of the product used.

C. Warranty: Upon request, a one year product and installation warranty will be issued by both the manufacturer and installer.

D. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.

Product must be classified by Underwriters Laboratory ® ("UL") as to Surface Burning Characteristics

Fire Resistance Ratings:	ASTM E-119
Surface Burning Characteristics:	ASTM E-84
Combustion Characteristics:	ASTM E-136

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers of Foamed-In-Place Masonry Insulation: Provide only open cell foam insulation. Subject to compliance with requirements, provide products from the following:

1. "Core-Fill 500™"
   Tailored Chemical Products,
   P.O. Box 4186,
   Hickory, N.C. 28603, (800) 627-1687

2. Lapolla Industries, Inc.
   15402 Vantage Parkway East, Ste. 322
   Houston, Texas 77032
   Tel: +1 281 219 4100, (877) 636-2948
   Email: sds@lapolla.com

2.02 INSULATING MATERIALS

A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

B. Foamed-In-Place Masonry Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.

1. Fire-Resistance Ratings: Minimum four (4) hour fire resistance wall rating (ASTM E-119) for 8" and 12" concrete masonry units when used in standard two (2) hour rated CMUs.
2. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
3. Combustion Characteristics: Must be noncombustible, Class A building material.
4. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.

5. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Application Assemblies:
Block Walls: 6", 8", 10" or 12" concrete masonry units
Cavity Walls: 2" cavity or greater

3.02 INSTALLATION OF FOAMED-IN-PLACE INSULATION

A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.

B. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

END OF SECTION

SECTION 07 26 16 - UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Products supplied under this section:
   1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:
   1. Section 03 30 00 Cast-in-Place Concrete
   2. Section 07 26 00 Vapor Retarders

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E1745- 11Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E1643- 11Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality control/assurance:
   1. Summary of test results per paragraph 9.3 of ASTM E 1745.
   2. Manufacturer’s samples and literature.
   3. Manufacturer’s installation instructions for placement, seaming and penetration repair instructions.
   4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor barrier shall have all of the following qualities:
1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:
a. Strength: ASTM E1745 Class A.
b. Thickness: 15 mils minimum

B. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.

2. Substitutions will be in accordance with Section 01 25 00.

2.2 ACCESSORIES

A. Seams :
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/edge seal:
1. Stego Crete Claw by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com.
2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
3. StegoTack Tape (double sided) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.
3a. Seal vapor barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.
OR
3b. Seal vapor barrier to footing/grade beam with double sided tape, termination bar, or both.
4. Overlap joints 6 inches and seal with manufacturer’s tape.
5. Apply tape/Crete Claw to a clean and dry vapor barrier.
6. Seal all penetrations (including pipes) per manufacturer’s instructions.

7. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
8. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION

SECTION 07 41 13 - INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION INCLUDES

A. Foamed-insulation-core standing seam metal roof panels, with related metal trim and accessories.

1.3 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Metal Wall Panels" for factory-formed metal wall panels.

D. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal copings, flashings, reglets, and roof drainage items in addition to items specified in this Section.

E. Division 07 Section "Joint Sealants" for field-applied Joint Sealants.

F. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.4 REFERENCES

A. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International (ASTM): www.astm.org:

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792 - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
5. ASTM D 1621 – Compressive Properties of Rigid Cellular Plastics.

6. ASTM D 1622 – Apparent Density of Rigid Cellular Plastics.
7. ASTM C 518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
10. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
11. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
12. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
13. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
14. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
15. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
16. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

C. FM Global (FM): www.fmglobal.com:

1. ANSI/FM 4471 Approval Standard for Class 1 Panel Roofs.
2. ANSI/FM 4880 American National Standard for Evaluating Insulated Wall and Roof/Ceiling Assemblies.

D. Underwriters Laboratories, Inc. (UL): www.ul.com:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal roof panel assembly and accessories from a single manufacturer approved under an accredited third-party quality control program.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.7 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, curbs, vents, snow guards, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.

1. Include data indicating compliance with performance requirements.
2. Indicate points of supporting structure that must coordinate with metal panel system installation.
3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification:

1. Provide 12-inch- (305 mm-) long section of each metal panel profile.
2. Provide color chip verifying color selection.

1.8 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Warranty:

1. Submit manufacturer’s written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
2. The installation contractor shall issue a separate one (1) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.

1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
3. Shield foam insulated metal panels from direct sunlight until installation.

1.11 WARRANTY

A. Special Manufacturer’s Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.

B. The installation contractor shall issue a separate one (1) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

C. Manufacturer's Weathertight Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail to remain weathertight, including leaks, without monetary limitation within 20 years from date of Substantial Completion.

D. Special Panel Finish Warranty: Submit Manufacturer’s twenty-five (25) year limited warranty on the exterior paint finish for adhesion to the metal substrate and twenty-five (25) year limited warranty on the exterior paint finish for chalk and fade.

1. Fluoropolymer Two- Coat System:

    a. Color fading in excess of 5 Hunter units per ASTM D 2244.
    b. Chalking in excess of No. 6 rating per ASTM D 4214.
    c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877)713-6224; Email: info@ecoficientseries.com; Web: www.mbci.com.

1. Provide basis of design product, or comparable product in accordance with Section 01 25 00 Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 or ASTM E 1592 applied in accordance with IES AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

    a. Wind Uplift Testing: Certify capacity of metal panels by testing of proposed assembly per ASTM E 72 or ASTM E 1592.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure. Reference structural drawings for addt. information.

3. Seismic Performance: Comply with ASCE 7, Section 9, "Earthquake Loads."

C. Wind Uplift Resistance: Comply with UL 580 for wind-uplift class UL-90.

D. FM Approvals Listing: Comply with FM Approvals 4471 as part of a panel roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 construction. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-120.

2. Hail Resistance Rating: Class 1-SH.

E. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: Provide metal panel systems with the following characteristics when tested per ASTM E 84. The core shall have:

    a. Flame spread index: 25 or less.
    b. Smoke developed index: 450 or less.

2. Fire Performance of Insulated Roof: Class 1 roof panel per ANSI/FM 4880.

F. Air Infiltration, ASTM E 1680:

1. Maximum 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

G. Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft. (300 Pa).

H. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

I. Thermal Performance: When tested in accordance with ASTM C 518, "measurement of steady state thermal transmission," the panels shall provide a K-factor of 0.14 btu/sf/hr/deg F at a 75° F (24 C) mean temperature.

2.3 INSULATED METAL ROOF PANELS

A. Mechanically Seamed, Concealed Fastener, Foamed-Insulation-Core Metal Roof Panels: Structural metal roof panel consisting of ribbed exterior metal sheet and interior metal sheet, with factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, mechanically seamed, attached to supports using concealed clips and fasteners.

1. Basis of Design: MBCI, Insulated BattenLok.

2. ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.

a. Exterior Face Sheet: 22 gauge with stucco embossed surface and planked pan profile.

1) Finish: Fluoropolymer two-coat system.
2) Color: As selected by Architect from manufacturer's standard colors.

b. Interior Face Sheet: 24 gauge with stucco embossed surface and planked profile.

1) Finish: Exposed Galvalume Plus coating.
2) Color: As selected by Architect from manufacturer's standard colors.

3. Panel Width: 36 inches (914 mm).

4. Panel Thickness: 4 inch (102 mm).

5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent

a. Closed Cell Content: 95% or more as determined by ASTM D 6226
b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 15 psi as determined by ASTM D 1621
c. Minimum Density: 2.0 pcf (32 kg/m3) as determined by ASTM D 1622
d. Thermal Resistance (R-Value): 8 per inch of panel thickness. Minimum required R-Value of 30 as determined by ASTM C 518 at 75 degrees Fahrenheit mean temperature.

2.4 METAL ROOF PANEL ACCESSORIES

A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Clips: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, two-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

D. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating.

E. Joint Sealers: Provide Tape Mastic Sealants, Concealed Joint Sealant, and Urethane Joint Sealants per Section 07 92 00, "Joint Sealants".

F. Steel Sheet Miscellaneous Framing Components: ASTM C 645, with ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized zinc coating.

G. Roof Accessories: Approved by metal roof panel manufacturer. Refer to Section 07 72 00 "Roof Accessories" for requirements for curbs, equipment supports, roof hatches, heat and smoke vents, ventilators, and preformed flashing sleeves.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept sealant tape providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Exterior Face Sheet Coil-Coated Finish System

1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.

a. Color to be selected by Architect.

C. Interior Face Sheet Coil-Coated Finish System:

1. Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat.

a. Color to be selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of insulated metal panels.

2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to insulated metal panel system manufacturer but not greater than the following:

   a. 1/8 inch (3 mm) in 5 foot (152 cm) in any direction.
   b. 1/4 inch (6 mm) in 20 foot (610 cm) in any direction.
   c. 1/2 inch (9 mm) over any single roof plane.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.

3.2 METAL PANEL INSTALLATION

A. Mechanically-Seamed, Foamed-Insulation-Core Metal Roof Panels: Install insulated metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install insulated metal roof panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to metal framing using clips, screws, fasteners, sealants, and adhesives recommended by manufacturer and indicated on approved shop drawings.

1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.

2. Provide weatherproof jacks for pipe and conduit penetrating metal panels.

3. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

D. Joint Sealers: Install tape sealers and liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.

1. Seal panels in accordance with insulated panel manufacturer's instructions, and project design drawings.

2. Seal panel joints utilizing tape sealer and vapor seal bead of non-curing butyl; apply continuously without gaps in accordance with manufacturer's written instructions, approved shop drawings, and project drawings.

3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.

2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.

3. Provide concealed fasteners except where noted on approved shop drawings.

4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

B. Water-Spray Test: After completing portion of metal roof panel assembly including accessories and trim, test 2-bay area selected by Architect for water penetration, according to AAMA 501.2.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 42 13.13 – FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION INCLUDES

A. Flush-profile, concealed fastener metal wall panels, with related metal trim, and accessories.

1.3 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Air Barriers" for air barriers within wall assembly and adjacent to wall assembly.

D. Division 07 Section "Metal Soffit Panels" for soffit panels installed with metal wall panels.

E. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.

F. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.4 REFERENCES

A. ASTM International (ASTM): www.astm.org:

1. ASTM A755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
2. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
3. ASTM C920 - Specification for Elastomeric Joint Sealants.
4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

7. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
8. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

D. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.

1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.6 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.7 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products. Include data indicating compliance with performance requirements.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.

1.8 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Qualification Information: For Installer firm and Installer's field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.

D. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
3. Shield foam insulated metal panels from direct sunlight until installation.

1.11 WARRANTY

A. Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within two (2) years from date of Substantial Completion.

B. Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:

1. Fluoropolymer Two-Coat System:

a. Basis of Design System: MBCI, Signature 300.
b. Color fading in excess of 5 Hunter units per ASTM D2244.
c. Chalking in excess of No. 8 rating per ASTM D4214.
d. Failure of adhesion, peeling, checking, or cracking.
e. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877)713-6224; Email: info@mbci.com; Web: www.mbci.com.

1. Provide basis of design product.

2. Substitutions in accordance with Section 01 25 00.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.

C. Wall Panel Air Infiltration, ASTM E283:

1. No air infiltration at static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

D. Wall Panel Water Penetration Static Pressure, ASTM E331: No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft. (300 Pa).

E. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 FORMED METAL WALL PANELS

A. Flush-Profile, Concealed Fastener Metal Wall Panels: Structural metal panels consisting of formed metal sheet with vertical panel edges and two intermediate stiffening beads, symmetrically placed, with flush joints between panels, field assembled with nested lapped edges, and attached to supports using concealed fasteners.

1. Basis of Design: MBCI, FW-120 Panel.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A755/A755M.

a. Nominal Thickness: 24 gage coated thickness, with stucco embossed surface.

1) Exterior Finish: Fluoropolymer two-coat system.
2) Color: As selected by Architect from manufacturer's standard colors.

3. Panel Width: 12 inches (305 mm).
4. Panel Thickness: 1-1/2 inch (38 mm).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panels.

C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

D. Panel Sealants:

1. VOC Content of Interior Sealants: Sealants used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Architectural Sealants: 250 g/L.

2. Factory-Applied Seam Sealant: Manufacturer's standard hot-melt type.
3. Concealed Joint Sealants: Non-curing butyl, AAMA 809.2.
4. Elastomeric Joint Sealants: Urethane sealant, single-component, ASTM C920 Type S, Grade NS, Class 25, Use NT, A, M, G, O.
5. Foam Tape: Manufacturer's standard self-adhering type.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.

1. Basis of Design: MBCI, Signature 300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal

panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

A. Concealed-Fastener Formed Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading flange. Snap-fit back flange of subsequent panel into secured flange of previous panel. Where indicated, fasten panels together through flush-fitted panel sides.

1. Cut panels in field where required using manufacturer's recommended methods.
2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

D. Joint Sealers: Install liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.

1. Seal panel base assembly, openings, panel head joints, and perimeter joints using joint sealers indicated in manufacturer's instructions.
2. Seal perimeter joints between window and door openings and adjacent panels using elastomeric joint sealer.
3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 CLEANING AND PROTECTION

A. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 54 19 - ADHERED MULTI-PLY ROOF SYSTEM

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 AREAS COVERED

A. Low slope roof area

1.02 INSTALLER QUALIFICATIONS

A. Roofing Installer must be:
   1. Currently prequalified with the Owner in accordance with Owner's prequalification requirements.
   2. Currently in good standing with the manufacturer.

B. It shall remain each Contractor's responsibility to determine his current status with the manufacturer's certification plan.

1.03 QUALITY ASSURANCE

A. Applicator/Installer:
   1. Acceptable to roof material manufacturer for the manufacturer's warranty requirements.
   2. Five (5) years successful experience on projects similar in size and scope.
   3. Experienced in the type of roofing work required.
   4. Successfully completed previous projects warranted by the manufacturer.

B. Manufacturer’s Observation Reports: Beginning with the commencement of the roofing system installation for the project and continuing through the completion of the roofing system installation and all its associated components, the Roofing System Manufacturer or their appointed representative shall provide jobsite observations and written observation reports including digital photos as follows and this shall be confirmed in writing by the manufacturer and made part of the roofing submittals.

   1. Keep the Architect / Owner informed as to the progress, status, and quality of work as observed.
   2. Provide jobsite observations no less than (2) hours per week throughout the installation of the roofing system and its associated components. Reports shall include detailed weekly reports to the Architect, Contractor, and Subcontractor along with digital photographs of work in progress. These reports and photographs shall be descriptive of actual work in progress, status, and condition, and be presented in a written format with digital color photographs.

3. Report to the Architect / Owner in writing any refusal or failure of the Contractor to correct installations, practices and/or conditions in conflict with the specifications and/or manufacturer's recommended guidelines called to the Contractor's attention.
4. It will be the sole responsibility of each bidder to ensure these conditions are to be met by the roofing system manufacturer and/or their appointed representative prior to bidding.

1.04 MANUFACTURER QUALIFICATIONS

A. A qualified manufacturer that has been UL Listed and has FM Approvals for membrane roofing system similar to that used in this project for a minimum of fifteen (15) years.

B. The roofing membrane manufacturer is defined as a company which makes the primary roofing membrane and flashing membrane in its own factories from ruder, rawer states of material. No "Private Label" roofing membrane or flashing membrane material (in which one company's name goes on a product manufactured by others) is acceptable for this project.

C. Testing Laboratory Services: Test results shall meet or exceed established standards.

D. Underwriters Laboratory (Roofing Covering): Class A fire hazard classification.

E. Comply with governing local, state, and federal regulations, safety standards, and codes.

1.05 REFERENCES (INCLUDING LATEST REVISIONS)

A. American Society for Testing and Materials:

1.	ASTM B 209	Specification for Aluminum and Aluminum Alloy Sheet and Plate
2.	ASTM C 719	Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cycle Movement (Hockman Cycle)
3.	ASTM C 794	Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
4.	ASTM C 920	Specification for Elastomeric Joint Sealants
5.	ASTM D 312	Specification for Asphalt Used in Roofing
6.	ASTM D 1863	Specification for Mineral Aggregate Used on Built-up Roofs
7.	ASTM D 2178	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
8.	ASTM D 2824	Specification for Aluminum - Pigmented Asphalt Roof Coatings
9.	ASTM D 4586	Specification for Asphalt Roof Cement, Asbestos Free
10.	ASTM A 361	Sheet Steel, Zinc-Coated (Galv.) by the Hot-Dip Process for Roofing and Siding
11.	ASTM C 177	Test for Thermal Laboratory Services
12.	ASTM C 728	Perlite Thermal Insulation Board

B. Federal Specifications:
1. LLL-I-535B
2. SS-A-701B
3. SS-C-153
4. SS-C-153C
5. SS-R-620B
6. TT-C-498C
7. TT-P-320D
8. TT-S-00227E
9. TT-S-00230C
10. SS-S-001534 (GSA-FSS)
11. L-P-375

C. Industry Standards:
1. The National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual

2. Single-ply Roofing Institute (SPRI) - A Professional Guide to Specifications Manual
3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - Architectural Sheet Metal Manual
4. American Society of Civil Engineers – ASCE 7

1.06 SUBMITTALS

A. Samples and Manufacturer's Submittals: Submit prior to delivery or installation.
1. Samples of all roofing system components including all specified accessories.
2. Submit samples of warranty that is to be issued as specified, upon project completion, complete with any addenda necessary to meet the warranty requirements as specified.
3. Submit Copy of manufacturer's warranty application submitted to manufacturer.
4. Submit latest edition of manufacturer's specifications and installation procedures. Submit only those items applicable to this project.
5. A written statement from the roofing materials manufacturer approving the installer, the project's specified warranty, receipt of contractor's warranty application, specifications, and drawings as described and/or shown for this project and stating the intent to guarantee the completed project.
6. Manufacturer's Equiviscous Temperatures (EVT) for the specified bitumen's.

B. Shop Drawings: Provide manufacturer's approved details of all perimeter conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.

C. Detailed project sequencing, staging, material loading, manpower plans, and detailed project construction schedule for approval.

D. Maintenance Procedures: Within ten days of the date of Substantial Completion of the project, deliver to the Owner three copies of the manufacturer's printed instructions regarding care and maintenance of the roof.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

B. Deliver materials requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.

C. Deliver materials in sufficient quantity to allow continuity of work.

D. Handle and store material and equipment in such a manner as to avoid damage. Liquid products shall be delivered sealed, in original containers.

E. Handle rolled goods so as to prevent damage to edge or ends.

F. Select and operate material handling equipment so as not to damage existing construction or applied roofing.

G. Moisture-sensitive products shall be maintained in dry storage areas and properly covered. Provide continuous protection of materials against wetting and moisture absorption. Store roofing and flashing materials on clean raised platforms with weather protective covering when stored outdoors.

H. Store rolled goods on end.

I. Protect materials against damage by construction traffic.

J. The proper storage of materials is the sole responsibility of the contractor and any wet or damaged roofing materials shall be discarded, removed from the project site, and replaced prior to application.

K. Comply with fire and safety regulations, especially with materials which are extremely flammable and/or toxic. Use safety precautions indicated on labels.

L. Products liable, such as emulsions, to degrade as a result of being frozen shall be maintained above 40° F in heated storage.

M. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day.

1.08 SITE CONDITIONS

A. Job Condition Requirements:
1. Apply roofing in dry weather.
2. Do not apply roofing when ambient temperature is below 45° F.
3. Coordinate the work of the contractor with the work to be performed by the Owner's personnel, to ensure proper sequencing of the entire work. The Owner's personnel will be erecting interior protection for equipment, if required. The contractor is to schedule his work so that adequate time is allowed for the Owner’s personnel to perform the work. No roof work shall be performed until the Owner’s personnel have completed erection of the interior protection in that area.
4. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with specifications.
5. Schedule the work so the building will be left watertight at the end of each day. Do not remove more roofing material than can be reinstalled in any working day.
6. All surfaces to receive new roofing shall be smooth, dry, and free from dirt, debris, and foreign material before any of this work is installed. Competent operators shall be in attendance at all times equipment is in use. Materials shall be stored neatly in areas designated by the Owner. Load placed on the roof at any point shall not exceed the safe load for which the roof is designed.
7. The contractor shall take all necessary precautions to protect the roof mat and deck from damage. The contractor shall be responsible for repairing all new areas of damage caused by the negligence of the contractor, at the contractor's expense. The Owner's on-site representative shall determine damage caused by contractor negligence.
8. The contractor shall follow local, state, and federal regulations, safety standards, and codes for the removal, handling, and disposal of asbestos containing materials, if present. When a conflict exists, use the stricter document.
9. Follow insurance underwriter's requirements acceptable for use with specified products or systems.
10. Due caution should be exercised so as not to alter the structural integrity of the deck. When cutting through any deck, care should be taken so as not to damage the deck or any part of the deck, such as post tension cables, etc.
11. All kettles shall have an automatic thermostat control, and temperature gauge, all in working order.
12. The contractor is to verify the location of all interior ducts, electrical lines, piping, conduit, and/or similar obstructions. The contractor is to perform all work in such a manner as to avoid contact with the above-mentioned items.

13. Surface and air temperatures should be a minimum 45° F during applications of cleaner and waterproof coating and remain above 45° F for a minimum of four (4) hours following applications. Verify compatibility of cleaner with coatings, paints, primers and joint sealers specified. Advise Owner's representative of any problems in this regard prior to commencing cleaning operations.
14. Temporary Sanitary Facilities: The contractor shall furnish and maintain temporary sanitary facilities for employees use during this project. These will be removed after the completion of the project. All portable facilities shall comply with local laws, codes, and regulations.

B. Protection of Work and Property:
1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. He shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations pertaining to asbestos as required shall be fulfilled by the contractor as part of his proposal.
2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the work of this contract. Examples of two categories or degrees of protection are generally as follows: a) removal, protection, preservation, or replacement and replanting of plant materials; b) protection of plant materials in place, and replacement of any damage resulting from the contractor's operations.
3. Twenty-four Hour Call: The contractor shall have personnel on call 24 hours per day, seven (7) days per week for emergencies during the course of a job. The Owner's Project Manager is to have the 24 hour numbers for the contact. Contractor must be able to respond to any emergency call and have personnel on-site within two (2) hours after contact. Numbers available to the Owner's Project Manager are to be home, mobile, and office numbers for:
   a) Job Foreman
   b) Job Superintendent
   c) Owner or Company Officer

C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds must be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.

D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.

E. Use of Premises:
1. The contractor is advised that the Owner will occupy the building at all times, and the contractor must provide all safeguards required to protect personnel and to keep noise levels as low as reasonably possible for each operation.
2. The contractor shall:
   a) Coordinate work in such a manner as to not interfere with the normal operation of the building.
   b) Assume full responsibility for protection and safekeeping of products stored on premises.
   c) Agree to hold the Owner harmless in any and all liability of every nature and description which may be suffered through bodily injuries, including death of any persons by reason of negligence of the contractor, agents, employees, or subcontractors.

F. Cleaning and Disposal of Materials:
1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.
2. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust. A suitable scrap chute or hoist must be used to lower any debris. At completion, all work areas shall be left broom clean and all contractor's equipment and materials removed from the site.
3. All bituminous or roofing related materials shall be removed from ladders, stairs, railings, and similar parts of the building.
4. Debris shall be deposited at an approved disposal site.

1.09 WARRANTY

A. Twenty (20) Year NDL Warranty: The completed roofing system shall be guaranteed for a minimum of twenty (20) years from the date of Substantial Completion for this project. Guarantee responsibilities shall be as follows:
1. Roofing contractor shall guarantee the entire roofing system for a period of two (2) years from the date of Substantial Completion as stated on the "Certificate of Substantial Completion" issued by the Architect/Engineer/Consultant.
2. The materials manufacturer shall guarantee the roofing system as supplied by system manufacturer for a total period of twenty (20) years from the date of substantial completion.
3. Membrane manufacturer shall provide the written warranty as specified.
4. The roofing system shall be guaranteed to be watertight and against any failures of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.
5. Warranty repairs shall be performed by a certified installer. The repairs shall be performed in accordance with the manufacturer's written instructions and recommended procedures so as to not void the warranty.

B. During the proposal period each Contractor shall make arrangements with the materials manufacturer to provide the required warranty. Refer to SUBMITTALS paragraph in this section for requirements concerning submittals of warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. Compatibility: Provide materials that are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

B. Materials herein specified shall be supplied or approved in writing by the manufacturer issuing the warranty.

C. The white polyester reinforced fleece backed adhered PVC with Elvaloy® KEE roofing system shall only be applied by manufacturer approved and trained roofing contractors.

D. The manufacturer shall have 15 years UL listing for the specified membrane to be used on the project. Membrane manufacturer shall have a minimum of 15 years FM approval, and 15 years manufacturing experience with the roofing membrane specified for this project.

E. All roofing and roof accessories shall be installed in compliance with manufacturer's current specifications and details.

F. All materials used on the project shall be asbestos free.

2.02 ROOFING MEMBRANE

A. Field roof membrane shall be a white polyester reinforced fleece-backed PVC with Elvaloy® KEE membrane.

B. Membrane shall have the following minimum physical property values:

Property	Test Method	Specification
Color		White
Thickness	ASTM D751	.067”
Thickness over scrim	ASTM D7635	.030"
Breaking Strength (lbf)	ASTM D751	325 x 324
Tear Strength (lbf)	ASTM D751	89 x 109
Seam Strength (lbf)	ASTM D751	295
Elongation	ASTM D751	50% x 42%
Heat Aging	ASTM D3045	> 90 %
Low Temp. Bend	ASTM D2136	Pass (-40°F)
Static Puncture Resistance	ASTM D5602	Pass
Dynamic Puncture Resistance	ASTM D5635	Pass
Permeance	ASTM E96	0.003 Perms
Dimensional Stability	ASTM D1204	0.3%
Weight change after Water Immersion	ASTM D570	1.20%
Accelerated Weathering	ASTM G155	Pass
Fungi Resistance	ASTM G21	No Growth
Solar Reflectivity	ASTM C1549	82% (White)
	ASTM C1549	69% (Gray)
	ASTM C1549	68% (Tan)
Emissivity	ASTM C1371	.91 (White)
	ASTM C1371	.86 (Gray)
	ASTM C1371	.87 (Tan)
SRI	ASTM E1980	109 (White)
	ASTM E1980	83 (Gray)
	ASTM E1980	83 (Tan)

2.03 FLASHING MEMBRANE

A. The flashing membrane shall be a white PVC with Elvaloy® KEEpolyester reinforced flexible sheet.

Property	Test Procedure	Physical Properties
Color		White
Thickness	ASTM D 751	60 mil Nominal
Breaking Strength	ASTM D 751	298 x 278 lbf
Seam Strength	ASTM D 751	286 lbf
Tear Strength	ASTM D 751	89 x 109 lbf
Elongation	ASTM D 751	35% x 34%
Heat Aging	ASTM D 3045	>90%
Static Puncture Resistance	ASTM D 5602	Pass
Dynamic Puncture Resistance	ASTM D 5635	Pass
Low Temperature Bend	ASTM D 2136	Pass @ -40°F
Permeance	ASTM E 96	0.003 Perms
Dimensional Stability	ASTM D 1204	0.3%
Wt. Change after Immersion	ASTM D 570	1.20%
Accelerated Weathering	ASTM G 155	Pass
Fungi Resistance	ASTM G 21	Pass
Solar Reflectivity	ASTM C 1549	0.82
Solar Emissivity	ASTM C 1371	0.91
Solar Reflectance Index (SRI)	ASTM E 1980	109
Underwriters Laboratory		Class A
Factory Mutual		Class 1-90

2.04 NON-REINFORCED MEMBRANE

A. The non-reinforced membrane shall have the following minimum properties.
   1. Description: Non-reinforced thermoplastic white membrane, thickness approximately 45 mils.
   2. Use: Inside/outside corners, multiangled intersections, sealant pockets and other conditions where molding of the membrane is required.

2.05 BITUMEN

A. Shall be ASTM D 312 Type IV steep asphalt.

Slope	Interply	Cap Ply	Backnail	Strap
0 - ½" per 12"	Type IV	Type IV	No	No
½" - 2" per 12"	Type IV	Type IV	Yes	Strap if Possible
2" - 3" per 12"	Type IV	Type IV	Yes	Yes

2.06 CAULKS

A. Sealant for use at coping joints, reglet joints, etc., shall be a one-component urethane non-sag, gun grade sealant designed for use in active exterior joints, and shall meet or exceed Federal Specification No. 1 TT-S-00230C, Type II, Class A, ASTM C 920. Where joint surfaces are contained or are contaminated with bituminous materials, provide manufacturer's modified-type sealant (modified with coal-tar or asphalt as required), or approved equal.

B. To seal the leading edge of the membrane, to bond membrane at terminations with metal, and for open seam repair, sealant shall be a thermosetting, solvent free, non-slump, self-fixturing, multipurpose structural sealant which shall meet the following physical and performance properties, M-1 as manufactured by Chem Link Inc., or approved equal.

Properties	
Specific Gravity	1.62 (13.5 lbs./gallon)
Viscosity	800,000 cps Brookfield RTV, TF spindle, 4 rpm 70° F.
Shear Strength (ASTM D-1002)	300 psi+ (7 day ambient cure)
Elongation @ break (ASTM D-412)	300% (7 day ambient cure)
Hardness Shore A (ASTM C-661)	50 – 55 (14 day ambient cure)
Tack free time (ASTM C-679)	35 minutes
Low temperature flex	Minus 20° F: PASS
Slump (sag) (ASTM C-639)	Zero slump
Shrinkage (ASTM D-2453)	No measurable shrinkage (14 cay cure)
Service temperature	-40° F to 200° F

C. Polyether sealant: The joint sealant shall be a 100% solid, one-component, gun grade, non sag, polyether-base material. It shall be applicable for use at Kynar 500 coated metal, in, vertical, and overhead joints. The sealant shall cure under the influence of atmospheric moisture to form an elastomeric joint material. Materials shall comply to: ASTM C920, Type S, Grade NS, Class 50, Use T2, NT, M, A, G, and O; Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N, No. 81026; DuraLink as manufactured by Chem Link, Inc., or approved equal.

Properties	Results	Test Methods
Tensile strength, psi	250-300	ASTM D412
Peal strength, psi	25-30	ASTM C794
Elongation at break, %	750-800	ASTM D412
Hardness, Shore A	17-23	ASTM C661
Lap shear Strength, psi	150-175	ASTM D1002
Low temp. flexibility	Pass-10°F (-23°C) 1/4inch mandrel	ASTM D816
Service Temperature	-40°F to 200°F (-40°C to 93°C)	

2.07 UNDERLAYMENT PLIES

A. Shall be Underwriters Laboratory approved and listed in the FM Global Approval Guide.

B. Shall be SBS 80 mil SS base sheet, tested in accordance with ASTM D 5147, as approved by field membrane manufacturer, or approved equal.

2.08 INSULATION

A. All insulation shall be approved in writing by the membrane manufacturer as to thickness, type, and manufacturer. All insulation must be approved for the specific application, Underwriters Laboratory approved, and be listed in the FM Global Approval Guide.

B. Polyisocyanurate Roof Insulation: Insulation shall be two layers of rigid polyisocyanurate foam board; thickness and LTTR-value shall be a minimum of 25.0; meeting Federal Specification No. HH-I-1972/1 or 2 with 20 psi minimum compressive strength and 2.0 pcf minimum density. Board shall be surfaced on two (2) sides with non-asphaltic facer material. No single layer shall be less than 1.5” thick or greater than 2.7” thick.

C. Tapered Polyisocyanurate Roof Insulation: Shall be tapered polyisocyanurate board per Federal Specification No. HH-I-1972/1 or 2, with a 20 psi minimum compressive strength and 2.0 pcf density minimum. Insulation shall be of thickness required for one-half inch (1/2") slope per foot to roof drains as shown on drawings. Insulation shall be surfaced on two (2) sides with a non-asphaltic facer material.

D. Cover Board: Impact-resistant, nonstructural, specially engineered gypsum and cellulose fiber panels with 95% recycled content; uniform water-resistance throughout core and surface. Board size four feet by eight feet (4' x 8'), thickness 1/2"; conforming to ASTM C 1278, meeting FM 4470 Class 1 criteria, classified by Underwriters Laboratory, and listed in the FM Global Approval Guide. Board will meet the following physical properties, Securock™ Roof Board, as manufactured by USG Corporation, or approved equal.

Test	Typical Value	Test Method
Fire Resistance	Class A	UL 790
Permeance	≤ 30	ASTM C473
Surface water absorption	≤ 1.6 nominal grams	ASTM C473
Water resistance	Maximum 10% weight percentage gain	
Mold Resistance	Minimum rating of "10"	ASTM D3273

2.09 FASTENERS AND PLATES

A. General: All fasteners and plates for the installation of insulation, and for the installation of the membrane, shall be supplied and warranted by the membrane manufacturer for the specific application.

B. Membrane attachment toggles, if required, shall be provided and warranted by the membrane manufacturer.

C. All fasteners and plates shall be FM Global approved corrosion resistant screws or anchors supplied and warranted by the membrane manufacturer. Fasteners shall be of a type and length recommended by the manufacturer for fastening the insulation and/or protection layer (through the existing roof in reroofing) to the structural roof deck.

2.10 FASTENERS

A. Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide, and be as recommended by the fastener manufacturer for the specific application.

B. Fastener for Brick: Shall be one-fourth inch by two inches (1/4" x 2"), zinc with plated steel or stainless steel nail, one piece unit, flat head, as manufactured by Rawl Zamac Nailin, or approved equal.

C. Fastener for Steel Deck: Shall be a #14 fastener, fluorocarbon coated, with CR-10 coating. A minimum .200 diameter shank and .250 diameter thread. To be used with round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to thirty (30) Kesternich cycles (DIN 50018) shows less than ten percent (10%) red rust which surpasses FM Global Approval Standard 4470, as manufactured by Olympic Manufacturing Group, Inc., or approved equal. Fasteners, plates, and/or bars shall be listed in the FM Global Approval Guide.

2.11 BONDING ADHESIVE FOR FLASHING

A. Description: Adhesive is a bonding cement of synthetic rubber for adhering membranes to various substrates, produced by Ashland Chemical, or approved equal.

Typical Liquid Properties (Room Temperature)	
Color	Amber/Yellow
Base Product	Neoprene
Solids	25%
Specific Gravity	.87
Pounds/Gallon	7.25
Viscosity (CPS)	2500
Solvents	Ketone, Toluene, Aliphatic Hydrocarbon, Zylene
Estimated Coverage	
2 Sided Application	55/70 sq. ft. (2/2.5 mils dry)
DOT Label Required	Flammable Liquid
Code - 584661	

B. Handling: Contains ingredients which could be harmful if mishandled. Contact with skin and eyes should be avoided and necessary protective equipment and clothing should be worn.

2.12 ASPHALT ROOF PRIMER

A. Quick-dry asphalt-based primer for priming of asphalt roof surfaces.

Applicable Federal Specification	SS-A-701B
ASTM	D 41
Flash Point	105° F
Viscosity at 80° F (ASTM D 217)	50-60 K.U.
Weight per gallon	7.4 pounds
Drying time (to touch)	Min. 4 hours

2.13 CANT STRIP

A. Shall be wood fiber where used for non-structural purposes. Shall be treated solid wood where used for structural purposes meeting NRCA, FM Global and Underwriters Laboratory guidelines. If solid wood cant is used where insulation exists, cant is to be toe nailed into treated solid wood nailer the same height as insulation.

2.14 WOOD

A. All nailers, cants and wooden curbs shall be fire rated, treated lumber as required by NRCA, FM Global and Underwriters Laboratory guidelines.

2.15 TRIM STRIP

A. The trim strip shall have the following minimum properties.

1. Six inch (6") wide non-reinforced 45 mil thermoplastic used for capping butted ends of rolls.
2. The trim strip is seamed with the use of hot-air welding.

2.16 PIPE BANDS

A. Stainless steel bands with self-locking heads.

B. Tighten with hand tool for tension control and flush cut off.

2.17 PITCH PAN SEALANT

A. Shall be one-part, self-leveling polyurethane sealant meeting Federal Specification No. TT-S-00230C, Type I, Class A, ASTM C 920, Type S, Grade P, Class 25, for use in new pitch pans.

2.18 PIPESTANDS (6" OR SMALLER - LESS THAN 9" OFF ROOF SURFACE)

A. Black, polycarbonate construction with stainless steel roller pin assembly suitable for gas lines and conduit set in finished roof assemblies, Model No. 24R, sized accordingly, as manufactured by Miro Industries, Inc.

2.19 WALKWAY PAD

A. The walkway pad shall have the following minimum physical properties, and be applied with edges heat or solvent welded.

Property	Test Procedure	Physical Properties
Color		Gray
Size		36" wide x 60' long
Thickness	ASTM D 638	.080" nominal
Reinforcement		1000 Denier Polyester
Tear Strength	ASTM D 751	210 X 200 lbf
Puncture Resistance		96 lbs
Cold Resistance	ASTM D 1043	-40° C
Shore A Durometer		85
Hydrostatic Resistance		400 psi
Dimensional Stability	ASTM D 1240	≤ 1%
Ultraviolet Stability		12,000 hrs. Excellent

2.20 TERMINATION/PRESSURE BARS

A. Aluminum strip shall be extruded channel bar with a mill finish, width one inch (1"), thickness 0.100" ± .008", leg height one-fourth inch (1/4") top and bottom, leg angle ninety degrees (90°), for perimeter and curb anchorage, having predrilled holes six inches (6") on center, as manufactured by Olympic Fasteners, or approved equal.

2.21 T- JOINT COVERS

A. Supplied by the membrane manufacturer as a secondary covering to all T – Joints in the installation of thermoplastic roof systems consisting of waterproofing coverings equal to or greater than 60 mils in thickness.

2.22 VERTICAL WALL SHIMMING MATERIAL

A. Shall be one of the following unless otherwise accepted by Owner's representative: OSB, exterior grade plywood, gypsum core board or concrete core board. Proper selection of material is required to achieve FM Global and UL guidelines.

2.23 SELF-ADHERING UNDERLAYMENT FOR TEMPORARY WATERPROOFING

A. A premium heavyweight, minimum 60 mil, self-adhering underlayment, to use as a temporary waterproofing barrier.

2.24 OVERNIGHT SEAL

A. Temporary night in accordance to the manufacturers and the NRCA recommendations shall be provided for the purpose of night sealing the roof system.

2.25 DELIVERY AND STORAGE

A. All materials shall be delivered with appropriate carton and can labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

2.26 PRECAUTIONS

A. Some of the indicated materials are extremely flammable and/or toxic. Use precautions indicated on can and carton labels.

2.27 MISCELLANEOUS MATERIALS

A. Other materials shall be as specified or of the best grade for the proposed use as recommended by the manufacturer.

PART 3 - EXECUTION

3.01 REFERENCE

A. The manufacturer's Technical Specifications shall be considered a part of this specification and should be referred to for more specific application procedures and recommendations.

B. Application of materials shall be in strict accordance with the manufacturer's recommendations except where more stringent requirements are shown or specified. In the instance of a conflict between these specifications and those of the manufacturer, the more stringent specifications shall take precedence.

C. General Installation:
1. Protect adjacent areas with tarpaulin or other durable materials.
2. Contractor shall prevent overspray and be responsible for parking lot areas and/or adjoining areas not part of this contract.
3. Contractor shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e. pitch dams, envelopes, and filler strips.
4. Prepare surfaces according to manufacturer's or applicator's published instructions. All metal that is to receive bitumen, or come in contact with bitumen or adhesive, shall be first primed with appropriate primer. Any prefinished sheet steel that is to receive bitumen, or come in contact with bitumen or adhesive, shall be scored, scuffed or abraded prior to receiving primer.
5. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
6. All surfaces/substrates shall be clean and dry prior to application of materials.
7. Prior to application of felts and membrane, all foreign matter, gravel, etc., shall be removed from the insulation and/or substrate. Gravel or debris between the insulation/substrate and plies is not acceptable.
8. Bitumen kettle shall have a visible thermometer and thermostatic control or some other means to provide positive monitoring of the bitumen temperature when it is heated in accordance with manufacturer's instructions.
9. Ambient temperature shall be 45° F and rising.
10. The maximum heating temperature of Type IV asphalt shall be 500° F.
11. The temperature of Type IV asphalt shall be approximately 430° F ± at the point of application or as recommended by the membrane manufacturer.

12. Maintain kettle and/or tanker temperature at least 25° F below the actual flash point of the bituminous materials used.
13. Never heat the bituminous materials at high temperatures for prolonged periods of time.
14. Do not allow bituminous materials to stand in luggers for long periods.
15. Circulate bituminous materials.
16. Insulate hot transport lines if required.
17. Wrinkles, buckles, kinks, and fishmouths are not acceptable when laying membrane.
18. Where deteriorated base flashing is removed, primed cant strips shall be installed at the intersection of the deck and the vertical surfaces. All flashings shall be mechanically top-fastened with a termination bar a minimum of six inches (6") on center at the top leading edge,and be a minimum of eight inches (8") in height from finished membrane.
19. Provide a water test of each roof section prior to substantial completion. The test should simulate rainfall of one inch (1") per hour minimum.
20. On slopes greater than one inch (1") in twelve inches (12"), refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.

3.02 SUBSTRATE PREPARATION

A. New Construction: Substrate shall be smooth and free of debris, sharp edges, and other surface irregularities prior to work starting. Substrate repair shall be performed as required to minimum of NRCA standards.

B. Metal Decks – New Construction:
1. All loose rust, bitumen, or other foreign material shall be removed from the deck before applying asphalt primer at the minimal rate of one and one-half (1-1/2) gallons per one hundred (100) square feet of area.
2. The deck span shall not exceed that recommended by FM Global Bulletin 1-28.
3. Expansion/control joints shall be installed so that no one area exceeds two hundred feet by two hundred feet (200' x 200').

3.03 INSULATION

A. Manufacturer's Instructions: In regard to attachment, the manufacturer's instructions or specifications shall determine the suitability for an application. Installation must meet ASCE 7 criteria and meet local governing building codes.

B. Precautions: The surface of the insulation must not be ruptured due to overdriving of fasteners.

C. Thermal insulation boards shall be laid on the substrate in parallel rows with end joints staggered and butted as close as possible. All joints shall be tight and at the roof perimeter and roof penetrations, insulation shall be cut neatly and fitted to reduce openings to a minimum. All openings one-fourth inch (1/4") or larger shall be filled with insulation.

D. Insulation shall be tapered or feathered at drains and scuppers to provide proper drainage (if applicable).

E. No more insulation shall be installed than can be covered by the completed roof system by the end of the day or the onset of inclement weather.

F. Tapered insulation and crickets, when specified, shall be placed in accordance with the drawings and/or as required to minimum of NRCA standards.

3.04 MECHANICALLY FASTENED INSULATION

A. Specified insulation shall be mechanically fastened to conform to the ASCE 7 criteria for wind uplift as dictated by wind zone applicable to location of project. Fasteners and fastening patterns shall be determined by building height, location and geographical area of the United States. It is the contractor's responsibility to consult current publications, literature, and bulletins of IBC and the manufacturer that are in effect at the time of this project. Boards shall be staggered and butted as close as possible with voids over one-fourth inch (1/4") to be filled.

B. The two thermal Insulation layers shall be loose-laid with edges parallel to flutes and bearing on deck surface/flats. The long dimension of base insulation layer must be fully supported by the top flange of the metal deck. The edges of insulation boards must not cantilever over the flutes of the metal deck. and shall be applied using offset joints, so that each layer breaks joints to a minimum of twenty-four inches (24") both ways with the preceding layer, and immediately walked in place.

C. The top surface of the second layer of insulation shall be covered with specified cover board using offset joints, so that each layer breaks joints to a minimum of twenty-four inches (24") both ways with the preceding layer, and mechanically fastened to conform to the ASCE 7 criteria for wind uplift as dictated by wind zone applicable to location of project. It is the contractor's responsibility to consult current publications, literature, and bulletins of IBC and the manufacturer that are in effect at the time of this project.

3.05 NAILERS

A. Wooden nailers shall be installed at gravel stops, drip edges, and expansion joints on outside perimeter of building according to NRCA, Underwriters Laboratory and IBC guidelines.

B. All Construction: Nailers shall be the same height as the new recovery board being installed where required. Nailers shall be raised if necessary by anchoring an additional nailer of appropriate height to the existing nailer if the existing nailer is not to be replaced. Nailers shall be anchored to resist a pull-out force of one hundred seventy-five pounds (175#) per foot. Fasteners shall be no less than two (2) per nailer, and be spaced at three feet (3') on center maximum. Expansion joint nailers shall extend upward a minimum of eight inches (8") above finish roof height.

3.06 WOOD CANTS

A. Toe of cant shall be level with the surface to receive new roof membrane and in all cases anchored according to NRCA, Underwriters Laboratory and IBC guidelines.

3.07 APPLICATION OF BASE PLY SHEET

A. The cover Board shall be covered with specified SBS 80 mil SS base sheet adhered as follows:

Base sheet shall be solid mopped at the nominal rate of thirty pounds (30#) ± 20 percent per one hundred (100) square feet using asphalt Type IV as required by slope, properly heated. Membrane shall be applied in accordance with the manufacturer's recommendations and in accordance with general practices as set forth by the NRCA Roofing Manual.

1. (Note: Base sheet shall not be left exposed to the elements for more than 3 days, or the top ply must be glazed coated with a solid mopping of Type IV asphalt at the nominal rate of thirty pounds (30#) per one hundred (100) square feet.

3.08 HOT APPLIED FLEECE BACKED MEMBRANE

A. Adhered Application: Adhere membrane to acceptable substrate with hot asphalt applied at the rate specified by the manufacturer.

1. The roof surface must be clean, dry and free of foreign material.
2. Position sheets as indicated on approved shop drawings.
3. Fold one end of the PVC with KEE Elvaloy® membrane sheet on top of itself until both ends meet. Apply hot asphalt to the prepared roof surface. The sheet can then be pulled and laid into the bonding material using care not to create any wrinkles.
4. Carefully push into place from fold line to overlap, avoiding wrinkles and air pockets. Roll or broom membrane flat.
5. Repeat procedure for other sheet half.
6. Lap seams shall be done by lapping the two inch (2") selvedge edge over the non-selvedge edge of the previous roll. The selvedge edge seam shall be made with the heat gun method.
7. Roll ends are butted together and capped with a minimum six inch (6") wide trim strip. The trim strip is then seamed with the heat gun.
8. T-Joint covers are required over all t joints on installations of thermoplastic roofing membranes equal too or greater than 60 mils in thickness. Center T-Joint cover over the t-joint and completely hot air weld the cover to the field membrane.

B. Lap Seaming Procedure: Overlap membrane for attachment method specified and hot-air welded with manufacturer's approved equipment.
1. All surfaces to be weld shall be clean, dry and free of foreign material.
2. All seams must then be checked with a needle probe and any voids repaired with the heat gun.

C. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize manufacturer's recommended application techniques, apply the specified materials (i.e. primary and secondary components and accessories, etc.) and exercise care in ensuring that the finished application is undamaged, free of cuts, tears, deformities, etc. and acceptable to the Architect/Engineer/Consultant/Owner.

3.09 FLASHING

A. Flash all penetrations, metal edge systems, walls, curbs, expansion joints, drains as shown on details and approved shop drawings with white reinforced PVC with KEE Elvaloy® flashing membrane.
1. Use prefabricated flashing accessories or components such as sealant pockets.
2. Mechanically fasten flashing at terminations according to approved details.
3. All membrane flashings terminations shall be secured with termination bar. Fastening membrane flashing through metal counterflashing is not acceptable.

B. Any lumber or shimming required for attachment or to make material flashing flush or level with offsets and/or transitions shall be incorporated in the flashing specifications.

3.10 BASE FLASHING (APPROXIMATELY 8" IN HEIGHT MINIMUM)

A. Base flashings shall be installed using the flashing membrane, with length of run not to exceed twenty linear feet (20').

B. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck.

C. Cant strips shall be installed at the intersection of the deck and all vertical surfaces.

D. The roofing field membrane shall extend up over and two inches (2") above the top of cant strips at all vertical intersections or out to the roof's edge.

E. All existing substrates receiving flashing membrane shall be clean and primed with primer, prior to application as required.

F. All flashings shall be mechanically fastened with a termination bar a maximum of six inches (6") on center, be a maximum of eight inches (8") above finished roof height, extend a minimum of four inches (4") onto the field of horizontal roof membrane, and not exceed twenty linear feet (20') of run in length.

G. After proper termination of the base flashing at a minimum eight inch (8") height (or maximum eighteen inch (18") height), a reglet and/or counterflashing shall be installed as detailed according to NRCA and SMACNA guidelines.

H. All vertical flashing lap seams of the flashing membrane shall be hot-air welded.

I. All flashing membrane shall be adhered with flashing bonding adhesive to the vertical substrate and hot-air welded to the field of roof membrane; hot-air weld vertical laps.

J. Flashing laps shall be minimum two-inch (2") width, no maximum. Hot-air weld of flashing lap shall be minimum two-inch (2") width, no maximum.

K. Hot-Air Welding of Flashing Laps:
1. When using a hand-held hot-air welder, the seams should be pressed together using a hand-held roller. The speed and temperature settings of the welding equipment can be affected by the weather conditions at the site of application, therefore, these parameters should be set by trial and error using two (2) pieces of the flashing membrane. Minimum width of hot-air weld two inches (2"), no maximum.
2. Lay the laps together and apply pressure to the welded seam to ensure full adhesion.
3. Allow the seams to set fully, and probe the entire length for voids. Re-seam voids immediately with a hot-air gun and roller.

L. All hot-air welded seams/laps shall be tested daily with a probe for integrity, no variance.

3.11 VERTICAL WALL FLASHING (FOR USE APPROXIMATELY 8-18" ABOVE THE FINISHED ROOF LINE AND EXTENDING UPWARD)

A. Flashing membrane shall be installed on the vertical beginning a minimum of eight inches (8") above the finished roof line (where the base flashing is terminated), with length of run not to exceed twenty feet (20'). Flashing shall be installed in strict accordance with the manufacturer's recommendations.

B. A horizontal intermediate termination bar shall be used to on wall flashings greater than forty-eight (48”) inches and covered with at membrane flashing stripping ply hot air heat welded to the flashing membrane.

C. All existing substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.

D. All substrates receiving welded-seam flashing membrane shall be clean and primed with primer, prior to application when applicable.

E. The vertical wall flashing membrane shall be set in flashing bonding adhesive according to manufacturer's guidelines.

F. All vertical flashing lap seams of the flashing membrane shall be hot-air welded.

G. Flashing laps shall be minimum two inch (2") width, no maximum. Hot-air weld of flashing lap shall be minimum two inch (2") width, no maximum.

H. Immediately following the laying of the flashing membrane, it shall be pressed or rolled in the width direction of the membrane. This will prevent excessive entrapment of air beneath the membrane. The pressing or rolling shall be in the width direction and with the laps so as not to buck the laps.

I. Any flashing extending further than eighteen inches (18") up onto a vertical surface shall be installed using the strapped method and must be fastened with a termination bar or installed up and over the parapet wall and fastened to the nailer on the outside of the wall.

J. The flashing membrane shall be run up the wall in sheet widths, run under the coping cap and be terminated on the outside of the wall six inches (6") on center; then the coping cap shall be reset. All side laps are to be hot-air welded.

K. Hot-air Welding Laps:
1. When using a hand-held hot-air welder, the seams should be pressed together using a hand-held roller. The speed and temperature settings of the welding equipment can be affected by the weather conditions at the site of application, therefore, these parameters should be set by the contractor by using two (2) pieces of flashing membrane. Minimum width of hot-air weld shall be two inches (2").
2. Lay the laps together and apply pressure to the welded seam to ensure full adhesion.
3. Allow the seams to set fully, and probe the entire length for voids. Reseam voids immediately with a hot-air gun and roller.

L. All hot-air welded seams/laps shall be tested daily with a probe for integrity, no variance.

M. Any lumber or shimming required for attachment or to make material flashing flush or level with offsets and/or transitions shall be incorporated in the flashing specifications.

3.12 PERIMETER FASTENING

A. Wood nailers are required for perimeter gravel stops or drip edges. Field membrane and all plies shall be mechanically fastened to nailer on twelve inch (12") centers maximum.

3.13 EDGING FLASHINGS

A. An NRCA-approved gravel stop/fascia system shall be installed in strict accordance with published instructions to meet ES-1.

3.14 WALKWAY PADS

A. Adhere and heat weld walkway pads where shown on drawings or where required to provide protected pathways from rooftop access points to mechanical or other equipment requiring rooftop maintenance.

3.15 CLEANING

A. Clean exposed surfaces of excess cement, adhesive, sealants, mortar and paint associated with the new work.

B. Clean work area of excess roofing materials and installation debris daily.

C. Repair or replace defaced or disfigured finishes caused by the work.

3.16 MEMBRANE CLEANING

A. After all membrane has been installed, it shall be cleaned with a cleaning agent compatible with the membrane as recommended by the manufacturer to return the membrane to a “like new” appearance.

3.217 PROTECTION

A. Protect all building surfaces against damage from roofing work.

B. Where traffic must continue over finished, installed roofing system, protect membrane, underlayment accessories and finishes from damage.

3.18 MEMBRANE PROTECTION

A. Where equipment pads, wood sleepers, or walkway slabs are to be installed over the roofing membrane, an additional layer of the roofing membrane shall be installed between the roofing membrane and the pad, sleeper, or slab or as otherwise detailed. Due caution shall be exercised to prevent roofing membrane damage during placement. Where required, membrane shall be welded to field membrane to prevent slippage.

3.19 PIPING/CONDUIT

A. Piping/conduit shall be raised to NRCA recommended heights, and new supports furnished. Permanent supports shall be installed upon pads approved by membrane manufacturer. Coordinate work with Owner's representative.

B. All gas lines, piping, and conduits shall be coated with industrial grade yellow paint.

3.20 OVERNIGHT SEAL

A. Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual, SPRI and membrane manufacturer's recommended procedure.

B. The roofing membrane shall be sealed to the roof deck or existing roof at the end of the day or at the onset of inclement weather to prevent water from flowing into the completed roofing system. Temporary seals shall be removed upon resumption of work.

END OF SECTION

SECTION 07 62 00 - SHEET METAL AND MISCELLANEOUS ACCESSORIES FOR ADHERED MULTI-PLY ROOF SYSTEM

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SUMMARY

A. Section Includes:
   1. Provide flashing and sheet metal components for moisture protection.
   2. Related accessories.

1.02 SUBMITTALS

A. Product Data:
   1. Submit shop drawings, product data and mockups of all sheet metal.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers in satisfactory use in similar service for five (5) years. Use experienced installers. Deliver, handle and store materials in accordance with manufacturer's instructions.

B. Reference Standards: Applicable portions of ASCE, SMACNA, ASTM and NAAMM publications.

1.04 WARRANTIES

A. Manufacturer's Product Warranty: Submit manufacturer's standard limited product warranty signed by the manufacturer's authorized official, guaranteeing to correct failures in product which may occur during the warranty period, without reducing or otherwise limiting any other rights to correction which the Owner/Project Consultant may have under the contract documents. Failure is defined to include product failure which leads to interruption of a watertight installation. Correction may include repair or replacement of failed product.

B. Contractor's Warranty Period: For roofing flashing and sheet metal, provide a written warranty which shall warrant work to be free of leaks and defects in materials and workmanship for two (2) years, starting from date of substantial completion.

C. Defects of the sheet metal occurring during the warranty period shall be promptly corrected by the contractor, and defects of the roofing shall be promptly corrected by the manufacturer at no additional cost to the Owner. Upon notification from the Owner or the Owner's representative that evidence of a defect exists, the responsible party shall immediately inform the Owner's representative of the date on which corrective work will be scheduled, and shall notify the Owner's representative when the corrective work has been completed.

PART 2 - PRODUCTS

2.01 SHEET METAL MATERIAL

A. Hot-dipped Galvanized Steel for use as counterflashings (where not visible from the ground) and expansion joints: Minimum 24-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 525.

B. PVC with Elvaloy® KEE Cladded Metal for Pitch Pans: Shall be G-90 galvanized steel with 25 mil Elvaloy® membrane.

C. PVC with Elvaloy® KEE Cladded Metal: Shall be G-90 galvanized steel with 25 mil Elvaloy® membrane lamination; width shall be four feet (4'), length shall be eight feet (8') or ten feet (10').

D. Hot-dipped Galvanized Steel for use as continuous clips: Minimum 20-gauge, G-90, hot-dipped galvanized metal, commercial quality, ASTM A 525.

E. Prefinished Galvanized Sheet Steel (where visible from the ground): Shall be 24-gauge flat stock, prefinished with Kynar finish meeting ASTM A 446, forty-five and one-half inches to forty-eight inches width by one hundred twenty inches in length (45-1/2" - 48" x 120") for use as new metal edge gravel guard, downspouts, gutters, coping and miscellaneous metal.

F. Stainless Steel: QQ-S-766, Class 301, 302, 304, or 316; or ASTM A 167, Type 301, 302, 304, or 316; form and condition most suitable for the purpose.

G. Aluminum and Aluminum Alloy Plate and Sheet: QQ-A-250; form, alloy, and temper shall be that most suitable for the purpose.

H. Sheet Lead: QQ-L-201, Grade B.

I. All existing sheet metal shall be replaced with new metal of like gauge and type, or as specified on drawings.

J. All prefinished metal color shall be as selected by Owner/Architect from manufacturer's full range of colors, including metallics.

2.02 FASTENERS

A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.

B. Fasteners and fastening plates or bars shall be listed in the FM Global Approval Guide.

C. Fastener for Brick: Shall be one-fourth inch by two inches (1/4" x 2"), zinc with plated steel or stainless steel nail, one piece unit, flat head.

D. Screws: Self-taping sheet metal type with neoprene washer, as appropriate.

E. Pop Rivets: Full stainless steel Series 42 or 44, as appropriate.

F. Continuous Clip: Concealed hold-down clip type; of same materials as coping, gravel guard, sized to suit application. Use a continuous clip, minimum 20-gauge G-90 galvanized.

2.03 RELATED MATERIAL

A. Plastic Cement: FS SS-C-153, cutback asphalt type.

B. Solder: QQ-S-571 composition best suited for purpose; use high tin content, minimum 60/40, for stainless steel and monel alloy.

C. Solder: For use with galvanized steel or copper, provide 50-50 tin/lead solder (ASTM B 32), with rosin flux.

D. Copper, Sheet, and Strip: QQ-C-576, ASTM B 370, light cold-rolled temper, minimum 16 ounce.

E. Sealant (for Sheet Metal): One-component polyurethane, conforming to requirements of FS TT-S-230C, non-staining and non-bleeding.

F. Miscellaneous Materials:
1. Downspout Boots: Provide and install cast iron by Neenah Foundry Company, or pre-approved equal.
2. Splash Blocks: Concrete, 3000 psi, 28 days. Provide and install with protection pads at all downspouts. Dimensions shall be a minimum eighteen inches wide by thirty-six inches long (18" x 36").
3. Metal Accessories: Provide and install sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size, and gauge required for performance.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, substrates are smooth and clean and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed and secure.

C. Beginning of installation means acceptance of conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating work. Provide all shop drawings and mock-ups one month prior to installation to the Owner/Project Consultant for approval.

B. Install starter and edge strips and cleats before starting installation.

3.03 FABRICATION - GENERAL

A. Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer's instructions and recommendations. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels as indicated, with exposed edges folded back to form hems.

B. Fabricate gravel stops/fascia, gutters/downspouts, counterflashings, expansion joints, and copings with new galvanized sheet metal as specified. Fabricate gravel guard and fascia to size and dimensions as indicated on the drawings. Fabricate light metal coping, gutters and downspouts as indicated.

C. Fabricate pitch pans with PVC with Elvaloy® KEE cladded metal as specified.

D. Form sheet metal on bending brake.

E. Form materials with straight lines, sharp angles and smooth curves.

F. Fold back edges on concealed side of exposed edge to form hem (1/2" minimum).

G. Weld or solder joints on parts that are to be permanently and rigidly assembled.

H. Limit single-piece lengths to ten feet (10').

I. Fabricate corner pieces with eighteen inch (18") extensions, mitered and sealed by forming as one piece.

J. Where installing flashing directly to masonry or dissimilar materials, backpaint with bituminous paint

K. Install new metal rooftop projections. New rooftop projection details shall be as recommended in NRCA or SMACNA handbooks. All rooftop projections shall be cleaned, all joints sealed, and painted with a rust inhibitive paint.

L. All sheet metal shall be sealed and watertight.

M. Metal work should be secured so as to prevent damage from buckling or wind. Where clips are shown, these are to be continuous.

N. All metal to receive bitumen or adhesive shall be first primed with asphalt primer.

O. All prefinished metal shall be sanded and/or abraded prior to receiving primer.

P. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

Q. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.04 INSTALLATION

A. General: All sheet metal termination to vertical wall shall have a through-wall with receiver installed on masonry walls or prefabricated "Z" bar flashing pre-installed to fluid applied wall finished prior to installation of sheet metal termination. This applies to edge metal, base flashing closures and all vertical surface intersections. Refer to NRCA, SMACNA, and metal manufacturer's guidelines.

B. PVC with Elvaloy® KEE cladded metal shall be fabricated as needed; follow these specifications and standard sheet metal practice for attachment to roof details.

C. Coping:
1. Install new pre-manufactured metal coping for a permanent watertight installation.
2. All coping shall be pre-manufactured to include low profile standing metal seam and to meet ES-1 requirements.
3. Shall be minimum 24-gauge prefinished Kynar installed in ten foot (10') sections maximum.
4. Vertical fascia shall extend minimum two and one-half inches (2-1/2") or be minimum one and one-half inches (1-1/2") below bottom of nailer, whichever is greater.
5. Fabricate corner pieces with minimum eighteen inch (18"), maximum forty-eight inch (48") extensions, formed and sealed with rivets and sealant, as one piece.
6. Hem exposed edges one-fourth inch (1/4") minimum.
7. Provide and install continuous clip, minimum 22-gauge.
8. Shall be fabricated in accordance with published details.

D. Counterflashing:
1. Provide and install new metal counterflashing as required for a permanent watertight installation.
2. Saw cut brick mortar joint to receive friction fit reglet and removable counterflashing as detailed in SMACNA Figure 4-4E.

E. Primary Thru Wall Scupper, Overflow Scupper, Collector Head and Downspout:
1. Fabrication:
   a) Fabricate scuppers, collector head and downspout of profile and size indicated, taking care that the roof drain leader fits properly into the back of the collector head. Seal the pipe to the collector head for watertightness.
   b) Field measure site conditions prior to fabricating work.
   c) Fabricate with required connection pieces.
   d) Fabricate section square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance.
   e) Hem exposed edges of metal.
   f) Form and seal all metal joints; provide for expansion joints per SMACNA.
2. Installation:
   a) Install collector head, downspout, and accessories at primary thru wall scuppers only.
   b) Join lengths with seams pop riveted and sealed watertight. Flash and seal collector head to downspouts and accessories.
   c) Seal all metal joints watertight for full metal surface contact.
   d) Collector Head: SMACNA style profile; submit detail for approval.
   e) Downspouts: Rectangular profile. Seal all joints, six inches by six inches (4" x 6").
   f) Support Brackets, Joint Fasteners: Profiled to suit gutters and downspouts.
   g) Anchorage Devices: SMACNA requirements. Type recommended by fabricator.
   h) Collector Head Support: Kynar.
   i) Downspout Supports: Straps, Kynar.

F. Pitch Pans:
1. Install pitch pans of 24-gauge, G-90 galvanized steel with a 25 Mil PVC with Elvaloy® Kee membrane lamination according to NRCA standards, minimum of six inches by six inches (6" x 6"). Maximum of one (1) conduit or service line per pitch pan. For multiple service line penetrations provide pipe box detail or roof penetration housing as required by MEP.
2. Pitch pans shall be fabricated to a minimum of six inches (6") above the finished roof membrane. The top vertical edge of the thermoplastic clad metal must be folded over to conceal the uncoated side of the metal inside the pitch pan. The pitch pan flange must be a minimum of three and one half inches (3.5") wide in contact with the horizontal roof plain or field of roof membrane.
3. Approved caulking or water block shall be applied under the pitch pan flange prior to securing the flange to the deck with approved fasteners a minimum of 4" on center.
4. All projections enclosed in pitch pans shall be cleaned in any manner suitable and coated with a rust inhibitive coating as approved by the Owner/Project Consultant. Coating shall be allowed to dry prior to pitch pan fill.
5. Base of pitch pans shall be filled with grout or cementitious binder to proper height and allowed to cure.
6. Top finish fill shall be self-leveling, one-part urethane, with maximum fill to within three-eighths inch (3/8") of top of pitch pan sides.
7. Strip the thermoplastic clad metal flange of the pitch pan to the field membrane with one strip of flashing membrane. The flashing membrane must extend from the outer edge of the pitch pan flange onto the field membrane a minimum of three inches (3") and butt to the vertical sides of the pitch pan on all 4 sides. The flashing membrane shall be hot air welded to the thermoplastic clad metal pitch pan and to the field membrane. Hot air welds shall be a minimum of two inches (2") wide.
8. Install preformed outside corners by hot air welding in place at all four (4) corners of the pitch pan.
9. Apply seam sealer to the edges of the flashing membrane as required by manufacturer.

G. Bonnets/Hoods:
1. Fabricate and install above all pitch pans, where necessary, or reinstall as applicable, metal bonnets over all pitch pans, NO EXCEPTIONS.
2. Bonnets/Hoods shall be manufactured with metal compatible with metal to which bonnet is to be attached.
3. On beams and other steel, weld in place bonnets fabricated from one-fourth inch (1/4") steel plate.
4. Draw band bonnets fabricated from 22-gauge galvanized steel may be used on circular projections.

3.05 FINISH

A. Backpaint concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals. Exposed surfaces to be provided with a factory applied fluorocarbon Kynar finish meeting ASTM A 446 and AAMA specification 605.2 for high performance coating.

B. New 24-gauge hot-dipped galvanized metal shall be painted on all locations visible from the ground with an industrial grade paint as selected by Project Manager/Architect from manufacturer's full range of colors, including metallics. Galvanized metal surface must be properly prepared by removing all oil, grease, and/or protective mill coatings by solvent cleaning surface in accordance with SSPC-SP1, and according to paint manufacturer's recommendation, to ensure proper adhesion of paint to metal.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION REQUIREMENTS

A. Submittals: Product Data and color Samples.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.

B. Elastomeric Sealants: Comply with ASTM C 920.
   1. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, M, and O, with the additional capability to withstand [50 percent movement in both extension and compression for a total of 100 percent movement] [100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement]. Use for building expansion joints.
   2. Single-component, nonsag polysulfide sealant, Type S; Grade NS; Class 12-1/2; Uses NT, M, G, A, and O. For general exterior use.
   3. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. For general exterior use.
   4. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; and Uses NT, M, A, and O. For general exterior use.
   5. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. Use for exterior traffic-bearing joints, where slope precludes use of pourable sealant.
   6. Single-component, pourable urethane sealant, Type S; Grade P; Class 25; Uses T, M, G, A, and O. Use for exterior traffic-bearing joints.
   7. Single-component, mildew-resistant silicone sealant, Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide. Use for interior sealant joints in ceramic tile, stone, and other hard surfaces in kitchens and toilet rooms and around plumbing fixtures.

C. Latex Sealant: Single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834. For interior use only at perimeters of door and window frames.

D. Acoustical Sealant for Exposed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834. For interior use only at acoustical assemblies.

E. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound. For interior use only at acoustical assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 1193.

B. Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section “Wood Doors” for wood doors in hollow metal frames.
3. Division 08 Section "Door Hardware (Scheduled by Describing Products)" for door hardware for hollow metal doors and frames.
4. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.4 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Samples for Verification:

1. Samples are only required by request of the architect and for manufactures that are not current members of Steel Door Institute.
2. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
3. For the following items, prepared on Samples about 12 by 12 inches (305 by 305 mm) to demonstrate compliance with requirements for quality of materials and construction:

a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow metal panels and glazing if applicable.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Preinstallation Conference: Conduct conference at Project site for hollow metal frames requiring electrical knockout boxes to verify installation of conduit on frames.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with this section requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Steelcraft; an Ingersoll-Rand company.
5. No Substitution; only material from an SDI member will be allowed on the jobsite unless prior approval is given in accordance with substitution request requirements per General Requirements section.

2.2 MATERIALS

A. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 1 3/4" thick beveled and handed doors of design indicated, fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel

2. Core Construction: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

3. Vertical Edges for Single-Acting Doors: Beveled edge

   a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheets. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level A (Heavy Duty), 16 gage (0.053-inch - 1.3-mm-) thick steel faces, with threat side of door exceeding 14 gage (0.067-inch - 1.7-mm-) thick steel, Model 2 (Seamless face and edges).
2. Provide doors with 22 gage Z-Channels steel stiffeners placed at 6 inches apart with foamed in place polyurethane core.
3. Provide thermal insulation with calculated R factor of 11.01 per ASTM C518 Standards.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm-) thick steel, Model 2 (Seamless face and edges).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheets.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded joints and back weld joints continuously, unless otherwise indicated.
3. Frames for Level 3 Steel Doors: minimum 14 gauge 0.067-inch- (1.7-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 3 Steel Doors: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames 48-inches and wider in opening width are required to be minimum 14 gauge 0.067-inch- (1.7-mm-) thick steel sheet.

6. Frames for Wood Doors: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.
7. Frames for Borrowed Lights: minimum 16 gauge 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engauge stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches (0.4 mm) thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8

C. Hollow Metal Doors:

1. Exterior Doors:

    a. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Top of door to be flush and completely sealed joints in top edges of doors against water penetration.
    b. Provide Polyurethane core.

2. Glazed Lites: Factory cut openings in doors with applied flush trim to fit.
3. Astragals: Provide overlapping astragal as noted in door hardware sets in Division 8 Door Hardware on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 8 Door Hardware.
5. Seamless Edge: Provide seamless edge on hollow metal doors by intermittently tack welding seam, grinding smooth and finishing edge free from defects and blemishes.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Continuously backweld joints at exterior frames.
2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops required wider dimension on glass side of frame.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 42-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 8 Door Hardware.
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
7. Grout Guards: Weld guard boxes to frame at back of mortise hardware prep in frames at all hinge, strike and other recessed hardware preps regardless of grouting requirements.

8. Provide A60 Galvannealed coating at frames in restrooms with showers/Jacuzzi, clean areas such as surgery rooms and surgical suites, clean rooms, and soil rooms.

9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
10. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

11. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers as follows. Keep holes clear during construction. Silencers to be supplied by frame manufacture regardless if specified in division 8 Door Hardware.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricators shop

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that glazed lites are capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
5. Gap for butted or mitered joints in glass stop should not exceed .0625-inch.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.

e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. Field Supplied Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
7. Grouting Requirements:

a. Do not grout head of frames unless reinforcing has been installed in head of frame.
b. Do not grout vertical or horizontal closed mullion members.

8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

    a. Secure exterior removable stops with security head screws.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Solid-core doors and transom panels with wood-veneer, hardboard or MDF and decorative-laminate faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.

B. Related Sections:
1. Division 6 Section "Interior Architectural Woodwork" for requirements for veneers from the same flitches for both wood doors and wood paneling.
2. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
3. Division 8 Section "Glazing" for glass view panels in wood doors.

1.4 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.

3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For decorative-laminate door faces and factory-finished doors.

D. Samples for Verification:

1. As requested by the Architect for verification, provide factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

E. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain wood doors from single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.

c. Telegraphing of core construction and delamination of face in decorative laminate-faced doors.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION, GENERAL

A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

B. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide all fire-rated doors edge construction with intumescent seals concealed by outer stile (Category A). Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Mineral-Core Doors:

1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.2 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Graham.
2. Algoma Hardwoods.
3. Eggers Industries.
4. Marshfield Door Systems, Inc.
5. V-T Industries Inc.

B. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Select White Birch.
3. Cut: Rotary Cut.
4. Match between Veneer Leaves: Book match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.

7. Exposed Vertical Edges: Same species as faces.
8. Core: Particleboard type LD-2, Mineral core.
9. Construction: Five plies. Stiles and rails are bonded to core, and then entire unit abrasive planed before veneering.

2.3 LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

1. Blade Type: Vision-proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked-enamel- or powder-coated finish.

B. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked-enamel- or powder-coated finish.

C. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces on all four sides, including edges of cutouts, mortises and on top and bottom edges.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 33 00 - ROLLING SERVICE DOORS

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section Includes: Manual overhead rolling doors.
B. Related Sections:
   1. 05 50 00 Metal Fabrications. Door opening jamb and head members
   2. 06 10 00 Rough Carpentry. Door opening jamb and head members
   3. 08 31 00 Access Doors and Panels. Access doors
   4. 08 70 00 Hardware. Padlocks. Masterkeyed cylinder
   5. 09 91 00 Painting. Field painting
C. Products That May Be Supplied, But Are Not Installed Under This Section:
   1. Control Station

1.2 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Wind Loading:
      a. Doors to withstand up to [__] PSF design wind load
      b. Supply doors to be operational up to 20 PSF maximum wind load

   2. Cycle Life:
      a. Special construction for high-cycle use, and a life cycle expectancy of up to 100,000

1.3 SUBMITTALS

A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
   1. Product Data
   2. Shop Drawings
   3. Quality Assurance/Control Submittals:
      a. Provide proof of manufacturer ISO 9001:2015 registration
      b. Provide proof of manufacturer and installer qualifications - see 1.4 below
      c. Provide manufacturer's installation instructions

   4. If it is not the specified product, supply certificate of compliance to specification

5. Closeout Submittals:
   a. Operation and Maintenance Manual
   b. Document stating that installed materials comply with this specification
   c. Warranty documentation

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years' experience in producing doors of the type specified
   2. Installer Qualifications: Manufacturer's approval

1.5 DELIVERY STORAGE AND HANDLING

A. Reference Section 01 66 00 Product Storage and Handling Requirements
B. Follow manufacturer's instructions

1.6 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.
B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:
   Cookson: 1901 S. Litchfield Road, Goodyear, AZ 85338 Telephone: (800) 294-4358
B. Substitutions in accordance with Section 01 25 00.

2.2 PRODUCT INFORMATION

A. Model: ESD10, Refer to drawings for size(s).

2.3 MATERIALS

A. Curtain:
   1. Slats:
      a. Galvanized Steel: No. 5F (prefinished with GalvaNex™ Coating System), Grade 40 steel, ASTM A 653 galvanized steel zinc coating. Gauge as required to meet performance requirements.
   2. Finish:
      a. Powder Coat:
         1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
            a) SpectraShield color as selected by Architect from manufacturer's color range, more than 180 colors
            b) Custom color as selected by Architect
            c) AtmoShield textured environmental coating; color as selected by Architect.

B. Endlocks:
Alternate slats each secured with two ¼" (6.35 mm) rivets. Fabricate interlocking sections with high strength galvanized cast iron. Provide endlocks/windlocks as required to meet specified wind load.

C. Bottom Bar
1. Configuration:
   a. Extruded Aluminum (Standard to 21'4" opening width): Extruded aluminum alloy 6063-T5.
2. Finish:
   a. Powder Coat:
      1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
         a) AtmoShield textured environmental coating; color as selected by Architect.

D. Guides:
1. Fabrication:
   a. Structural steel angles. Provide windlock bars as required, removable bellmouths, and bottom bar stoppers of same material.
2. Finish:
   a. Powder Coat:
      1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
         a) AtmoShield textured environmental coating; color as selected by Architect.

E. Counterbalance Shaft Assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. (110 N). Provide wheel for applying and adjusting spring torque

F. Brackets:
Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures
1. Finish:
   a. Powder Coat:
      1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
         a) AtmoShield textured environmental coating; color as selected by Architect.

G. Hood:
Galvanized steel with reinforced top and bottom edges. Provide intermediate support brackets as required.
1. Finish:
   a. Powder Coat:
      1) Zirconium pre-treatment followed by baked-on polyester powder coat. minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.

a) AtmoShield textured environmental coating; color as selected by Architect.

H. Weatherstripping:
1. Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides
2. Guides: Vinyl strip sealing against fascia side of curtain
3. Hood: Neoprene/rayon baffle to impede air flow above coil
4. Lintel Seal: Nylon brush seal fitted at door header to impede air flow

2.4 OPERATION

A. Manual ControlGard Chain Hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide. Chain hoist to include integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

2.4 ACCESSORIES

A. Locking:
1. Padlockable chain keeper on guide. (Manual Chain operated.)

F. Interior Aesthetic Covers:
1. Operator and Bracket Mechanism Cover: Galvanized steel sheet metal cover to enclose exposed operating components at coil area of unit. Finish matching hood.
2. Guide Trim Package: Powder coated steel to match guides.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates
C. Commencement of work by installer is acceptance of substrate

3.2 INSTALLATION

A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports
B. Follow manufacturer's installation instructions

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer
B. Remove surplus materials and debris from the site.

3.5 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative
B. Instruct Owner's Representative in maintenance procedures

END OF SECTION

SECTION 08 33 20 – ROLLING COUNTER SHUTTERS

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section Includes: Manual rolling counter doors

B. Related Sections:
1. 05 50 00 Metal Fabrications. Door opening jamb and head members
2. 06 10 00 Rough Carpentry. Door opening jamb and head members
3. 08 31 00 Access Doors and Panels. Access doors
4. 08 70 00 Hardware. Padlocks. Masterkeyed cylinder
5. 09 91 00 Painting. Field painting.

C. Products That May Be Supplied, But Are Not Installed Under This Section:
1. Control Station

1.2 SUBMITTALS

A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
1. Product Data
2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
3. Quality Assurance/Control Submittals:
   a. Provide manufacturer ISO 9001:2015 registration
   b. Provide manufacturer and installer qualifications - see below
   c. Provide manufacturer's installation instructions
4. Closeout Submittals:
   a. Operation and Maintenance Manual
   b. Certificate stating that installed materials comply with this specification

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: ISO 9001: 2015 registered and a minimum of five years experience in producing counter doors of the type specified
2. Installer Qualifications: Manufacturer's approval

1.4 DELIVERY STORAGE AND HANDLING

A. Reference Section 01 66 00 Product Storage and Handling Requirements.
B. Follow manufacturer's instructions.

1.5 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship
B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:
1. Cookson:
1901 South Litchfield Road, Goodyear, AZ 85338. Telephone: (800) 294-4358.
2. Cornell
3. Substitutions: In Accordance with Section 01 25 00.

2.2 PRODUCT INFORMATION

A. Model: ESC10 with integrated stainless steel countertop. Refer to drawings for size(s).

2.3 MATERIALS

A. Curtain:
1. Slat Configuration:
a. Galvanized Steel with Finish as Described Below: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22 gauge ASTM A 653, Commercial Quality, galvanized steel with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal

2. Finish:
a. Atmoshield® Powder Coating System (Color Selected by Architect):
1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
2) Zirconium pre-treatment followed by baked-on polyester powder coat, with finished color as selected by Architect, minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

B. Endlocks:
Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats

C. Guides:
1. Fabrication:

a. Aluminum: Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.

2. Finish:
   a. Atmoshield® Powder Coating System (Color Selected by Architect):
      1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
      2) Zirconium pre-treatment followed by baked-on polyester powder coat, finished color as selected by Architect; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

D. Shaft Assembly:
   1. Counterbalance Shaft Assembly:
      a. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
      b. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque

E. Brackets:
Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures
   1. Finish:
      a. Atmoshield® Powder Coating System (Color Selected by Architect):
         1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
         2) Zirconium pre-treatment followed by baked-on polyester powder coat, with finished color as selected by Architect, minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

F. Hood:
Minimum 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets.
   1. Finish:
      a. Atmoshield® Powder Coating System (Color Selected by Architect):
         1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
         2) Zirconium pre-treatment followed by baked-on polyester powder coat, with finished color as selected by Architect; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

2.4 OPERATION

A. Manual Operation:
   1. Push-Up: Manual lift or pole with hook

2.5 ACCESSORIES

A. Locking:

1. Padlockable slide bolt: Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides. Provide interlock switches on motor operated units.

B. Countertop:
1. Stainless steel 14 gauge type 304 #4 finish: “T” shaped design for face of wall mounted unit of size and configuration for opening size and wall construction

C. Operator and Bracket Mechanism Cover:
Minimum 24 gauge galvanized steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates
C. Commencement of work by installer is acceptance of substrate

3.2 INSTALLATION

A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports
B. Follow manufacturer's installation instructions

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer
B. Remove surplus materials and debris from the site

3.5 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative
B. Instruct Owner's Representative in maintenance procedures

END OF SECTION

SECTION 08 41 13 – ALUMINUM STOREFRONT

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
1. Entrance and storefront systems, complete with reinforcing, fasteners, anchors and attachment devices.
2. Aluminum doors complete with hardware.
3. Accessories necessary to complete work.

C. Related Sections:
1. Section 01 40 00 - Quality Requirements.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00 - Rough Carpentry.
4. Section 07 92 00 - Joint Sealants.
5. Section 08 71 00 - Door Hardware.
6. Section 08 81 00 - Glass and Glazing.

1.2 REFERENCES

A. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
1. 503.1 Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Systems.
2. 701.2 Specifications for Pile Weatherstripping.
3. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
4. SFM-1 Aluminum Storefront and Entrance Manual.

C. American National Standards Institute (ANSI):
1. A117.1 Safety Standards for the Handicapped.

D. American Society for Testing and Materials (ASTM):

1.	A36	Structural Steel.
2.	B209	Aluminum and Aluminum - Alloy Sheet and Plate.
3.	B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4.	B308	Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
5.	C509	Cellular Elastomeric Pre-formed Gasket and Sealing Material.
6.	C864	Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
7.	E283	Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
8.	E330	Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
9.	E331	Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS):

1.	TT-P-645A	Primer, Paint, Zinc Chromate, Alkyd Type.

F. Steel Structures Painting Council (SSPC):

1.	Paint 12	Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 SYSTEM REQUIREMENTS

A. Design Requirements:

1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
7. Provide for expansion and contraction without detriment to appearance or performance.
8. Assemblies shall be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

B. Performance Requirements:

1. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot (0.0003 m3/sm2) of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf (300 Pa).

2. Water infiltration: No uncontrolled water penetration when tested in accordance with ASTM E 331 at test pressure of 8.0 psf 380 Pa.

C. Thermal Requirements:
1. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees Fahrenheit (82 degrees Celsius) without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
2. Ensure doors function normally within limits of specified temperature range.

D. Structural Requirements, as measured in accordance with ANSI/ASTM E330:
1. Wind loads for exterior assemblies:
a. Basic loading:
1) [_____] psf acting inward.
2) [_____] psf acting outward.

2. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures shall not exceed 1/175 of its clear span.

E. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00.

B. Product Data:
1. Submit manufacturer's descriptive literature and product specifications.
2. Include information for factory finishes, hardware, accessories and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:

1. Submit shop drawings covering fabrication, installation and finish of specified systems.

2. Include following:
a. Fully dimensioned plans and elevations with detail coordination keys.
b. Locations of exposed fasteners and joints.

3. Provide detailed drawings of:
a. Composite members.
b. Joint connections for framing systems and for entrance doors.
c. Anchorage.
d. System reinforcements.
e. Expansion and contraction provisions.
f. Hardware, including locations, mounting heights, reinforcements and special installation provisions.
g. Glazing methods and accessories.
h. Internal sealant requirements as recommended by sealant manufacturer.

4. Schedule of finishes.

D. Samples:

1. Submit samples indicating quality of finish, in required colors, on alloys used for work, in sizes as standard with manufacturer.
2. Where normal texture or color variations are expected, include additional samples illustrating

range of variation.

E. Test Reports:

1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of re-testing. Include other supportive data as necessary.

F. Certificates:

1. Submit manufacturer's certification stating that systems are in compliance with specified requirements.

G. Qualification Data:

1. Submit installer qualifications verifying years of experience.
2. Include list of projects having similar scope of work identified by name, location, date, reference name and phone number.

H. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:

1. To ensure quality of appearance and performance, obtain materials for each system from either a single manufacturer or from manufacturer approved by each system manufacturer.

B. Installer Qualifications: Certified in writing by Contractor as qualified for installation of specified systems.

C. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

D. Conform to requirements of ANSI A117.1 and local amendments.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 60 00.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

1.7 WARRANTY

A. Provide warranties in accordance with the Contract General Conditions.

B. Provide written manufacturer's warranty, executed by company official, warranting against defects in materials and products for two (2) years from date of Substantial Completion.

C. Provide written installer's warranty, warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.

1. Warranty shall cover following:
   a. Complete watertight and airtight system installation within specified tolerances.

b. Completed installation will remain free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

c. System is structurally sound and free from distortion.

d. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement.

e. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers

1. YKK AP America, Inc.
2. Vista Wall Architectural Products
3. Kawneer
4. Oldcastle Building Envelope

B. Substitutions: Submit under provisions of Section 01 25 00, a minimum of 10 days prior to bid date.

C. Acceptable Entrance Doors:

1. Monumental Swing Doors: YKK AP Series 50M Swing Doors.
50M Description: 2" (54.0 mm) thick heavy wall door stile by 5" (127.0 mm) with mid-panel panic device system or equivalent by specified manufacturer.

D. Acceptable Storefront Framing Systems:

1. Framing System: YES 45 FI (2" x 4-1/2") YKK AP or equivalent by specified manufacturer.

2.2 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:

1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H34 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
2. Shapes and sizes to suit installation.
3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.

D. Fasteners:

1. Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.

2. Do not use exposed fasteners, except where unavoidable for application of hardware.
3. For exposed locations, provide countersunk Phillips head screws with finish matching items fastened.
4. For concealed locations, provide manufacturer's standard fasteners.
5. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is unacceptable.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil (0.77 mm) thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Glazing Gaskets:

1. Compression type design, replaceable, molded or extruded, of neoprene, or ethylene propylene diene monomer (EPDM).
2. Conform to ASTM C509 or C864.
3. Profile and hardness as required to maintain uniform pressure for watertight seal.
4. Provide in manufacturer's standard black color.

H. Weatherstripping:

1. Wool pile conforming to AAMA 701.2; or extruded EPDM elastomeric conforming to ASTM C509 or C864.
2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

I. Internal Sealants: Types recommended by sealant manufacturer.

J. "Anti-Walk" Edge Blocking: "W" shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading.

K. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.

2.3 GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08 81 00.

2.4 FABRICATION

A. Coordination of Fabrication:

1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
2. Fabricate units to withstand loads which will be applied when system is in place.

B. General:

1. Conceal fasteners wherever possible.
2. Reinforce work as necessary for performance requirements and for support to structure.
3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or pre-formed separators which will prevent contact and corrosion.
4. Comply with Section 08 81 00 for glazing requirements.

C. Aluminum Framing:

1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
2. Fabricate frame assemblies with joints straight and tight fitting.

3. Reinforce internally with structural members as necessary to support design loads.
4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
5. Seal horizontals and direct moisture accumulation to exterior.
6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA Glazing Manual.
9. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.

D. Entrance Doors:

1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.

2. Provide extruded aluminum glazing stops of [square] [beveled and mitered (for single glazing only)] design, [permanently anchored on security side and removable on opposite side.]

E. Hardware:

1. Receive hardware supplied in accordance with Section 08 71 00 and install in accordance with requirements of this Section.
2. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
3. Comply with hardware manufacturer's templates and instructions.
4. Use concealed fasteners wherever possible.
5. Coordinate mid-panel panic device system with hardware at storefront doors to ensure compatibility.

F. Welding:

1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

G. Flashings:

1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

2.5 FINISH

A. Manufacturer's standard colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 40 00.

B. Verify dimensions, tolerances and method of attachment with other Work.

3.2 INSTALLATION

A. Erection Tolerances:

1. Limit variations from plumb and level:
   a. 1/8 inch (3 mm) in 10 feet (3 M) vertically.
   b. 1/8 inch (3 mm) in 20 feet (6 M) horizontally.

2. Limit variations from theoretical locations: 1/4 inch (6 mm) for any member at any location.

3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch (2 mm) from flush surfaces not more than 2 inches (51 mm) apart or out-of-flush by more than 1/4 inch (6 mm).

B. Install doors and hardware in accordance with manufacturer's printed instructions.

C. Set units plumb, level and true to line, without warp or rack of frame.

D. Anchor securely in place, allowing for required movement, including expansion and contraction.

E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or pre-formed separators to prevent contact and corrosion.

F. Seal perimeter members as shown on manufacturer’s installation instructions or as required for unique job conditions. Set other members with internal sealants and baffles as called for in manufacturer’s installation instructions. Use sealants as recommended by sealant manufacturer.

G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 00.

H. Glazing: Refer to requirements of Section 08 81 00. Utilize "anti-walk" edge blocking on all vertical edges of glazing.

3.3 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.4 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 71 00 - FINISH HARDWARE

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 DESCRIPTION OF WORK

A. Work under this section comprises of furnishing and installing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor’s base bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the General Contractor’s base bid. The hardware supplier shall verify all cylinder types specified for locking devices supplied as part of the door system with the door manufacturer and/or door supplies.

B. The General Contractor shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the General Contractor to address any such issue shall be considered acceptance of the hardware specified and all discrepancies shall be corrected at the General Contractor’s expense and considered a part of their base bid. Change orders shall not be issued if deemed by the Architect and/or Building Owner to fall under and/or be covered as a part of the General Contractor base bid, due to failure to comply with this instruction notification.

C. Items include but are not limited to the following:

1. Hinges - Pivots
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Coordinators

7. Closers
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead Controls
10. Electrified Hold Open Devices
11. Thresholds, Seals and Door Bottoms
12. Silencers
13. Miscellaneous Trim and Accessories

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.03 RELATED WORK specified elsewhere that should be examined for its effect upon this section:

A. Section 06 20 00 - Finish Carpentry
B. Section 08 11 13 – Steel Doors and Frames
C. Section 08 14 16 – Flush Wood Doors
D. Sections within 08 31 13 – Access Doors
E. Section within 08 41 13 – Aluminum Entrances, Storefront and Window Framing
F. Sections within 08 80 00 – Glass and Glazing
G. Sections within 09 91 00 - Painting
H. Division 26 – Electrical
I. Division 28 – Access Control

1.04 REFERENCES SPECIFIED in this section subject to compliance as directed:

A. NFPA-80 - Standard for Fire Doors and Windows
B. NFPA-101 - Life Safety Code
C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities
E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products
F. UFAS - Uniform Federal Accessibility Standards
G. UL – Under-writer’s Laboratories
H. WHI - Warnock Hersey International, Testing Services
I. State and Local Codes including Authority Having Jurisdiction
J. Positive PressureUL10C
K. IBC-2018 – International Building Code
L. NFPA-70 – International Electrical Code

1.05 SUBMITTALS

A. HARDWARE SCHEDULES submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.

B. Submit manufacturer’s cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

C. Certification of Compliance:

1. Submit any information necessary to indicate compliance to all these specifications as required.

2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.

D. Submit any samples necessary as required by the Architect.

E. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.

F. Doors and Frames used in positive pressure opening assemblies shall meet UL10C in areas where this specification includes Seals for smoke door.

1.06 QUALITY ASSURANCE

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an AHC or AHC /CDC and/or a person of equivalent experience (minimum fifteen (15) years in the industry) who will be made available at reasonable times to consult with the Architect/Contractor and/or Building Owner regarding any matters affecting the finish hardware on this project.

B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

1.07 DELIVERY, HANDLING AND PACKAGING

A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.

B. Pack each item of hardware completes with all necessary parts and fasteners.

C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

1.08 SEQUENCING AND SCHEDULING

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed in order to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.09 WARRANTY

All finish hardware shall be supplied (By the Hardware Supplier) with a Two- (2) year written warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:

1. All Closers are to have a thirty- (30) year written warranty.
2. All Exit Devices are to have a three- (3) year written warranty.
3. All Grade 1 Locksets are to have a ten- (10) year written warranty.
4. All Continuous are to have a ten- (10) year written warranty.

PART 2 – PRODUCTS

2.01 FASTENERS

A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.

B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted if required be the door manufacturer. All thresholds shall be fastened with wood screws and plastic anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.

C. Design of all fastenings shall harmonize with the hardware as to material and finish.

D. All hardware shall be installed with the Manufacturers standard screws as provided. The use of any other type of fasteners shall not be permitted. The general contractor shall provide wood blocking in all stud walls specified and/or scheduled to receive wall stops, No Exception.

2.02 ENVIRONMENTAL CONCERN FOR PACKAGING

Hardware shipped to the project jobsite shall be packaged in biodegradable packs such as paper or cardboard boxes and wrapping.

2.03 HINGES

A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Ives, Hager or Stanley.

B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification (Refer to 3.02 Hardware Sets).

C. Exterior Five Knuckle Door Hinges shall be manufactured from solid stainless steel, aluminum or bronze base metal and provide all out-swinging doors with non-removable pins or security studs as called for in 3.02 Hardware Sets.

D. Interior Five Knuckle Door Hinges shall be manufactured from a steel base metal. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

E. Provide all exterior & interior hinges in a size 4½” x 4½” for all 1¾” thick doors up to and including 36 inches wide. Doors over 1¾” through 2¼” thick, use 5” x 5” hinges. Doors over 36 inches use 5” x 4½” unless otherwise noted in 3.02 Hardware Sets.

F. Were exterior or interior door hinges are required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of enough throw.

G. Provide heavy weight hinges on all exterior or interior doors over 36 inches in width.

H. At exterior or interior labeled door's ball-bearing type hinges shall be provided. For all doors equipped with closers provide ball-bearing-type hinges.

I. Finishes at all Interior and Exterior door hinges shall be provide as specified in 3.02 Hardware Sets.

J. Continuous hinges shall be Architectural Builders Hardware (ABH) Geared Hinges as specified or equal products manufactured by Select Products.

2.04 LOCK AND LOCK TRIM

A. All the locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locksets specified are Schlage "ND" series with the Sparta lever as specified or acceptable products manufactured by Falcon "T" series or Sargent "11" lines.

B. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.

C. Mechanical Locks shall meet ANSI Operational Grade 1, Series 4000 as specified.

1. Hand of lock is to be field reversible or non-handed.
2. All lever trim is to be through-bolted through the door.

2.05 CYLINDERS AND KEYING

A. Provide all Interior locks and Exit devices requiring cylinders with Schlage Large Format Interchangeable Cores keyed to the New Everest S123 Large Format Interchangeable Core Master Key System and complies with performance requirements of ANSI A156.5. All keys shall be of nickel silver material only. The hardware supplier shall meet with the General Contractor, the Architect and Building Owner at the project site to determine all permanent keying requirements. The hardware supplier shall provide One (1) Knox Box if required by the local Fire Marshall. The contractor shall, as required by the local Fire Marshall and Building Owner mount the Knox Box.

B Furnish all exterior and interior locks, cylinders and Exit devices with temporary keyed construction cores feature for the duration of construction. Provide ten (10) construction keys and two (2) construction Control keys total.

C. Cores shall be keyed and maintained as directed by the Building Owner & the Architect. Provide four- (4) keys per cylinder and ten- (10) master keys per master used. Provide a bitting list for changes used and include additional bitting for future expansion as instructed by Building Owner during the project keying meeting. Signature for all deliveries to Building Owner shall be required.

D. Factory stamp all keys "Do not duplicate" and with key symbol as directed by the Building Owner.

2.06 EXIT DEVICES

A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty; electrified devices and trim to be the same series and design as mechanical devices and trim.

B. Exit Devices to be “UL” listed for life safety. All exit devices for labeled doors shall have “UL” label for “Fire Exit Hardware”. All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer’s listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.

C. All exit devices to be of a heavy duty, chassis mounted design, with one-piece removable covers, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.

D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets (“Sparta” #17 lever design).

E. Exit Devices shall be the modern push rail design. All exit devices shall be mounted with sex bolts.

F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship. Exit devices shall be certified by an independent testing lab for a minimum of 1,000,000 cycles.

G. Furnish roller strikes for all rim and surface vertical rod exit devices. Internal springs shall be coil compression type. Furnish security dead latching for all active latch bolts. Plated latch bolts not accepted.

H. Exit Devices shall be Von Duprin 33A & 99 series as specified or acceptable products manufactured by Falcon 24 & 25 series and Precision “2100, 2200, 2400 & 2600” series.

2.07 SURFACE MOUNTED DOOR CLOSERS

A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maximum degree of opening (trim permitting).

B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength cast iron cylinder to provide control throughout the entire door opening cycle.

C. Size all closers in accordance with the manufacturer’s recommendations at the factory.

D. All closers to have adjustable spring power sizes 1 or 2 through 4 or 6 and separate tamper resistant, brass, non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified otherwise.

E. All closer covers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match closer. Provide closer covers only if provided as a standard part of the door closer package.

F. Closers shall have heavy-duty arms. All closer arms shall be of enough length to accommodate the reveal depth and to insure proper installation. The hardware supplier shall provide any and all required brackets, spacers or filler plates as required by the manufacture for a proper and functional installation as part of their base bid.

G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

1. All parallel arm mounted closers to be factory indexed to insure proper installation.
2. Furnish heavy-duty cold forged parallel arms for all parallel arm mounted closers.

H. Provide closers with special application and heavy-duty arms as specified in the hardware sets or as otherwise called for to insure a proper operating, long lasting opening. Drop plates and any additional brackets required for the proper installation of the door closer shall be included in the hardware supplier's base bid.

I. Finish: Baked on Powder Coated finish shall match other hardware.

J. Provide and mount all door closers with sex bolts as provided by the manufacturer.

K. Closers shall be LCN 4040XP series at all exterior doors & 1461 FC series at all Interior doors or acceptable products manufactured by Sargent "281" series.

2.08 DOOR STOPS AND HOLDERS

A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.

B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.

C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified**.** The General Contractor shall provide wood blocking in all stud walls specified and scheduled to receive wall stops.

D. Finish: Same as other hardware where available.

E. Acceptable Products

1. Floor and wall stop as listed in hardware sets. Equivalent products as manufactured by Ives, Architectural Builders Hardware (ABH), Glynn Johnson and Trimco are acceptable.

2.09 PUSH PLATES, DOOR PULLS, AND KICKPLATES

A. All push plates, door pull, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, Architectural Builders Hardware (ABH) and Trimco are acceptable.

B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than door width (LDW) as specified. They are to be of 16-gauge thick stainless steel. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.

C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.

D. Finish: Same as other hardware where available.

2.10 FLUSH BOLTS AND COORDINATORS

A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Architectural Builders Hardware (ABH) and Trimco are acceptable. Finish shall match the adjacent hardware.

2.11 THRESHOLDS AND SEALS

A. Provide materials and finishes as listed in hardware sets. Equivalent product by National Guard Products, Zero, and Reese are acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.

B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal.

C. Seals shall comply with requirements of UL10C. All thresholds, door bottoms and weather strip inserts shall be a silicone-based product as specified in 3.02 Hardware Sets. Other materials used shall be rejected, unless originally specified.

D. Seals shall comply with the requirements of the Wood Door Manufacturer’s certification requirements.

2.12 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets.

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.13 DOOR SILENCERS

A. Provide door silencers at all openings without gasket. Provide two- (2) each at each pair of doors and three- (3) or four- (4) each for each single door (coordinate with the frame manufacturer).

2.14 KEY CABINET

A. Provide a (each campus) key cabinet Lund 1200 series for installation by the contractor as instructed by the Architect and the Building Owner. Key Cabinet

shall be of such size as to hold 150% of the total number of keys supplied for this project.

2.15 PROPRIETARY PRODUCTS

A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.

B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and the Building Owner.

C. Architect and the Building Owner reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION

3.01 INSTALLATION AND SERVICE ITEMS OF FINISH HARDWARE

A. All finish hardware shall be installed by an experienced finish hardware installer with at least ten (10) years of experience after a pre-installation meeting between the contractor, hardware Manufacturers representative, the hardware supplier, hollow metal supplier and wood door supplier. The finish hardware installer shall be responsible for the proper installation and function of all doors and hardware.

B. The hardware supplier's office and/or warehouse shall be located within a one hundred (100) mile radius of the project site as to better service the general contractor and the Building Owner during this project.

C. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.

D. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.

E. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

3.02 HARDWARE SETS - **Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor's base bid.**

HARDWARE GROUP NO. 01
FOR USE ON DOOR #(S):
104A 110C
PROVIDE EACH RU DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	20-061 ICX W/CONST. CORE	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
		BALANCE HARDWARE	PROVIDED BY DOOR MFG		

-COORDINATE HARDWARE WITH DOOR MFR.

HARDWARE GROUP NO. 02
FOR USE ON DOOR #(S):
105
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 03
FOR USE ON DOOR #(S):
101 111 112 114 115
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 04
FOR USE ON DOOR #(S):
117
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328S-2 PCS JAMB HEIGHT	AA	ZER
1	EA	HEAD SEAL	429S-1 PC HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 X FRAME WIDTH	A	ZER

HARDWARE GROUP NO. 05
FOR USE ON DOOR #(S):
100
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP REG X MTG BRKT, SPCR, PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	GASKETING	328AA H & J	AA	ZER
1	EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 X FRAME WIDTH	A	ZER

HARDWARE GROUP NO. 06
FOR USE ON DOOR #(S):
102 109

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458 12"	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	COORDINATOR	COR-FL-SIZE REQUIRED	689	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
2	EA	WALL STOPS	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	ASTRAGAL	44STST-DOOR HEIGHT (PUSH SIDE MOUNTED)	STST	ZER

HARDWARE GROUP NO. 07
FOR USE ON DOOR #(S):
104
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	1461 HD FC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 08
FOR USE ON DOOR #(S):
103
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 09
FOR USE ON DOOR #(S):
110B 113B 113C 116B
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	PANIC HARDWARE	9947-L-LBR-07 X LENGTH & HEIGHT	628	VON
2	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	1461 HDPA FC	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	MEETING STILE PROTECTION	8194-2 PCS DOOR HEIGHT (PULL SIDE MOUNTED)	AA	ZER

HARDWARE GROUP NO. 10
FOR USE ON DOOR #(S):
110 110A 113 113A 116 116A
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONTINUOUS HINGES	112XY-DOOR HEIGHT	628	IVE
1	EA	PANIC HARDWARE	9947-EO X LENGTH & HEIGHT	628	VON
1	EA	PANIC HARDWARE	9947-NL-OP X LENGTH & HEIGHT	628	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 DT	630	IVE
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328S-2 PCS JAMB HEIGHT	AA	ZER
1	EA	MEETING STILE PROTECTION	328S-2 PCS DOOR HEIGHT	AA	ZER
1	EA	HEAD SEAL	429S-1 PC HEADER WIDTH	AA	ZER
2	EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 X FRAME WIDTH	A	ZER

HARDWARE GROUP NO. 11
FOR USE ON DOOR #(S):
106A
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY X DOOR HEIGHT	628	IVE
2	EA	PANIC HARDWARE	3347A-EO X LENGTH & HEIGHT	628	VON
2	EA	VANDAL RESISTANT PULL	VR910 DT	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH 4040-18PA 4040-30 4040-61	689	LCN
2	EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-V3-226 X FRAME WIDTH	A	ZER
		SEAL	PERIMETER SEAL BY DOOR MFG		
		ASTRAGAL	MEETING STILE SEAL BY DOOR MFG		

HARDWARE GROUP NO. 12
FOR USE ON DOOR #(S):
107 108
PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8303 8" 3.5" X 15"	630	IVE
1	EA	SURFACE CLOSER	1461 HD FC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 13
FOR USE ON DOOR #(S):
106
PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	A110HD-ACCESS PANEL 8 WIREDOOR HEIGHT	628	ABH
1	EA	ELEC PANIC HARDWARE	RX-QEL-3347A-EO-CON X LENGTH & HEIGHT	628	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3347A-NL-OP-CON X LENGTH & HEIGHT	628	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 DT	630	IVE
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
1	EA	OH STOP	100S (ACTIVE DOOR)	630	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH 4040-18PA 4040-30 4040-61 (INACTIVE DOOR)	689	LCN
1	EA	SURF. AUTO OPERATOR (PUSH SIDE)	9542 HL/D MS AS REQ (120/240 VAC (ACTIVE DOOR)	ANCLR	LCN
1	EA	ACTUATOR/BOLLARD PKG	8310-3836T	AL	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
2	EA	DOOR SWEEP	39A X DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-V3-226 X FRAME WIDTH	A	ZER
2	EA	HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
2	EA	HARNESS (TO POWER)	CON-6W - CONNECTION LEADS		SCH
1	EA	POWER SUPPLY	PS902 900-4RL		VON
		CARD READER	CARD READER PROVIDED BY SECURITY CONTRACTOR		
		DOOR CONTACT	PROVIDED BY SECURITY CONTRACTOR		
		SEAL	PERIMETER SEAL BY DOOR MFG		
		ASTRAGAL	MEETING STILE SEAL BY DOOR MFG		

NOTE: COORDINATE WATERTIGHT PERIMETER SEAL WITH ALUM DOOR/FRAME MFG.

OPERATION: ENTRY BY THE CARD READER OR KEY OVERRIDE. FREE AND IMMEDIATE EGRESS AT ALL TIMES VIA THE ACTUATOR OR PANIC DEVICE PUSH PADS. THE ELECTRIFIED LATCH BOLTS WILL BE SEQUENCED WITH THE AUTOMATIC OPENERS AND RETRACT PRIOR TO THE AUTOMATIC OPENERS ACTIVATING.

END OF SECTION

SECTION 08 81 00 — GLASS AND GLAZING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Glazing for hollow metal doors and frames.

B. Glazing for aluminum frames.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Hollow metal doors and frames.

B. Aluminum entrances and storefronts.

C. Aluminum window systems.

1.4 SUBMITTALS

A. Submit manufacturer’s literature with material and performance descriptions for each type of glass, sealant and glazing accessories.

B. Submit detailed shop drawings indicating locations, installation and sealing methods.

C. Submit 12” x 12” physical samples of each type of tinted or wire glass and panel.

D. Obtain approved shop drawings from hollow metal supplier, aluminum frame supplier, plastic laminate door supplier.

E. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to water infiltration, air infiltration, glass failure due to improper sizing or installation, sealant failure.

1.6 QUALITY ASSURANCE

A. Glazing contractor shall have a minimum of 3 years experience in the installation of glazing products for projects of similar size and scope as this project.

B. Each piece of glass shall bear manufacturer's label indicating type.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not deliver glass or panels to the jobsite until openings are ready for glazing.

B. Deliver glass and panels in manufacturer's original protective packaging. Store in a dry, well ventilated area and take care to prevent condensation on the materials. Keep glass faces separated.

1.8 MINIMUM COMPLIANCE STANDARDS

A. SAFETY: Contractor shall be responsible for meeting all Federal and applicable code requirements for types and locations of glazing regardless of drawing indications. Comply with the current standards of the Consumer Products Safety Commission and Federal Standard 16 CFR 1201 Federal Architectural Glazing Materials Safety Standard.

B. INSTALLATION: Comply with recommendations of Flat Glass Marketing Association – FGMA Glazing Manual.

PART 2 - PRODUCTS

2.1 GENERAL

A. GLAZING SHEETS: Glazing materials shall conform to the highest qualities as specified in the following standards:
   1. Float glass: FS DD-G-451d and ASTM C1036.
   2. Float glass, heat strengthened: ASTM C1036 and ASTM C1048.
   3. Float glass, tempered: FS DD-G-1403B and ASTM C1036, ASTM C1048, ANSI Z97.1, and Consumer Product Safety Commission 16 CFR 1201.
   4. Wired glass: FS DD-G-451, ASTM C1036 and ANSI Z97.1. Misco diamond pattern.
   5. Insulating glass: ASTM C1036. Meet industry standards set by the Sealed Insulating Glass Manufacturers Association (SIGMA).

B. MISCELLANEOUS
   1. Glazing sealants: FS TT-S-1543A (silicone rubber); FS TT-S-230 (synthetic rubber); FS TT-S-001657 (butyl rubber).
   2. Glazing tape: Architectural Aluminum Manufacturer's Association.

2.2 MANUFACTURERS

A. GLASS:
1. Guardian
2. PPG Industries
3. Pilkington.

B. TEMPERING, LAMINATING AND HEAT STRENGTHENING:
1. Oldcastle
2. Trulite

C. WIRE GLASS:
1. Pilkington
2. PPG Industries

D. GLAZING TAPE:
1. TREMCO – tape, shims, setting blocks, edge blocking.

E. GLAZING SEALANT:
1. TREMCO,
2. General Electric.

2.3 MATERIALS: Types as indicated in the drawings.

A. TEMPERED GLASS: 1/4" clear and solar tint float glass tempered by the vertical or horizontal process and meeting requirements of FS DD-G-1403B.

B. WIRE GLASS: Shall be 1/4" thick. Polish plate glass reinforced with diamond pattern wire mesh No. 24 gauge minimum, with a mesh not larger than 1”.

C. HOLLOW METAL FRAME AND DOOR GLAZING SYSTEM:
1. Glazing: 1/4” Tempered.
2. Glazing tape: 1/8” x 3/8” x continuous preshimmed butyl tape; Tremco 440.
3. Setting blocks: Neoprene or EPDM in minimum 4” lengths.
4. Edge blocking: Neoprene or EPDM in minimum 4” lengths and sized to allow for 1/8” clear expansion at both vertical edges.
5. Add sealant at exterior glazing.

2.4 INSULATING GLASS

A. Solar Control Tinted Insulated Units
1. Conformance: ASTM C 1172 and complying with testing requirements in CPSC 16CFR-1201 for Category II materials.
2. Overall Thickness: 1 inch (25 mm)
3. Outboard Lite: Bronze float glass.
   a. Tinted Float Glass: ASTM C 1036, Type I, Class 2, Quality q3.
   b. Glass Thickness: 1/4 inch (6 mm).
   c. Heat Treatment: Fully Tempered, ASTM C 1048, Kind FT
4. Interspace: ½ inch (12 mm) hermetically sealed air
5. Inboard Lite: Clear float glass.
   a. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3.
   b. Glass Thickness: 1/4 inch (6 mm).
   c. Heat Treatment: Fully Tempered, ASTM C 1048, Kind FT
6. Sealant: Approved by glass manufacturer.

7. Nominal shading coefficient: 0.53

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install glass without warping, binding or stress. Allow for expansion and contraction of glass due to temperature changes. Do not install sealant with surfaces or ambient temperature below 40 degrees F.

B. HOLOW METAL FRAMES AND DOORS:
1. Ensure that finish painting of doors and frames is complete.
2. Cut glazing tape to length and install against permanent stop, flush with face of stop.
3. Place setting blocks at 1/4 points.
4. Rest glass on setting blocks and press against stop for full contact and adhesion at perimeter.
5. Place continuous glazing tape on opposite-face perimeter of glass in same manner described above. Install removable stop; avoid displacement of tape; and exert pressure on tape for full continuous contact.
6. Knife trim excess of protruding tape (leave recessed for sealant at exterior glazing).
7. Do not touch glass to metal.

C. PLASTIC LAMINATE DOORS:
1. Follow procedures specified above for non-rated doors. Metal stops provided by door manufacturer.
2. Follow recommendations of door manufacturer for rated doors. Metal stops provided by door manufacturer.

D. ALUMINUM FRAMES: Follow door and frame manufacturer’s printed instructions for glazing gasketed systems. Provide watertight installation at exterior systems.

3.2 CLEANING AND PROTECTION

A. During glazing operations, provide sufficient stick-on safety labels or hang streamers on new glazing.

B. Prior to project closeout, thoroughly clean all glazing inside and out with commercial glass cleaner.

C. Reglaze any openings where glass is chipped, broken, scratched, pitted or stained.

END OF SECTION

SECTION 09 20 00 — LATH AND PLASTER

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install plaster lathing and accessories, three coat stucco system with floated finish as indicated in the drawings and specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Metal studs and gypsum sheathing.

B. Insulation

C. Dampproofing and waterproofing.

D. Painting

1.4 SUBMITTALS

A. Submit manufacturer's product data describing masonry mix, waterproofing additive, oriental stucco, lath and metal accessories.

B. Submit mix design.

C. Submit a 12" x 12" lath and plaster, metal edged sample for each type of plaster and each finish texture for Architect's approval.

D. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to cracking, water infiltration, loss of adhesion, spalling or discoloration.

1.6 QUALITY ASSURANCE

A. Plaster contractor shall have a minimum of 3 years experience in the installation of plaster systems for projects of similar size and scope as this project.

PART 2 - PRODUCTS

2.1 LATHING MATERIALS

A. CHANNELS: 16 gauge, cold rolled pressed steel, galvanized. Flanges minimum 7/16" wide. Minimum weight shall be 475 pounds per 1000 lineal feet for 1-1/2" channels and 300 pounds per 1000 lineal feet for 3/4" channels.

B. METAL LATH: Copper - alloy steel as follows: 1. Interior dry areas: Flat expanded diamond mesh at ceilings and soffits. Self- furring type at sheathed walls. Galvanized or painted finish. Minimum 3.4 lbs. per square yard. 2. Exterior and interior wet areas: Flat expanded diamond mesh at ceilings and soffits. Self-furring type at sheathed walls. Galvanized finish meeting requirements of FS QQ-Z-325C, Type 1. Minimum 3.4 lbs. per square yard.

C. WIRE: Annealed galvanized metal wire. Minimum 18 gauge tie wire; minimum 8 gauge hanger wire.

D. LATHING ACCESSORIES: Galvanized for interior dry areas; solid zinc alloy for exterior work.
1. Casino Beads: MUcor #66 with expanded metal flange, 26 gauge.
2. Corner Beads: U.S.G. NO. 4-R, or approved equal, 26 gauge expansion type.
3. Control Joints: No. 75 per U.S.G.
4. Expansion Joints: No. 40 zinc expansion flange type per Keene.

E. Wire clips for attachment of furring channels to runner channels shall be formed hairpin clips, 8 gauge galvanized soft steel wire.

F. METAL STUDS: Provided and installed under another section of these specifications.

2.2 PLASTERING MATERIALS

A. REINFORCING: Alkaline resistant fiberglass strands, 1/2".

B. PORTLAND CEMENT: ASTM C-150, Type I, white for finish coat.

C. SAND: ASTM C-144, red torpedo sand for scratch and brown coats.

D. MASONRY MIX: Pre-mixed dry masonry mortar mix meeting requirements of A.S.T.M. C-91, Type N, as manufactured by Trinity, Ideal, TXI or Lonestar.

E. FINISH: "Oriental Exterior" stucco as manufactured by United States Gypsum Company, or approved equal. Colors shall be as selected by the Architect. Deliver to job in manufacturer's original packages, with labels intact, seals unbroken. Prepare stucco finish coat for application by mixing with water only.

F. WATERPROOFING: "Hvdrocide" as manufactured bv Sonneborn.

G. WATER: Clean, potable and free from any amounts of mineral and organic substances that would affect set of Plaster.

H. No asbestos or admixtures.

2.3 MIXES

A. SCRATCH COAT:
1. 1 sack Portland cement.
2. 2 sacks masonry mix.
3. 9 cu. ft. sharp sand
4. 1-1/2 lbs. fiberglass strands.

B. BROWN COAT:
1. 1 sack Portland cement.
2. 2 sacks masonry mix.
3. 10 cu. ft. sharp sand.
4. 1-1/2 lbs. fiberglass strands
5. Integral waterproofing per manufacturer's recommendations

C. Plaster mixes shall comply with ASTM C926.

PART 3 - EXECUTION

3.1 GENERAL

A. Install furring, lathing, and all plaster work level and plumb, true and rigid. Ensure that all work to be concealed by plaster has been completed and inspected prior to beginning plaster work.

B. Obtain access panels, frames, or other built-in items from the appropriate trades before beginning plaster work.

C. Exercise precautions to prevent damage to work of other crafts. Plaster droppings on glass or aluminum surfaces shall be immediately removed with clean water and soft cloths.

3.2 EXTERIOR PLASTER (STUCCO)

A. All exterior work and interior wet areas to have Portland Cement Finish "Oriental Exterior" sand finish 3/16" to 1/4" thick finished coat, texture as approved by Architect. Color and texture shall be uniform.

B. Exterior plaster and interior wet areas to include integral waterproofing, galvanized lath, and pure zinc accessories.

3.3 SUSPENDED CEILING & SOFFIT INSTALLATION

A. Install suspended ceilings or exterior soffits in indicated locations. Unless otherwise indicated, suspension system shall consist of *1-1/2"* runner channels, *3/4"* furring channels, suspended from structure above by galvanized hanger wires.

B. Space hanger wire 48" maximum in either direction for interior ceilings. Maximum 36" in either direction for stucco soffits.

C. Space runner channels 48" on center maximum for interior plaster ceilings, supported from resilient hangers; space 36" on center maximum for plaster soffits

D. Wrap each hanger wire twice around channels; secure by at least 3 turns around itself. Space furring channels 12-1/2" on center maximum and at right angles to runners.

E. Secure to runner channels with wire clips or saddle tied with 2 strands of 16 gauge tie wire giving wire ends 3 twists.

F. Isolate penetrations (such as light fixtures) with control joints and reinforce with furring channels

3.4 METAL LATH & ACCESSORIES

A. Apply metal lath to form true surfaces, straight, without sags or buckles, with long dimension at right angles to direction of supports. Secure lath to supports at 6" intervals. Secure side laps on ceilings to supports; tie at 6" intervals between supports. Lap lath at sides at least *1/2".* Lap lath at ends at least 1", stagger laps; and locate only over supports. Break end joints of lath on alternate sheets of lath. Lath ties shall have a minimum of three complete turns.

B. Provide corner beads on external plaster corners and where indicated. Corner beads shall be single lengths where length of corner does not exceed standard stock lengths. Miter or cope beads at corners; fasten securely with tie wire spaced 8" maximum; stagger on two wings.

C. Install casing beads (stops) where plaster abuts other surfaces, at edges of plaster panels, and elsewhere as indicated. Set casing beads level, true to line. Install casing beads in lengths as long as practicable, with joints in straight runs aligned with suitable formed splices. Secure casing beads to metal lath with tie wire spaced 8" maximum.

D. Provide expansion joints in exterior and interior plaster as shown. Expansion joints shall be in single lengths where possible. Secure expansion joints to metal lath with tie wire; space ties or nail anchors not over 8" apart.

E. Provide control joints in exterior and interior plaster between expansion joints so that no panel dimension exceeds 12' or 120 square feet of area.

3.5 APPLICATION

A. Maintain temperature of at least 40 degrees F. in building prior to plaster application, until it is dry. Plaster shall be three coat work on all bases. Plaster thickness from plaster base to finished plaster surface shall be as noted on drawings but shall be a minimum thickness of 3/4" at its thinnest point. Do not combine scratch and brown coats. No irregularities shall show in finished surface, such as "cat faces", streaks, waviness, trowel, float or brush marks. Finished surfaces shall be true, uniform in texture and finish.

B. Apply scratch coat with sufficient pressure to force mortar through mesh and key firmly to lath. Scratch to form rough surfaces. Apply brown coat 48 hours after scratch coat has set; bring out to grounds; straighten to true surface with rod, darby; leave rough, and ready for finish coat.

C. Apply finish over base coat which has been wetted evenly by brushing or spraying. Apply finish coat not sooner than seven (7) days after brown coat. Provide light sand finish per approved sample.

D. Keep plaster moist for the curing period between coats. Limit thickness *of* scratch, and brown coat to maximum 3/8" each.

3.6 PLASTER CUTTING & PATCHING

A. Execute after other work is in place, and after painter has applied priming coat. Thoroughly rake out, or cut out, moisten and fill with finishing material. Float finish with adjoining work. Point up around fixtures, outlet boxes, switch plates, fittings, piping and other appliances abutting or extending into plastering.

3.7 FINISH PLASTER PROTECTION

A. Provide protection against damage for finished plaster work. Protect plastering from freezing or premature drying. Execute no plastering work in cold weather, except where work is adequately protected and proper temperatures are maintained to prevent freezing.

END OF SECTION

SECTION 09 21 16 — INTERIOR DRYWALL SYSTEMS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install acoustical batt insulation within interior drywall partitions.

B. Provide and install all interior drywall systems including light gauge metal studs and tracks, horizontal bridging, gypsum wall board and finishing systems, suspended gypsum board ceilings and soffits, furred gypsum board.

C. Provide and install troweled firestopping system at drywall ceiling and wall penetrations at rated walls.

D. Provide and install specified corner guards at each wall corner.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Painting

B. Door frames

C. Carpentry (wood blocking)

D. Plaster on metal studs

E. Mechanical, electrical and plumbing penetrations in rated drywall systems.

1.4 SUBMITTALS

A. Submit manufacturer's product data describing all materials.

B. Submit gypsum board finish schedule indicating level of finish proposed per each area. Finish levels shall be levels 1 through 4 as specified herein and defined by "Recommended Specification: Levels of

Gypsum Board Finish" as jointly published by AWCI, CISA, GA, and PDCA. Submit copy of publication with finish schedule.

C. Submit manufacturers detail drawings and detailed installation methods for fire rated penetrations and filling of voids with specified firestopping system. Submit only those systems applicable to this project.

D. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to cracking, joint tape delamination or tearing, dimpling at fastener heads, bowing or warping of wall board, cracking at metal accessories, acoustical sealant failure.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.

B. Damaged or deteriorated materials shall be removed from the premises.

C. During cold weather installation of gypsum panels and joint finishing, temperatures within the building shall be maintained within the range of 50 degrees to 80 degrees F. Adequate ventilation shall be provided to carry off excess moisture.

D. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice"

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Drywall Framing:
1. ClarkDietrich Building Systems

B. Gypsum Board and Related Accessories:
1. National Gypsum Co.
2. United States Gypsum Co.
3. Georgia Pacific
4. James Hardie

C. Acoustical Batts:
1. Owens-Corning
2. Certaineed
3. Manville

D. Acoustical Sealant:
1. TREMCO
2. Ohio Sealants, Inc.

E. Specialty Trims:
1. Fry Reglet Corp.
2. MM Systems Corp.

F. Corner Guards:
1. American Specialties, Inc.

2.2 FRAMING: Comply with ASTM C645-09 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645-09 requirements for metal unless otherwise indicated.

2. Protective coating: Comply with ASTM C645-09; roll formed from hot dipped galvanized steel; complying with ASTM A1003/A1003M and ASTM A653/A653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvannealed products are not acceptable.

A. METAL STUDS: 25 gauge galvanized roll formed, screw channel type studs with minimum 5/16 inch flanges and 1-1/4 inch legs. Provide widths of 1-5/8 inch, 2-1/2 inch, 3-5/8 inch, 4 inches and 6 inches as indicated in the drawings. Provide conduit punchouts at 24" o.c.

1. "EQ" (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86-2010 (approved February 2010 Effective March 1, 2010) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C645-09.

2. Non-structural Studs: Cold-formed galvanized steel C-studs, ClarkDietrich Building Systems Pro STUD drywall studs as per ASTM C645-09 for conditions indicated below:

   a. Flange Size: 1 1/4 inch (32mm)

   b. Web Depth: As specified on drawings, 1-5/8 inches (41 mm) 2-1/2 inches (64 mm) 3-5/8 inches (92 mm) 4 inches (102 mm) 6 inches (152 mm).

   c. Member Description: ProSTUD 25 (25ga equivalent drywall stud) 70ksi Minimum Thickness: 0.0150 inches (0.3810mm) Minimum Design Thickness: 0.0158 inches (0.4013mm)

   d. Member Description: ProSTUD 22 (22ga equivalent drywall stud) 70ksi Minimum Thickness: 0.0179 inches (0.4547mm) Minimum Design Thickness: 0.0188 inches (0.4775mm)

   e. Member Description: ProSTUD 20 (20ga equivalent drywall stud) 65ksi Minimum Thickness: 0.0220 inches (0.5588mm) Minimum Design Thickness: 0.0232 inches (0.5893mm)

B. RUNNER CHANNELS: Provide 25 gauge galvanized channels with minimum 1-1/4 inch flanges with hemmed edges, in widths to accommodate stud sizes.

1. Non structural Track: Cold-Formed galvanized steel runner tracks, ClarkDietrick Building Systems ProTRAK drywall track in conformance with ASTM C645-09 for conditions indicated below:

   a. Flange Size: 1 1/4 inch (32mm)

   b. Web Depth: Track web to match stud web size.

   c. Minimum Material Thickness: Track thickness to match wall stud thickness or as per design.

C. FURRING CHANNELS: Provide 20 gauge galvanized "z" channels with face width of 1-1/4 inches, depth of 3/4 inches, and back width of 2-9/16 inches minimum, hemmed edges.

D. CEILING SUSPENSION: Provide 16 gauge galvanized channels, 3/4" x 1/2" and 11/2" or 2" x 17/32".

1. Firestop tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance rated assembly

indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; MaxTrak or an equivalent product.

2.3 ACCESSORIES

A. CORNER BEADS: 26 gauge galvanized beaded angle with 1-1/4" legs.

B. Channel Bridging and Bracing: Steel, 0.0538-inch (1.37mm) minimum base metal thickness, with minimum 1/2 inch (13mm) wide flanges.
   a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Spazzer 9200 Bridging and Spacing Bar, or an equivalent product.
   b. Depth: As indicated on drawings, 7/8 inch by 7/8 inch by 50 inches.
   c. Install at 48” o.c. horizontally.

2. Backing Plate: Proprietary fire-resistance treated blocking and bracing in width indicated.

   a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Danback Fire-treated wood backing plate or an equivalent product.

C. EDGE TRIM: 26 gauge galvanized steel "J" mould and angle with continuous bead. ClarkDietrich Building Systems 200.A and 200.B.

D. WIRE: 9 gauge galvanized hanger wire and 16 gauge galvanized be wire.

E. SCREWS: Bugel head Type "S" self tapping drywall screws in lengths recommended by wallboard manufacturer. USG "Super-Tite".

F. CONTROL JOINTS: Roll formed zinc with 1/4" open joint, and perforated flanges. Provide with fireseal backing at rated systems. ClarkDietrich Building Systems No. 093.

G. JOINT ADHESIVE: Premixed water based compound. USG taping joint compound.

H. LAMINATING ADHESIVE: Durabond sheetrock setting-type for double-layer application and column fireproofing.

I. JOINT REINFORCING: Center creased paper tape equal to "Perf-A-Tape".

J. TROWELED FIRESTOPPING
   1. System Type: A combination of glass fiber or mineral wool insulation packing material with troweled-on application of sealing compound.
   2. Sealing Compound: Red tinted compound job mixed with water providing protection from heat (to temperatures of 1850 degrees F), smoke, toxic gas, fire and water. "Sta-Smooth FS 90 Fire-Shield Compound Fire and Smoke Stop" as manufactured by National Gypsum Co. or approved equivalent by Domtar Gypsum, Inc.
   3. Approvals:
      a. Rated as noncombustible as defined by NFPA Standard 220 when tested in accordance with ASTM E 136 at Underwriters Laboratories.
      b. Meet all requirements of ASTM E 814 and UL 1479: Fire tests of through penetration fire stops.

K. CORNER GUARDS: Stainless steel surface mounted corner guards with beveled edge legs. 3” by 8’ lengths, as manufactured by American Specialties, Inc.

2.4 WALLBOARD

A. TYPICAL: 5/8" thick x 48" wide paper-faced gypsum panels, tapered long edges, lengths as required. U.L. listed and conforming to ASTM C-1396/C1396M-09a Standard Specification for Gypsum Board, Gold Bond BRAND Gypsum Board panels by National Gypsum Co. or equal.

B. WATER RESISTANT: 5/8" thick x 48" wide U.L. listed, Gold Bond BRAND XP Gypsum Board with Sporgard by National Gypsum Co. or equal. Comply with ASTM C-1396/C1396M-09a Standard Specification for Gypsum Board.

C. ACOUSTICAL: 5/8” thick x 48” wide, length as required. U.L. listed, “Gold Bond BRAND 5/8" SoundBreak XP Wall Board with Sporgard by National Gypsum Co. or equal.

D. IMPACT RESISTANT: 5/8” thick x 48” wide, length as required. U.L. listed, “Gold Bond eXP Interior Extreme IR Gypsum Panel by National Gypsum Co. or equal.

2.5 TILE BACKER BOARD

A. 5/8" thick x 48” wide, length as required, Gold Bond BRAND eXP Tile Backer by National Gypsum Co. or equal. Acrylic coated moisture and mold resistant gypsum panel for use as a substrate for tile applications in high moisture areas. Manufactured with enhanced moisture and mold resistant core and facer.

PART 3 - EXECUTION

3.1 PARTITION INSTALLATION

A. STUD SYSTEM ERECTION: Attach metal runners at floor and to structural elements with suitable fasteners spaced maximum 24" o.c. Position studs vertically, engaging floor track and runner at ceiling or structure. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners and existing construction elements.

B. Anchor all studs adjacent to door and window frames, partition intersections, and corners to ceiling and floor runner flanges. Securely anchor studs to jamb and head anchor clips of door or side-light frames by screw attachment. Over door and side-light frames, install horizontal runner with a web-flange bend at each end, and secure with one positive attachment per flange.

C. Install diagonal stud bracing above ceiling at strike side of door jambs and at other locations as indicated in the drawings. Secure to structure.

D. Follow stud manufacturer's recommendations for all framing construction and fastening.

3.2 WALL PANEL ERECTION

A. Apply gypsum panels vertically or horizontally. Position all edges over studs for vertical application; all ends over studs for horizontal application. Use maximum practical lengths to eliminate end joints. Fit ends and edges closely together. Stagger joints on opposite side of partition.

B. For single-layer vertical application of gypsum panels, space screws 12" o.c. in field of panels and 8" o.c. staggered along vertical abutting edges. For horizontal panel application, space screws 12" o.c. in field and along abutting end joints.

C. For double-layer screw attachment, space screws 16" o.c. for both layers. Apply both layers of gypsum panels vertically with joints in face layer offset from base layer joints. For 5/8" panels, use 1 " screws for base layer and 1-5/8" screws for face layers. For 1/2" panels, use 7/8" screws for base layer and 1-5/16" screws for face layer.

3.3 CHASE WALL ERECTION

A. Align two parallel rows of floor and ceiling runners spaced as indicated in the drawings. Attach to concrete slabs with powder actuated anchors 24" o.c. and to suspended ceiling tees or structure with suitable fasteners 24" o.c.

B. Position metal studs vertically in runners, 16" o.c., with flanges in the same direction and with studs on opposite sides of chase directly across from each other. Anchor all studs to floor and ceiling runner flanges with U.S.G. Metal Lock Fastener tool.

C. Cut gypsum panel bracing to be placed between rows of studs, 12" high by chase wall width. Space braces 48" o.c. vertically and attach to stud webs with screw fasteners. 2-1/2" metal studs may be used in lieu of gypsum panels. Anchor web at each end of metal brace to stud web with two 3/8" pan head screws.

3.4 CEILING FRAMING

A. GRILLAGE ERECTION: Space 8 gauge hanger wires 48" o.c. along carrying channels and within 6" of ends of carrying-channel runs. Wrap hanger around and through beams or joists. Install 1-1/2" carrying channels at 24" o.c. Position channels for proper ceiling height, level and secure with hanger wire saddle-bed along channel. Provide 1" clearance between runners and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to support. Overlap splices at least 8" and securely wire-fie each end with double-strand 16 gauge tie wire.

B. Erect metal furring channels at right angles to 1-1/2" carrying channels or main support members Space furring (16”) o.c. and within 6"of walls. Provide l" clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 16 gauge be wire. Overlap splices at least 8" and securely wire-tie each end with double-strand 16 gauge fie wire.

C. At light troffers or any openings that interrupt the carrying or furring channels, install additional cross reinforcing to restore lateral stability of grillage.

D. At rated ceilings meet all requirements of selected U.L. Design No.

E. METAL STUD CEILING FRAMING OPTION: Attach runners at ceiling height through gypsum panels to each partition stud with two screws. Insert metal studs in runners and attach each end with one 3/8" pan head screw. Install 1-5/8" stud cross-bracing over stud framing, space 48" o.c. and attach to each framing stud with two 3/8" pan head screws. At hangers, install 12" long stud section for box reinforcing or lap studs 12" and secure each end with two 3/8" pan head screws. At light troffers or any openings that interrupt the ceiling, install additional cross reinforcing to maintain structural integrity of framing.

F. GYPSUM PANEL ERECTION: Apply gypsum panels of maximum practical length with long dimension at right angles to furring channels. Position end joints over channel web and stagger in adjacent rows. Fit ends and edges closely. Fasten panels to channels with 1 ", Type S screws, spaced 8" o.c. in field of panels and 8" along ends and edges.

3.5 EXTERIOR WALLS: Reference Section 05 41 00.

3.6 ACOUSTICAL BATTS

A. Install unfaced full thickness acoustical fiberglass batts between studs at partitions as scheduled on the drawings. Fit batts tight to studs, tight to floor and head tracks and tight to one another. Batts shall run full height of partition unless indicated otherwise in the drawings.

3.7 ACOUSTICAL SEALANT

A. Install continuous bead of sealant at bottom tracks at drywall partitions.

B. Install vinyl foam double stick tape and sealant where head track terminates at ceiling.

C. See drawings for additional locations.

3.8 ACCESSORY APPLICATION

A. JOINT SYSTEM: Finish all face panel joints and corners with U.S.G. Joint System installed according to manufacturer's directions.
   1. Mix joint cement in strict accordance with manufacturers directions.
   2. Butter cement into joints filling them evenly and fully.
   3. Center tape and press down into cement leaving sufficient cement under tape for proper bond. Cover with thin coat of cement to fill recess between tape and board to bring material flush with surface.
   4. Face panels shall be cut fit around all wall outlets and switch boxes, utility lines, etc. All voids and cracks, occurring around all openings in board shall be taped and covered with joint cement.

B. LAMINATING ADHESIVE: Spread to provide 1/2" adhesive beads 4-1/2" o.c. for full sheet lamination. For strip lamination, apply adhesive in vertical strips of four 1/2" beads, 1-1/2" to 2" o.c. Space strips 24" o.c.

C. CORNER BEAD: Reinforce all vertical and horizontal exterior corners with corner bead fastened with 9/16" rosin-coated staples 9" o.c. on both flanges along entire length of bead.

D. METAL TRIM: At exposed edges of board or where board terminates against other materials, apply metal trim over panel edge and fasten with screws.

E. SCREWS: Power-drive at least 3/8" from edges or ends of panel to provide uniform dimple of 1/32" deep.

F. CONTROL JOINTS: Cut panel at joint and back with double framing members. Attach control joint to face layer with 9/16" rosin-coated staples spaced 6" o.c. on both flanges along entire length of joint. At rated walls, provide fireseal behind joint. Provide joints at 25' maximum or as otherwise indicated in the drawings.

G. CORNER GUARDS: Install as per manufacturer’s recommendations.

3.9 TROWELED FIRESTOPPING:

A. General: Install systems in complete accordance with manufacturers printed instructions and approved submittal for the required fire rating of the particular condition. Install firestopping systems at all penetrations and voids in all rated drywall ceilings and walls.

B. Through-penetrations. Ensure that pipe, conduit, duct, cables or other penetration element is rigidly supported by drywall framing on both sides of wall or ceiling assembly. Oversize opening in wall board to allow for required opening size and thickness of packing material in accordance with system and rating requirements. Install packing material in accordance with system requirements and compressed to allow for required thickness of sealing material. Trowel red-tint sealing material into void (same thickness as gypsum board) and smooth flush with both faces of drywall. Provide additional layer(s) of gypsum board around penetration where necessary to achieve required minimum thickness of sealing material.

C. Void-filling: For voids such as intersection of walls and smooth or corrugated deck, pack void with compressed packing material and trowel red-tint sealing material into void (same thickness as gypsum board) and smooth flush with both faces of drywall. Provide additional layer(s) of gypsum board around penetration where necessary to achieve required minimum thickness of sealing material.

3.10 WOOD BLOCKING: Coordinate with project carpenter to ensure installation of fire retardant wood blocking between studs for mounting casework, millwork, toilet partitions, drinking fountains and other equipment.

3.11 FINISHING SCHEDULE: Follow published "Recommended Specification: Levels of Gypsum Board Finish" as follows:

A. LEVEL 1 FINISH: At concealed areas above ceiling.

B. LEVEL 2 FINISH: At gypsum backing board to be covered with file or panels thicker than 1/4".

C. LEVEL 3 FINISH: At mechanical rooms, storage rooms, custodial and maintenance rooms, electrical and telephone closets.

D. LEVEL 4 FINISH: All other drywall areas scheduled for paint, fabric or vinyl wall covering.

END SECTION

SECTION 09 22 00 - PLASTER ACCESSORIES

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Related work specified elsewhere includes:
1. Rough carpentry.
2. Finish carpentry and millwork.
3. Metal support systems.
4. Furring and lathing.
5. Plaster.
6. Gypsum board systems.
7. Painting.
8. Wallcovering.

1.2 SUBMITTALS

A. Product data: Indicate product description, including compliance with specified requirements and installation requirements. Mark manufacturer's brochures to include only those products proposed for use.

1.3 QUALITY ASSURANCE

A. Applicable standards; standards of the following, as referenced herein:
1. Aluminum Association (AA).
2. American Society for Testing and Materials (ASTM).

B. Allowable tolerances in horizontal planes:
1. Variation from level: +1/8" in 12'-0".

2. Variation in plane of adjacent wallboard panels prior to joint treatment: 1/16".

C. Allowable tolerances in framed vertical construction.

1. Position: +1/4" maximum variation from design position.
2. Alignment: 1/8" in 8'-0"; 1/4" maximum in any continuous wall, line or surface.

3. Surface smoothness: No joint or fastener location, roughness or blemish discernible after application of finish when viewed at any angle from a distance of 5'-0" under occupancy lighting conditions, with surface preparation as specified in Painting section.

1.4 DELIVERY, STORAGE AND HANDLING

A. Storage:

1. Stack accessories off floor on pallets or similar platforms providing continuous support for accessories to prevent sagging. Stack accessories so that long lengths are not over short lengths.

2. Do not overload floor systems.

3. Handle materials to prevent damage to surfaces, edges and ends of sheet metal items. Reject and remove damaged material from site.

1.5 WARRANTY

A. Finish warranty: Warrant fluoropolymer coating to remain free, under normal atmospheric conditions, from peeling, checking, cracking, chalking in excess of numerical rating of 8 when measured in accord with ASTM D4214-98, of fading in excess of 5 N. B. S. Units during warranty period. Warranty period shall be 5 years, beginning at Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. Acceptable manufacturer; subject to compliance with specified requirements:

Fry Reglet Corporation.
625 S. Palm Ave.
Alhambra, CA 91803
Phone 800-237-9773 Fax 800-200-4397

B. Accessory systems of similar design and construction, as manufactured by other manufacturers, may be submitted for Architect's consideration. Acceptance is subject to compliance with specified design criteria, as evidenced by submittal of specified product data. Submittals shall comply with requirements of Product Options and Substitutions section.

2.2 MATERIALS AND FINISH:

A. Anodized finish:

1. Architectural 200R1 medium etch (AA-M32c10A21), clear color.

2. Thickness of anodic coating shall be tested in accord with ASTM B244-97 and sealed to pass modified dye stain test ASTM B136-84(1998).

B. Color anodized finish:

1. Two-step impregnated color Class II Architectural 0.40-0.70 mils (AA-M12C22A33).

2. Thickness of anodic coating shall be tested in accord with ASTM B244-97 and sealed to pass modified dye stain test ASTM B136-84(1998).

3. Color: As selected by Architect from manufacturer's standard color selection.

2.3 REVEALS:

A. Channel screed:
1. Acceptable product: Number PCS. DCS.

2. Characteristics: Screed shall provide reveal and control joint to plaster walls and Ceilings.
3. Description: Sc
b. Material: Extruded aluminum.
c. Dimensions: As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

B. 1/4" channel screed:
1. Acceptable product: Number PCS-75-25/25.
2. Characteristics:
3. Description: Screed provides narrow profile control joint.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.

C. "V reveal molding:
1. Acceptable product: Number PCSV-75.PCSV-75-Short
2. Characteristics:

a Description: Molding shall create a "V" shaped reveal.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.

D. "F" reveal molding:
1. Acceptable product: Number FDM. FPM.
2. Characteristics:
a. Description: Reveal molding shall form a trim reveal around doors or between walls and floors.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

E. "T" reveal molding:
1. Acceptable product: Number TRM
2. Characteristics:

a. Description: Molding shall provide a reveal at junction of dissimilar materials.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

F. Plaster key reveal molding:
1. Acceptable product: Number PRZ.
2. Characteristics:
a. Description: Molding shall provide termination and reveal at juncture of walls, plaster ceilings and soffits.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

G. Reveal molding:
1. Acceptable product: Number PRM.
2. Characteristics:
a. Description: Reveal shall provide termination and terminate juncture of walls, plaster ceilings and soffits.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

H. Contemporary reveal molding
1. Acceptable product: Number CDRMCVPR
2. Characteristics:
a. Description: Contemporary Reveal Molding provides an attractive vertical or horizontal recess in drywall or veneer plaster that creates the illusion the panels are “floating” in space.
b. Material: Extruded aluminum
c. Dimensions: As indicated on drawings.
d. Radius:__ As indicated on drawings.

2.4 CONTROL JOINTS:

A. 2-piece plaster control screed.
1. Acceptable product: Number DCS.PCS
2. Characteristics:
a. Description: Screed shall provide control joint in interior plaster and exterior stucco.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.

2.5 SOFFIT VENTS:

A. Soffit vents:
1. Acceptable product: DS.
2. Characteristics:

a. Description: Vent shall act as drip screed and provide ventilation to areas above soffit.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

B. 5/8" soffit vent:
1. Acceptable product: Number DS-875-5/8-V-300.
2. Characteristics:
a. Description: Vent shall function as drip screed and vent for areas above soffit and shall feature a 3/8" long bottom leg to support 5/8" soffit material.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

C. Soffit vent:
1. Acceptable product: Number DS-375-V-875.
2. Characteristics:
a. Description: Vent shall function as drip screed and vent for areas above soffit and shall separate soffit from fascia with reveal and add uniform edge to soffit/fascia joint.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

D. Soffit vent:
1. Acceptable product: Number DCS.PCS
2. Characteristics:
a. Description: Vent shall provide ventilation to areas above soffit, forming a reveal.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

E. Vented soffit molding:
1. Acceptable product: Number WPM.
2. Characteristics:
a. Description: Molding shall provide reveal and venting for soffits and screed point for applying stucco.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

F. Soffit vent E.I.F.S.:
1. Acceptable product: Number VFS.
2. Characteristics:
a. Description: Vent shall provide drip screed and ventilation to areas above soffit.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.

d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

2.6 E.I.F.S. MATERIALS:

A. E.I.F.S. channel screed:
1. Acceptable product: PCS.
2. Characteristics:
a. Description: Screed shall act as a 1/4" ground channel screed, control joint, and reveal details on exterior walls and soffits.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

B. E.I.F.S. soffit vent:
1. Acceptable product: Number PCS.
2. Characteristics:
a. Description: Vent shall provide ventilation in soffits.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

C. E.I.F.S. Clean Finish soffit vent:
1. Acceptable product: Number SV-75-V-300/EIFS.
2. Characteristics:
a. Description: Vent shall be applied after E.I.F.S. application is complete.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

D. Direct application E.I.F.S. soffit vent:
1. Acceptable product: Number DS.
2. Characteristics:
a. Description: Vent shall provide drip screed in stucco or synthetic E.I.F.S. finishes.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

E. E.I.F.S. soffit vent (Direct Applied):
1. Acceptable product: Number DRM.
2. Characteristics:
a. Description: Vent shall provide vent in direct applied E.I.F.S. substrates in soffits with an E.I.F.S. system.
b. Material: Extruded aluminum.
c. Dimensions: __ As indicated on drawings.
d. Radius: __ As indicated on drawings.
e. Ventilation: Provide horizontal vents for air movement.

F. E.I.F.S. soffit vent:

1. Acceptable product: Number VFS.
2. Characteristics:
   a. Description: Vent shall function as drip screed and provide ventilation to areas above soffit.
   b. Material: Extruded aluminum.
   c. Dimensions: __ As indicated on drawings.
   d. Radius: __ As indicated on drawings.
   e. Ventilation: Provide horizontal vents for air movement.

G. E.I.F.S. drip screed:
1. Acceptable product: Number DS.
2. Characteristics:
   a. Description: Screed shall join soffit and fascia while providing drip joint to prevent water stains on soffit and vertical wall of building.
   b. Material: Extruded aluminum.
   c. Dimensions: __ As indicated on drawings.
   d. Radius: __ As indicated on drawings.
   e. Ventilation: Provide horizontal vents for air movement.

2.7 FASTENERS:

A. Fasteners: Exposed fasteners (provided by installer) shall be countersunk and shall match accessories in color.
1. Aluminum to aluminum: Aluminum or Type 302 or 304 stainless steel.
2. Aluminum to stainless steel or carbon steel: Type 302 or 304 stainless steel.

2.8 FABRICATION:

A. Mounting holes: Provide mounting holes located at 8" o. c.

B Venting: Vent slots shall be 1" by 1/8" spaced 1-1/2" lengthwise. Each row of vent slots shall provide 1 square inch of free area per lineal foot.

C Make custom miters and intersections with welded corners or with high-strength industrial tape on backs.

D. Radius shapes shall be as indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install plaster accessories in accord with manufacturer's product data and as follows:
1. Corner trim: Install at designated corners.
2. Metal trim shapes: Install at exposed edge of wallboard at door and window openings, at intersections with other materials and at intersection of walls with ceilings.
3. Install corner beads and metal trim shapes to framing system with mechanical anchors spaced at 8" o. c.
4. Joint treatment: Finish joints and attachment flanges as specified in Plaster Stucco section.
5. Dust surfaces and leave ready for decoration. Joint and fastener treatment shall be indistinguishable in finished work.

3.2 PROTECTION

A. Protect accessories from damage until date of Substantial Completion. Replace accessories which become damaged.

END OF SECTION

SECTION 09 30 00 — WALL AND FLOOR TILE

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install all ceramic wall and floor tile and base as indicated in the drawings and specified herein.

B. Provide and install all quarry tile flooring and base as indicated in the drawings and specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Cast-in-place concrete.

B. Drywall systems.

C. Masonry.

D. Waterproofing and dampproofing.

1.4 SUBMITTALS

A. Per SUPPLEMENTARY GENERAL CONDITIONS, submit samples, type of tile and color for Architect’s approval. Mark with manufacturer’s name and space where tile is to be installed.

B. Submit manufacturer’s printed literature describing products.

C. Submit (2) boxes of tile chips showing full range of available colors.

D. Submit (2) boxes of grout color samples.

E. Submit 12” x 12” grouted sample board for each tile/grout combination selected.

F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to cracking, crazing, staining, joint spalling or cracking, loosening of bond.

1.6 QUALITY ASSURANCE

A. Tile Contractor shall have a minimum of 3 years experience in tile installation for projects of similar size and scope as this project.

B. Conform with all applicable requirements of the American Standards Association Specifications (A-108 Series) and the "Tile Handbook" of the Tile Council of America. Tile shall bear the seal of Tile Council of America, Inc., and be equal to or exceed Standard Grade.

1.7 DELIVERY & STORAGE

A. Deliver all manufactured materials in original, unbroken containers bearing name of manufacturer, brand and grade seal. Keep materials dry, clean and protected against deterioration in any form and at room temperature.

B. Maintain room temperature between 70 and 80 degrees F. 24 hours prior, during and a minimum of 48 hours after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. CERAMIC TILE:
1. American Olean
2. Dal-Tile

B. QUARRY TILE:
1. American Olean
2. Dal-Tile

C. GROUT:
1. American Olean
2. Laticrete
3. Tex Rite

2.2 MATERIALS

A. QUARRY TILE:

1. Floor Tile: Unglazed, slip resistant squared quarry tile.
   a. Water absorption: Classified "Impervious" per A.S.T.M. C-373. Less than 1/2 of 1% absorption.
   b. Size: Nominal 6" x 6" x 1/2" thick.
   c. Base: 6" high base. Bottom tile with integral cove (provide bullnose plastic edge strip at top of all tile base).
   d. Type: Quarry Tile in ***groups 1 through 2*** as selected by the Architect from one of the specified manufacturers.
   e. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.

B. TOILET ROOMS:
1. Floor Tile: Unglazed porcelain ceramic with cushioned edges and sheet backing.
   a. Water absorption: Classified "Impervious" per A.S.T.M. C-373. Less than 1/2 of 1% absorption.
   b. Size: Nominal 2" x 2" x 1/4" thick.
   c. Base: 4" high base. Bottom tile with integral cove.
   d. Type: Porcelain Tile in ***groups 2 through 3*** as selected by the Architect from one of the specified manufacturers.
   e. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.

2. Wall Tile: Glazed ceramic with cushion edges.
   a. Size: Nominal 4" x 4" x 1/4" thick.
   b. Base: See floor base.
   c. Type: ***Groups 3 through 4*** for field tile and for accent banding as selected by the Architect from one of the specified manufacturers.
   d. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.

3. Trim: Terminate tile with bullnose edges and rounded outside corners. Provide square inside corners and at ceiling/wall joints.

C. THINSET BOND COAT: Latex/Portland Cement mortar mix meeting requirements of ANSI A118.4. Provide Portland cement and sand in a 1 to 1 mixture gauged with Laticrete 4237 latex additive. Use on dry cured mortar bed at slab recesses, where thinset on concrete slab, and where thinset on wall substrates.

D. SEALANT: One part silicone rubber meeting requirements of FS TT-S-001543, as manufactured by Dow Corning or General Electric.

E. GROUT:
1. Walls: Portland Cement waterproof, dry set grout as manufactured by American Olean. Color(s) as selected by Architect.
2. Floor and base: Interior grout shall be epoxy type as manufactured by American Olean. Color(s) as selected by Architect.

F. SEALANT: One part silicone rubber meeting requirements of FS TT-S-001543, as manufactured by Dow Corning or General Electric.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine surfaces to receive tile and do not start work until defects that will adversely affect tile work have been corrected.

B. Inspect all surfaces to see that they are dry, clean, free of oily or waxy film, firm, level and plumb. Report any unsatisfactory conditions to the Architect. Starting installation shall be deemed as acceptance of surfaces.

C. Do not start until work of other trades, which goes through or in the space behind tile has been completed. Do not proceed with installation until adjoining work is satisfactory protected. Close off spaces in which tile is being set to traffic and other work during installation and for at least 48 hours after completion of tile work.

D. Do not apply mortar and adhesives to surfaces covered by frost. Maintain minimum temperature-for installation of tile above 50 Deg. F. Prevent rapid evaporation of moisture from mortar bed. Do not set tile on dry bed.

E. Install specified mortar bed at slab depressions. Slope mortar bed uniformly to drain(s).

3.2 INSTALLATION

A. GENERAL: Tile shall be installed in accordance with current Tile Council of America's "Handbook for Ceramic Tile Installation", design numbers as indicated below.

B. Center fields and patterns on applied areas so that no tile is less than half size. For heights stated in feet and inches, maintain full courses to nearest attainable height without cutting tile.

C. Except where otherwise shown or specified, make joints in wall tile vertical and horizontal and joints in floor tile perpendicular and parallel to walls. Control joint widths of glazed tile by lugs on the sides of tile. Control joints widths between sheets of ceramic mosaic tile by supporting boards with metal spacing strips.

D. Grind and fit tile carefully at intersections, against trim finish and at built-in fixtures and accessories. Fit tile closely around outlets, pipes, fixtures and fittings so that plates, escutcheons and collars will overlap cuts. Cut and drill tile and trim shapes accurately without damage. Rub all exposed cut edges smooth with abrasive stone.

E. Coat trim with 1/32 to 1/16" pure coat paste. Set in same mortar mix as is recommended for setting flat tile on walls. Do not use pure coat as mortar to set trim and angles.

F. FLOORS:
1. Interior thinset on concrete floor slab:
   a. Tile bonded with minimum 3/32" thick latex-Portland cement bond coat over cleavage membrane adhered to floor slab **(modified TCA F113).**
   b. Adhere cleavage membrane to slabin strict accordance with manufacturer's recommendations using specified latex-Portland cement bond coat. Increase typical curing time of bond coat by 50%.
2. Interior thin-set on recessed mortar bed: Tile bonded with minimum 3/32" thick Latex-Portland Cement bond coat to reinforced mortar bed over loose bond breaker membrane over floor slab **(TCA F111).**

G. WALLS:

1. Ceramic Tile at Drywall Toilets: Thinset to water resistant gypsum wallboard.
2. Ceramic Tile at Masonry: Bonded to mortar bed at masonry. No. **W211**.
3. 12" x 12" Porcelain – Up to 3 ft. High Wainscot: Install with mastic over drywall.
4. 12" x 12" Porcelain – Over 3 ft. High Wainscot: Thinset over tile backer board.

H. EXPANSION JOINTS:
1. At floor tile provide 1/4" sealant expansion joints in accordance with TCA recommendations where tile abuts walls, curbs, columns and other restraining surfaces, where substrate material changes, at floor slab construction joints (cold joints), and each way in pattern approved by the Owner.
2. At walls install sealant expansion joints at inside corners, at maximum 30', and at other conditions subject to cracking or movement. Install specified sealant at expansion and control joints, at doorframe perimeters and similar conditions.

3.3 LAYOUT

A. Layout all work so that no tiles less than half size occur. Align all joints vertically and horizontally.

B. Cut and drill neatly without marring tile. Rub smooth any necessary cuts with a fine stone and set no cut edge against any fixture, cabinet, or other tile without a joint at least 1/16" wide.

C. Maximum plane variation shall be 1/8" + or – in 10' when a straight edge is laid on the surface in any direction.

3.4 GROUTING AND SEALING:

A. Follow grout manufacturer's recommendations for grouting procedures and precautions. Damp cure non-epoxy grout in accordance with manufacturer's recommendations.

B. Grout Haze Removal:
1. Unglazed Tile: For cement grout remove all grout haze following grout manufacturer's recommendations for use of acid and chemical cleaners. Rinse tilework thoroughly with clean water before and after chemical cleaners. Polish surface of tilework with soft cheesecloth.
2. Glazed Tile: For cement grout remove all grout haze with cheesecloth rub.
3. Take special care with epoxy grout to keep tiles clean as work progresses.

3.5 PROTECTION

A. Protect tiled floors from foot and wheel traffic for at least 7 days after installation.

B. Place plywood panels over traffic floors.

C. In non-traffic areas, cover floors with heavy paper taped in place.

D. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of tile installed.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install all lay-in acoustical ceiling panels and suspended grid system in accordance with the drawings and as specified herein.

B. Provide and install light fixture protection at all rated ceilings.

C. Provide and install hold-down clips where required for rated system.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Steel joists (spacing)

B. Mechanical (air devices)

C. Electrical (lighting fixtures)

1.4 DRAWING REFERENCES

A. See drawings, finish schedule and Section 2.2 for ceiling types and ratings.

1.5 SUBMITTALS

A. Submit manufacturer's product data describing all materials, finishes, ratings and installation requirements.

B. Submit physical samples for each type of acoustical file proposed.

C. Submit physical samples for each type of grid proposed.

D. Submit tile manufacturer's certification for whether hold-down clips are required for the selected tile(s) and rated system(s).

E. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.6 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to rusting or deflection of grid, deterioration or deflection of acoustical tiles.

1.7 QUALITY ASSURANCE

A. Suspended acoustical ceiling contractor shall have a minimum of 3 years experience in the installation of specified systems for projects of similar size and scope of this project.

B. Installation of acoustical tile and panels shall not begin until residual moisture from plaster, drywall, concrete or terrazzo work is dissipated. Before installation, the building shall be enclosed and permanent heating and cooling equipment in operation.

1.8 DELIVERY AND STORAGE OF MATERIALS

A. Do not deliver materials to jobsite until spaces are ready for ceiling installation.

B. All materials shall be delivered in manufacturer's original packaging and stored in an enclosed shelter providing protection from damage and exposure to the elements.

C. Damaged, rusted or deteriorated materials shall be removed from the premises.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. TYPICAL CEILING PANELS:
1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.

B. SPECIALTY CEILING PANELS
1. Acoustical Resources, Inc.
2. Wenger
3. U.S.G.

C. GRID SYSTEMS:
1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.
3. Chicago Metallic Corp.

2.2 MATERIALS:

A. TYPICAL CEILING PANELS:

1. 24" x 24" x 5/8" white **"Cortega Square Lay-in" No. 770**, square-edged as manufactured by Armstrong or equivalent (color, pattern, texture) by specified manufacturer. **Non-rated system.**

B. SUSPENSION SYSTEM:

1. Components shall be formed from commercial quality cold-rolled steel, electro-galvanized, 2'x2' module.

2. The suspension system shall support the ceiling assembly with a maximum deflection of 1/360 of the span per A.S.T.M. C-635-69.

3. Main tee with double web design 1-1/2" high and rectangular bulb; 15/16" exposed flange with rolled cap; cross tee holes at 6" o.c.

4. Four foot cross tee 1-1/2" high with double web design. Rectangular bulb joining main runners at 2' on center.

5. Two foot cross tees perpendicular to 4' cross tees. Two foot cross tees minimum of 1-1/2" high, No. CMC 222-41 or equivalent by specified manufactured.

6. Wall molding - hemmed edge, electro-galvanized cold rolled steel with equal leg width, finish to match grid.

7. Finish: Typical finish, factory white painted steel. At high humidity areas including kitchens, dressing rooms, toilet rooms provide factory white painted aluminum cap.

8. Rating: Provide U.L. listed grid for scheduled system rating.

PART 3 – EXECUTION

3.1 COORDINATION

A. Verify that above ceiling work, including fire dampers, ductwork, piping, wiring and insulation is complete and approved prior to beginning ceiling work.

3.2 INSTALLATION

A. Ceiling systems shall be suspended from structural members by 12 gauge annealed wire; spacing as recommended by manufacturer. Provide additional support for light fixtures and grilles at each corner. Provide secondary support framing ("Unistrut") where spacing of structural members exceeds suspension system manufacturer's recommendations.

B. Acoustical lay-in panels shall be installed in strict accordance with the manufacturer's instructions. Tile shall be installed with fissures or pattern all in same direction.

C. Provide additional hangers at ceiling suspended items including projection screens, speakers, exit lights, air supply and return grilles.

D. Space main runner hangers a maximum of 6 inches from wall. Do not support systems from wall.

E. Adjust hangers to ensure level ceiling in plane.

3.3 RATED CEILINGS

A. Provide specified ceilings in fire rated assembly. Protect light fixture protection in accordance with approved U.L. Design to meet required assembly rating. Provide additional hangers to meet the requirements of the particular U.L. rating.

B. Ceiling system manufacturers not listed in the required U.L. design number (reference drawings) shall be responsible for determining whether their rated system is acceptable to the particular local code authority.

C. For ceiling tiles weighing 1 lb. per square foot or more, verify no requirement for hold-down clips at rated systems.

3.4 CLEANING AND REPLACEMENT

A. At completion, replace file unit and grid systems that are damaged. Clean or replace tile and grid systems that cannot be cleaned.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of ceiling tile installed.

END OF SECTION

SECTION 09 64 66 – WOOD GYMNASIUM FLOORING

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 DESCRIPTION

A. Related work specified under other sections.

1. CONCRETE SUBFLOORS - SECTION 03 30 00
   a. Slab depression: 2-1/8” for 25/32” flooring including 7/16” pads. The general contractor shall furnish and install the concrete subfloor depressing the slab sufficiently to accommodate the floor system. The slab shall be steel troweled and finished smooth to a tolerance of 1/8” in any 10’ radius by the general contractor. High spots shall be ground level, and low spots filled in with approved leveling compound by the general contractor to the full approval of the installer (Flooring Contractor).

2. MEMBRANE WATERPROOFING - SECTION 07 10 00
   a. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on earth side of below grade walls by general contractor using suitable type membrane.

3. GAME STANDARD INSERTS – provided and installed by gym floor installer.

1.2 REFERENCES

A. MFMA - Maple Flooring Manufacturers Association
B. DIN - Performance Standard DIN 18032, Part 2.

1.3 QUALITY ASSURANCE

A. Manufacturer
   1. Manufacturer of resilient flooring shall be a firm specializing in manufacturing products specified in this section.
   2. Manufacturer of flooring and subfloor components must be ISO 9001:2008 Certified to assure quality control of materials provided.
   3. Manufacturer of gymnasium floor system and hardwood flooring surface shall be verified as a “Zero Waste” company confirmed through SWCA third-party auditing.
   4. Basis of design shall be “Rezill Panel” sports floor system as provided by Connor Sports Flooring, www.connorfloor.com, (800-833-7144).
   5. Materials other than those listed must be approved by written addendum.

B. Installer
   1. The complete installation of the flooring system, as described in the scope of these specifications, shall be carried out by an experienced installer (Flooring Contractor), and the work shall be performed in accordance with most recent installation instructions of the manufacturer.
   2. Installer shall be liable for all matters related to installation for a period of one year after the floor has been substantially installed and completed.

C. Performance Testing
   1. Flooring system shall have been independently tested and evaluated for Athletic Performance according to the International Standard DIN 18032, Part 2.
   2. Flooring system shall have been independently tested and evaluated for Engineering Performance according to the Structural Testing and Engineering Measures (STEM).

1.4 SUBMITTALS

A. Specification - Submit Manufacturer's specification sheets.
B. Sample - Submit one sample of specified system.
C. Submit certification that floor system to be provided has been tested by an independent agency veryfing the flooring system meets or exceeds all six of the minimum standards as established by DIN 18032, part 2.
D. Maintenance Literature - Upon completion of floor installation, send to owner, attendants or individuals in charge and responsible for the upkeep of the building a CARE CARD. This card spells out care and maintenance instructions including temperature and humidity ranges for areas where flooring is installed.

1.5 WORKING CONDITIONS

A. The wood flooring specified herein shall not be installed until all masonry, painting, plaster, tile, marble and terrazzo work is completed, and overhead mechanical trades and painters have finished in the wood floor areas. The building shall be enclosed and watertight.
B. The concrete subfloor shall be determined dry by industry standard testing procedures, free of foreign materials and turned over to the installer broom clean. Moderate room temperature of 65 degrees or more shall be maintained a week preceding and throughout the duration of the work. Humidity conditions within the building shall approximate the humidity conditions that will prevail when the building is occupied.
C. Permanent heat, light and ventilation shall be installed and operating during and after installation, maintaining a range of temperature and humidity compatible with the expected low and high moisture content of the flooring. The wood moisture content range is determined by the flooring contactor based on the facility's mechanical controls and/or geographical location.
D. Flooring must be stored in a dry, well-ventilated area, not in contact with masonry, to acclimate to building conditions and shall be installed at moisture content compatible with the normally expected environmental range of temperature and relative humidity achieved while the facility is occupied.
E. General Contractor shall lock floor area after floor is finished to allow proper curing time. If general contractor or owner requires use of gym after proper curing time, he shall protect the floor by covering with non-marring Kraft paper or red rosin paper with taped joints until acceptance by owner of complete gymnasium floor.
F. Working conditions as described above shall be followed. Variations and substitutions shall be submitted for approval to the Architect.

1.6 HUMIDITY CONTROL

A. Since all wood flooring will expand and contract as relative humidity varies, it is important to minimize extremes between low and high. Hardwood flooring is manufactured at moisture content most compatible with a 35%-50% relative humidity range. Geographical regions and available mechanicals determine the typical range of temperature and humidity for each facility. Maintaining a 15% fluctuation between highest and lowest average indoor relative humidity provides limited shrinkage and growth. Facility managers should make use of available HVAC systems to prevent excessive tightening and shrinkage of flooring.

1.7 WARRANTY

A. Manufacturer warrants that the materials it has supplied will be free from manufacturing defects for a period of one year. The foregoing warranty is in lieu of and excludes all other warranties not expressly set forth herein, whether express or implied in operation of law or otherwise, including, but not limited to, any implied

warranties of merchantability or fitness. This warranty is expressly limited to the flooring materials (goods) supplied by the manufacturer. This warranty does not cover floor damage caused (wholly or in part) by fire, winds, floods, moisture, other unfavorable atmospheric conditions or chemical action, nor does it apply to damage caused by ordinary wear, misuse, abuse, negligent or intentional misconduct, aging, faulty building construction, concrete slab separation, faulty or unsuitable subsurface or site preparation, settlement of the building walls or faulty or unprofessional installation of specified manufacturer flooring systems.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers
   1. Connor Sports Flooring
   2. Robbins Sports Surfaces
   3. Aacer Flooring
   4. Action Floor Systems

B. Substitutions: Shall be in accordance with Section 01 25 00.

C. Vapor Barrier - 6-mil polyethylene.

C. Resilient Pads
   1. Manufacturer's 7/16" x 2" x 2" resilient pads

D. Subfloor - 2 layers of 15/32" x 4'x 8' APA rated plywood (or Flooring Manufacturers approved equivalent) sheathing, Exposure 1.

E. Flooring (Connor Laytite Maple or manufacturer's approved equivalent)
   1. 25/32" x 2-1/4", Second & Better Grade, Northern Hard Maple Flooring, TGEM, MFMA Grade marked and stamped as manufactured by Connor Sports Flooring, Amasa, MI. or manuf. approved equivalent.

F. Fasteners
   1. Flooring Fasteners - 2" barbed cleats or coated staples.
   2. Subfloor Fasteners - 1" staples or equivalent.

G. Finish Materials – Manufacturer's oil modified polyurethane sealer and finish.

H. Game Lines - Game line paint shall be recommended by the finishing materials manufacturer and must be compatible with the finish.

I. Wall Base - 3" X 4", heavy duty, molded, vented cove base with pre-molded outside corners.

PART 3 - EXECUTION

3.1 EXECUTION

A. Inspect concrete slab for proper tolerance and dryness. Report any discrepancies to general contractor and architect in writing.
B. Concrete slab shall be broom cleaned by general contractor.
C. Installer (Flooring Contractor) shall document all working conditions provided in General Specifications prior to commencement of installation.

3.2 INSTALLATION

A. Subfloor
   1. Cover concrete with poly, sealing and lapping joints a minimum of 6”.
   2. Subfloor
      a. Install lower layer of subfloor perpendicular to finish maple flooring, spacing all edges 1/4" and staggering joints 4’. Provide 1-1/2” expansion voids at perimeter and at all vertical obstructions. The underside of first layer shall have resilient pads attached 12” on center (32 per sheet) and 6” from edges on all sides. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
      b. The second layer of subfloor shall be laid at a 45-degree angle over the first layer, 1/4" spacing at all edges and stagger joints 4’. Provide 1-1/2” expansion voids at perimeter and at all vertical obstructions. Attach second layer of subfloor with fasteners 12” on center.

B. Maple Flooring
   1. Install maple flooring by power nailing or stapling approximately 12” on center with end joints properly driven up.
   2. If required, size joints between flooring strips to allow for intermediate expansion in accordance with local humidity conditions.
   3. Provided 1-1/2” expansion voids at perimeter and at all vertical obstructions.

3.3 FINISHING

A. Maple Flooring
   1. Machine sand with coarse, medium, and fine paper to a smooth, even and uniform surface.
   2. Remove sanding dust from entire surface by tack or vacuum.
   3. Inspect entire area of floor to insure that surface is acceptable for finishing, clean and completely free from sanding dust.
   4. Apply two (2) coats of approved seal and two (2) coats of approved finish per manufacture’s instructions.
   5. Buff and clean floor between coats.
   6. Games Lines: Apply game lines and logos as indicated on drawings, between seal and first coat of finish.

3.4 BASE INSTALLATION

A. Install vent cove base to walls with base cement or screws. Use pre-molded outside corners and mitered inside corners.

3.5 CLEANING

A. Remove excess and waste materials from the area of work.

END OF SECTION

SECTION 09 65 13 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.

B. Related Sections:
   1. Section 09 65 19 Resilient Floor Tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Product Schedule: For resilient products.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 – PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. Armstrong World Industries, Inc.
      b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      c. Johnsonite.
      d. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TS (rubber, vulcanized thermoset).
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch (3.2 mm)

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: Matte.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:
   1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. Johnsonite.
      b. Roppe Corporation, USA.
      c. Burke Mercer Flooring Products

B. Description: Provide as required for complete installation
   1. Carpet edge for glue-down applications,
   2. Nosing for carpet
   3. Nosing for resilient floor covering
   4. Reducer strip for resilient floor covering
   5. Joiner for tile and carpet
   6. Transition strips.

C. Material: Rubber.

D. Profile and Dimensions: Manufactures standard profile and dimensions.

E. Colors and Patterns: As selected by Architect from manufacturer’s full range.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and

substrate conditions indicated.

1. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of [carpet] [resilient floor covering] that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 09 65 19 - RESILIENT FLOOR TILE

PART 1 – GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUMMARY

A. Section Includes:
   1. Luxury vinyl tile (LVT).

B. Related Sections:
   1. Section 09 65 13 "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.
C. Samples for Initial Selection: For each type of floor tile indicated.
D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 – PRODUCTS

2.1 LUXURY VINYL TILE (LVT)

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Mohawk Group (Basis of Design)
   2. Mannington Mills, Inc.
   3. Bolyu

B. Tile Standard: ASTM 1700, Class III, Type A

C. Gauge: 0.10” (2.5mm)

D. Wear layer: 20 mil (0.5mm)

E. Size: The following sizes are basis of design. Variations to these shall be submitted for review and approval 10 calendar days PRIOR to bid date. To be considered as equal to basis of design, substitute products must approximate pattern and color line of the LVT specified above. Requests for substitutions that do not submit complete, straightforward, and referenced information for product comparison will be considered non-responsive and rejected without further notice. Basis of Design as follows:
   1. Global Entry Collection - Matuto at Offices, Lobby & Hallways: 12” X 24”

F. Colors at Offices, Lobby, Hallways: Refer to drawings for patterns and layouts. Colors to be selected by the Architect.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
   1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
   2. LVT Adhesive shall be from manufacturer’s products as required and installed in accordance with manufacturer’s requirements.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture

content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
   a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Floorstone as required to achieve working conditions.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) and in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
   1. Apply five coats.

E. Cover floor tile until Substantial Completion.
   1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of tile installed.

END OF SECTION

SECTION 09 91 00 – PAINTING AND FINISHING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide all labor, materials, and equipment required for all painting, staining and finishing as indicated in the drawings, the approved submittals, and as specified herein. Painted or stained systems include but are not necessarily limited to the items listed below:

B. EXTERIOR SYSTEMS:

1. All visible wood unless noted otherwise.
2. All ferrous metal. All galvanized metal unless noted otherwise. Touch-up on welds or damaged finishes.
3. Exposed conduit, piping, etc., except for roof mounted piping not visible.
4. Exposed roof mounted equipment visible from ground level or from upper floors of the building.
5. All exposed concrete masonry units.
6. All items normally painted in accordance with good construction practice.

C. INTERIOR SYSTEMS:

1. All visible wood or behind cabinet doors unless noted otherwise.
2. All ferrous metal. All galvanized metal unless noted otherwise. Touch-up on welds or damaged finishes. Structural steel, steel joists and deck exposed to view except in mechanical rooms.
3. Exposed conduit, piping, outlet boxes, raceways, and panel boxes except galvanized or aluminum piping located in mechanical or electrical rooms.
4. All exposed concrete masonry units, gypsum board and plaster unless otherwise noted.
5. All factory-primed hardware. Back-priming of all wood trim, millwork or finished carpentry prior to installation.
6. All hollow metal doors and frames.
7. All items normally painted in accordance with good construction practice.
8. All unfinished louvers and grilles.

1.3 WORK TYPICALLY EXCLUDED

A. Shop applied primer on structural steel and miscellaneous metals items.

B. Aluminum frames, doors, and windows.

C. Plastic clad casework, millwork, and wall panels.

D. Factory finished equipment unless noted otherwise (provide job touch-up).

1.4 DRAWING REFERENCE: Reference any paint or finish notes in the drawings for any pre-selected colors or other requirements.

1.5 SUBMITTALS

A. Submit manufacturer's product data describing each proposed type of paint, sealer, stain, or coating and it's recommended use. Include viscosity and percent solids information. Where not the specified base manufacturer, list the specified brand name and type and the proposed substitute. The Architect shall be the sole judge as to equivalency of systems.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.6 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of two years after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to peeling, crazing, cracking, blistering, mildewing, chalking or dusting, pin holes, color fade or loss of hardness or sheen.

1.7 QUALITY ASSURANCE

A. Painting contractor shall have a minimum of 5 years experience in the application of the specified systems for projects of similar size and scope as this project.

B. If requested by the Architect, provide system manufacturer's certification of the proposed painting contractor as approved for application of the product.

1.8 DELIVERY, STORAGE AND HANDLING

A. Do not deliver painting materials to the jobsite until spaces and surfaces are ready for painting.

B. Deliver materials in manufacturer's original containers, unopened except for shop mixing of colors. Containers shall bear manufacturer's readable labels indicating brand and type of paint. Any additional containers with labels indicating products not approved shall be removed form the jobsite. Any applied material not previously approved by the Architect is subject to removal and reapplication with the appropriate approved product.

C. Store materials in environmentally controlled area. Interior products shall be acclimated to a temperature range of 50-80 degrees F. at least 24 hours prior to application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. TYPICAL PAINTS: Systems are based on the first listed manufacturer. Only equivalent systems provided by specified manufacturers in accordance with attached Product Comparison sheet and as approved by the Architect are approved for use.

1. Sherwin Williams, Inc.
2. Pittsburgh Paints
3. Benjamin Moore Co.

B. SPECIALTY PAINTS:

1. Epoxies: Sherwin Williams, PPG.

C. SUBSTITUTIONS: In accordance with Section 01 25 00 Substitution Procedures.

2.2 INTERIOR SYSTEMS

A. SYSTEM TYPES FOR NEW WALLS (Unless indicated otherwise on Finish Schedule or drawings):

1. Drywall in toilet rooms, storage rooms, and mechanical/electrical/toilet rooms/ classrooms: **Semi Gloss Enamel** at walls and ceilings.
2. Drywall soffits: **Eggshell Enamel**.
3. Typical masonry (CMU): **Gloss Enamel.**
4. Masonry (CMU) in toilet rooms: **Gloss Epoxy.**
5. Steel railings: **Gloss Aliphatic Urethane.**

B. SYSTEM DESCRIPTIONS:

1. Primer on gypsum board: SW PrepRite High Build Primer B28W601 – one coat over light to medium texture (submit texture sample for approval)
2. Eggshell Enamel on Drywall: SW Pro Mar 400 Latex Eg-Shel B20W4400 – one coat over specified primer.
3. Semi-Gloss Enamel on Drywall: SW Pro Mar 400 Latex Semi Gloss B31W4400 - one coat over specified primer.
4. Epoxy Paint on Drywall: One coat SW PrepRite 200 Latex Primer B28W200 over specified primer.
5. Gloss Enamel on Drywall: Two coats SW Water Based Catalyzed Epoxy B70 Series gloss acrylic over specified primer.
6. Semi-Gloss Enamel on shop-primed metals: SW Water Based Industrial Enamel B53-300 acrylic gloss Enamel – two coats.
7. Natural Finish on Wood: SW Sherwood BAC Wiping Stain (one coat) + SW Wood Classics Sanding Sealer B26V3 (one coat) + SW Wood Classics Satin Varnish A66.
8. Clear Finish on Wood: SW Wood Classics Polyurethane Varnish A67 (two coats). Sand lightly between all coats.
9. Block Filler: SW Prep Rite Block Filler B25W25 (for areas not subject to moisture); SW Heavy Duty Block Filler (for areas subject to moisture). Provide 2 coats as specified under “Execution”.
10. Gloss Enamel on CMU or concrete: Two coats block filler plus two coats SW Water based Industrial Enamel gloss acrylic latex over specified primer.
11. Semi-Gloss Enamel on CMU or concrete: Two coats block filler plus two coats SW Water Based Industrial Enamel semi-gloss acrylic latex over specified primer.

12. Semi-Gloss Epoxy Paint on concrete: One coat SW Water Based Epoxy semi-gloss over cured concrete plus finish coat of SW Water Based Epoxy semi-gloss. Minimum paint thickness 3.0 dry mils.
13. Gloss Epoxy Paint on CMU: Two coats block filler (unless surface-bonded) plus finish coat of gloss. Minimum paint thickness 3.0 dry mils.
14. Gloss Epoxy Paint on concrete: One coat SW Water Based Epoxy gloss over cured concrete plus finish coat of SW Water Based Epoxy gloss. Minimum paint thickness 3.0 dry mils.
15. Semi-Gloss Enamel on utility piping and galvanized metals: SW Pro-Cryl Universal Metal Primer – one coat + SW DTM Acrylic Semi Gloss – two coats.
16. Semi-Gloss Epoxy Paint on CMU: Two coats block filler plus finish coat of SW Water Based Epoxy semi-gloss. Minimum paint thickness 3.0 dry mils.
17. Gloss Aliphatic Urethane Enamel on primed steel railings: Over epoxy shop primer apply two coats SW Hydrogloss Single Component Water Based Urethane B65-181 Urethane Gloss Enamel using airless spray equipment.
18. Dry Fall Acrylic (exposed deck, structure and rigging): One coat SW Super Save Lite Acrylic Dry Fall Eggshell Primer & Finish. Black color. Overspray dries to non-adhering dust in a ten foot fall.

2.3 EXTERIOR SYSTEMS

A. SYSTEM TYPES:

1. Exterior Metals: **Gloss Enamel.**
2. Field welds: **Zinc-Rich Coating.**

B. SYSTEM DESCRIPTION:

1. Gloss Enamel on Galvanized Metals: SW Pro-Cryl Universal Metal Primer B66W310 (one coat) + SW Sher-Cryl HPA B66-300 enamel – two coats.
2. Block Filler on CMU: SW Heavy Duty Block Filler B24W46, one coat.
3. Gloss Enamel on Shop-Primed Metals: SW Sher-Cryl HPA B66-300 gloss enamel-two coats.
4. Gloss Enamel on Aluminum: SW Pro-Cryl Universal Metal Primer B66W310 – (one coat) + SW Sher-Cryl HPA B66-300 gloss enamel – two coats.
5. Field Welds: "ZRC" cold-applied galvanizing.

PART 3 - EXECUTION

3.1 PREPARATION

A. METALS: Remove grease, oil, and dirt. Touch-up any damaged primer with like material. Remove any welding tags and grind smooth before painting. Fill any open galvanizing ports.

B. PLASTER, CMU, CONCRETE: Remove dusting and mortar residue. Remove any efflorescence and seal. Ensure that plaster, concrete and mortar joints are dry and fully cured.

3.2 APPLICATION

A. GENERAL: All paint and finishes be brushed or sprayed in even, uniform coats without runs or sags. Allow each coat to dry completely before applying succeeding coats. All surfaces shall be dry and no painting shall be done in damp conditions or when the ambient temperature is below 50 degrees F.

B. WOOD DOORS: Factory sealed tops, bottoms, and edges of plastic laminate surfaced doors left undisturbed require no additional finishing. Reseal any job cuts. Paint metal glazing stops.

C. MECHANICAL/ELECTRICAL EQUIPMENT: Painting contractor shall examine the mechanical and electrical drawings to determine quantities and locations of exposed piping, louvers not shown in Architectural drawings, electrical and telephone panels in finished areas, exposed electrical conduit in finished areas.

D. BLOCK FILLER AT CMU: Apply **first coat** of filler to ensure penetration into voids and work into block texture with bristle brush. Follow with a **minimum of one additional coat.** Provide uniform finish with no pinholes.

E. DRYWALL: Paint finish, sheen and texture shall be uniform and match the samples submitted to and approved by the Architect.

PART 4 – SCHEDULES

4.1 COLOR SELECTIONS

A. SCHEDULE: Unless colors are pre-selected in the Bidding Documents, the Architect shall prepare color schedule for the project using colors selected from the approved paint manufacturer(s). Where colors are pre-selected, the painting contractor shall use the colors selected or submit a schedule of proposed exact color matches by one of the specified paint manufacturers. Provide 12” x 12” samples of actual paint for each color whether pre-selected color or proposed color match.

B. DOCUMENTATION: Upon completion of the Project, painting contractor shall furnish to the Architect a complete schedule of paint brands, types, and colors actually used for each room and area.

4.2 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color (field and accents) of paint used.

END OF SECTION

SECTION 09 96 53 - ELASTOMERIC COATING

PART 1 – GENERAL

1.0 Coordination

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 Description

A. Provide internally plasticized, elastomeric high-build waterproof emulsion coating with terpolymer acrylic resins coating for vertical applications for sealing exterior exposed masonry walls.

1.2 Submittals

A. Submit for approval samples, product data.

1.3 Quality Assurance

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for five years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Elastomeric Coating:
   1. DOWSIL™ AllGuard Silicone Elastomeric Coating as manufactured by Dow Corp.
   2. Acrylic Clear Elastomeric Coating as manufactured by EPDM Coatings.
   3. TREMGard HB Elastomeric Acrylic Wall Coating as manufactured by TREMCO.

B. Color:
   1. Clear

PART 3 - EXECUTION

3.1 Installation

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials with uniform appearance.

B. Coordinate with work of other sections.

C. Surface Preparation:

1. Masonry: Masonry, concrete and stucco surfaces should be clean and free of oil and grease. Remove loose particles, laitance, efflorescence, and other foreign materials by wire brushing, power washing, or other effective means. Surface with heavy chalk face should be power-washed or sand blasted. Repair all cracks, openings, and imperfections with one-part urethane sealant.

2. Concrete Block: Concrete block should be clean and dry. Mortar joints should be free of voids and cracks.

D. Application:

1. Roller Application: Spread Rate: 1-1/2 gallons/100 sq. ft. or as per manufacturer’s recommendation.

2. Spray Application: As per manufacturer’s recommendation.

3.2 CLEANING

A. As work proceeds and upon completion of areas, remove coating where spilled, splashed or spattered.

B. During progress of work keep premises free from accumulation of tools, equipment, surplus materials.

C. Upon completion of work, leave premises neat and clean, to the satisfaction of the Owner.

END OF SECTION

SECTION 10 11 23 – TACK BOARDS

PART 1 – GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SUMMARY

A. Perform all work required to complete the bulletin boards, and marker boards indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

B. The requirements of Division 0 – "Bidding and Contract Requirements" and Division 1 – "General Requirements" of this Project Manual shall apply to all Work required for this Section.

1.02 SUBMITTALS

A. SAMPLES:
   1. Submit for approval samples of typical accessories showing construction and finish specified.

B. SHOP DRAWINGS:
   1. Submit manufacturer's literature and mark sufficiently to indicate compliance with these specifications. Show locations, methods of supporting, methods of anchoring and finishes of each accessory.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Material manufacturer by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.

   1. Claridge Products and Equipment, Inc.
   2. Newline

2.02 MATERIALS

A. TACKBOARDS: Fabri-cork tacking surface on 1/4" cork, 1/4" hardboard; overall 1/2" thick; wt. 2 1/2" lbs./sq. ft.; colors to be selected from manufacturer's standard colors. **Size: 4' x 8'.**

B. LOCATION: At Room No. 106 Lobby. Refer to drawings for exact location.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings. Install accessories plumb, square, level and true with wall or surfaces.

B. Frames of recessed accessories shall neatly trim the opening. Gaps and voids between frames and finished walls will not be allowed. Exposed and concealed fasting shall match finish or fixtures and shall be stainless steel, theft proof type.

C. Install concealed anchor plates to wall construction for mounting. Provide grounds or rough bucks, where required, to rigidly secure accessories.

3.02 CLEANING

A. Remove all manufacturer's temporary labels or marks of identification. Clean and polish to remove all oil, grease, and foreign material. Leave in a neat, orderly and clean condition acceptable to the Architect.

END OF SECTION

SECTION 10 14 00 — GRAPHICS AND SIGNAGE

PART 1 - GENERAL

1.1 COORDINATION:

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Material and installation for the Plastic Room Identification Plaques.

B. Material and Installation for Exterior/Interior Building Identification Letters.

C. Material and Installation For Building Dedication Plaque with logos (including but not limited to conversion of architectural drawings into useable vector line art format).

D. Material and Installation for custom City of Edinburg logo (including but not limited to conversion of architectural drawings into useable vector line art format).

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Interior wall materials and finishes.

B. Exterior wall materials and finishes.

C. Typical handicapped site signage.

1.4 SUBMITTALS

A. Submit manufacturer’s product data describing materials, and mounting methods for Room Identification Plaques, Exterior/Interior Building Identification Letters, and Building Dedication Plaque.

B. Submit color samples of actual material for color and finish selection by Architect.

C. Submit finished sample of room identification plaque(s) with any required symbols other than text.

D. Submit paper “rubbing” of final layout of Building Dedication Plaque for Architect’s approval.

E. Submit full size paper layout of Exterior/Interior Building Identification Letters for each line of text.

F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to color fading, delamination, failure of anchoring or fastening, cracking, breaking or tarnishing.

C. Exterior signage or building letters contributing to streaking or staining of building shall be a defect to be corrected by the Contractor, with building materials cleaned or replaced as required.

1.6 QUALITY ASSURANCE

A. Fabrication and installation company shall have a minimum of 3 years experience in the installation of similar systems for projects of similar size and scope.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to the jobsite until surfaces are ready for installation of graphics.

B. Store materials in covered, dry, temperature and humidity controlled space.

2 PART TWO – PRODUCTS

2.1 MANUFACTURERS

A. ROOM IDENTIFICATION PLAQUES:
1. Corpus Christi Stamp Works
2. Sign International
3. Multi-Graphics Incorporated

B. EXTERIOR BUILDING IDENTIFICATION LETTERS:
1. A.R.K. Ramos
2. Gemini Inc.
3. Matthews Architectural Products
4. Sign International

C. BUILDING DEDICATION PLAQUE:
1. A.R.K. Ramos
2. Matthews Architectural Products
3. The Southwell Co.
4. Sign International

2.2 MATERIALS

A. ROOM IDENTIFICATION PLAQUES:
1. 6” X 9” X ¼” thick two tone series:
2. Fabrication: Constructed of Wilson Art face laminate (as selected by the Architect from manufacturer’s standard selections) laminated to a solid acrylic core. The raised 1/32” acrylic copy

shall be cut through the laminate face color and chemically welded to the acrylic core to assure permanent attachment, including the symbols. Any lower and secondary copy shall be 5/8" high Helvetica Medium (all caps) incised copy paint filled. Colors as selected by the Architect. Any secondary copy shall be 8-stroke computer engraved. Rounded corner letters will not be acceptable. The edge of the signs shall be finished to match the face laminate color-to-color as selected by the Architect.

3. At toilet rooms also provide with 2" high raised gender and wheelchair symbols when handicapped equipped noted on schedule. Symbols shall be chemically welded through the face laminate to the acrylic core. Edges painted a color as selected.
4. The raised copy shall be accompanied with grade 2 Braille by means of Visi Touch DuraDot Braille manufacturing system. The clear Glass DuraDot shall have a 0.059 surface diameter and raised 1/32" above the face laminate and shall be unitized to the acrylic core through the face laminate. The edges of the sign shall be finished to match the face laminate color-to color as selected by the Architect. Any secondary copy shall be 8-stroke computer engraved. Rounded corner letters will not be acceptable.
5. Installed plaques shall comply with all state, local, and federal requirements for compliance.

B. EXTERIOR/INTERIOR BUILDING IDENTIFICATION LETTERS

1. Scope: The project shall include a cast letters as described below, to be provided and installed by contractor. Letterstyle, finish and mounting to be selected by Architect.

2. Fabrication of Letters: Fabricate letters to comply with requirements indicated below and as indicated on drawings.

   A . Cut letters : Form letters by cutting from solid sheet material of thickness specified. Produce characters with smooth flat faces, sharp corners, precisely formed lines and profiles, free from pits, scale, sand holes and other defects. Supply anchoring devices on reverse side of individual letters as required.

3. Characteristics:
   - A. Metal: Aluminum
   - B. Size: 16 inches and 8 inches, unless noted otherwise on drawings.
   - C. Thickness: 1 1/2 inches.
   - D. Letterstyle: Sans Serif
   - E. Finish: As selected by Architect from manufacturer's finish options (submit samples).
   - F. Mounting: Concealed (refer to drawings for wall type).
   - G. 16" Text: **CITY OF EDINBURG INDOOR RECREATION CENTER AT "EL TULE" 700**
   - H. 8" Text: **MAIN COURT** *(Provide four sets)*
   - H. 8" Text: **COURT 02** *(Provide three sets)*
   - H. 8" Text: **COURT 03** *(Provide three sets)*

4. Template: Provide full size paper mounting template showing hole placement and location of mounting holes.

5. Finishes: Colors and surface textures for exposed letters as selected by the architect from the manufacturer's standard and ***premium*** selections.

C. BUILDING IDENTIFICATION PLAQUE:

1. 18” wide X 24” high cast bronze alloy plaque. Borders and raised text shall have satin finish. Background shall receive a dark oxidized leatherette finish. Faces and edges to be chemically cleaned and sprayed with two coats of clear acrylic lacquer.

2. Provide threaded stainless steel or brass studs on back for concealed mounting with epoxy. Letter style “Helvetica Medium” per A.R. Ramos or equivalent by specified manufacturer.

3. Layout, logos and letter sizes to be provided by the Architect. General contractor and its supplier shall perform all conversions of architectural drawings & logos into useable vector line art format or any other type of format as required in order to produce the building plaque layout as provided by the Architect.

D. CITY OF EDINBURG LOGO:

1. 10’-6” wide X 2’-6” high, aluminum City of Edinburg logo. Colors as shown on drawings.

2. Provide threaded stainless steel or brass studs on back for concealed mounting with epoxy.

3. City logo and letter sizes to be provided by the Architect. General contractor and its supplier shall perform all conversions of logos into useable vector line art format or any other type of format as required in order to produce the city logo layout as provided by the Architect.

3 PART THREE- EXECUTION

3.1 INSPECTION AND PREPARATION

A. Ensure that wall surfaces are completed and accepted by the Architect prior to installing wall-mounted items or painted wall graphics.

B. Obtain approved location schedule for Room Identification Plaques prior to delivery of plaques to the jobsite.

3.2 INSTALLATION

A. ROOM IDENTIFICATION PLAQUES:

1. Apply top and bottom strips of 1/8” thick double stick vinyl foam tape and backs of each plaque. Apply liberal amount of clear silicone rubber adhesive to a minimum of 50% coverage of back of plaque.

2. Plaques shall be mounted to the strike side of the door on the wall within 5’ of the floor and 6” max. from the jamb; when location is on a glass side light or window, mount with a solid color back-up plate to cover reverse side of the glass. Attachment shall be with foam tape and silicone.

B. BUILDING DIRECTIONALS SIGNS:

1. Apply top and bottom strips 1/8” thick double stick vinyl foam tape on backs of each sign. Apply liberal amount of clear silicone rubber adhesive to a minimum of 50% coverage of back of sign.

2. Signs shall be mounted to the strike side of the door on the wall within 5’ of the floor and 6” max. from the jamb; when location is a glass sidelight or window, mount with a solid color back-up plate to cover reverse side of the glass. Attachment shall be with foam tape and silicone.

C. EXTERIOR/INTERIOR BUILDING IDENTIFICATION LETTERS.

1. Pre-drill holes into masonry and insert threaded stud on back of letters into epoxy adhesive filled holes. Provide stainless steel spaces to set letters off wall ½" minimum 2 studs per letter. Refer to drawings for wall finish type.

D. BUILDING IDENTIFICATION PLAQUE/CITY LOGO:

1. Masonry Wall: Pre-drill holes into masonry walls and insert threaded studs on back of letters into epoxy adhesive filled holes. Mount plaque tight against wall.

2. Drywall: Mount plaque using a minimum of 4 moly type expansion screws and silicone adhesive. Mount plaque tight against wall.

END OF SECTION

SECTION 10 14 53 — TRAFFIC STRIPING AND PARKING SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide traffic line, parking stripe and symbol painting on concrete/asphalt paving as indicated in the drawings.

B. Provide and install pipe-mounted parking signs at handicapped parking spaces meeting requirements of ADA.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Reinforced concrete paving.

1.4 SUBMITTALS

A. PAINT: Submit manufacturer’s product literature indicating Federal specification numbers and manufacturer’s recommended use and application techniques.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

C. Provide full size template for handicapped stall symbol.

1.5 WARRANTY

A. Provide written warranty against defects in material and workmanship for a period of one year after date of Substantial Completion.

B. Warranted defects for paint striping shall include but not necessarily be limited to fading, bleed-thru, spalling, excessive wear or delamination.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PAINT: "Traffic-Line" alkyd base marking paint meeting Federal Specifications TTP-85 and TTP-115 Type 1 as manufactured by Devoe or equivalent.

1. Width: Typically 4 inches unless indicated otherwise in the drawings.
2. Colors:

a. White: Traffic lines, directional symbols, symbols for the handicapped.
b. Yellow: Striping for parking stalls.

B. HANDICAPPED PARKING SIGNS:

1. Provide sign size, colors and copy meeting state, local and federal requirements for handicapped parking signage.
2. Sign blank shall be 1/8" aluminum sheet with Dupont "Emron" glass paint background, graphics and copy.
3. Graphics and copy shall be photo silk screened.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that paving operations are complete and surfaces thoroughly dry, clean, and free of oil or grease stains or other contaminants.

B. Clean with high pressure wash or brush if necessary for proper adhesion.

3.2 PAINT

A. Spray apply two coats of marking paint in patterns indicated on the drawings after weathering of asphalt or concrete paving for a minimum of 30 days. Edges shall be sharply defined.

B. Provide minimum dry thickness of 2.5 mils. Provide additional coats if required for complete hiding.

3.3 HANDICAPPED PARKING SIGNS:

A. Set 2" galvanized pipe sign support in minimum 6" diameter x 24" deep concrete footing.

END OF SECTION

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install **solid phenolic toilet partition system and urinal screens** as indicated in the drawings, the approved shop drawings and as specified herein.

B. Provide and install all toilet room and accessories as indicated in the drawings and as specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Wood blocking between studs.

B. Wall and floor finishes.

1.4 SUBMITTALS

A. SOLID PHENOLIC PARTITION SYSTEMS:
1. Submit shop drawings for solid phenolic partition system indicating plan and elevation dimensions and mounting details. Submit hardware samples and full chain of melamine samples for partition doors.
2. Shop drawings indicating handicapped stall layouts not meeting State and Federal requirements will be returned and rejected without review.

B. ACCESSORIES:
1. Submit manufacturer’s product data describing size, type, finish and installation requirements for each item.
2. Indicate mounting heights for each item. Meet State and Federal requirements for the handicapped.

C. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to delamination of facing or edging, swelling of core, change in alignment of parts, failure of anchorage or fasteners.

C. Provide manufacturer's extended written warranty for systems and accessories where available.

1.6 QUALITY ASSURANCE

A. Partition system installation company shall have a minimum of 5 years experience in the installation of similar system for projects of similar size and scope.

B. Partition system installation company shall be authorized by the system manufacturer for this installation.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver partition system materials to the job site in manufacturer's original packaging.

B. Store materials in covered, dry, temperature and humidity controlled space.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. SOLID PHENOLIC PARTITION SYSTEMS:
1. Bobrick Washroom Equipment
2. Bradley Corporation
3. American Specialties, Inc.
4. Ampco

B. ACCESSORY MANUFACTURERS:
1. Bobrick Washroom Equipment
2. Bradley Corporation
3. American Specialties, Inc.

2.2 TOILET ROOM ACCESSORIES:

1. Grab bars: Furnish and install grab bars at each handicapped toilet stall. Bars shall be Bobrick No. B-6806 series, 1-1/2" outside diameter, satin finish stainless steel, configuration as indicated on the drawings, 1-1/2" clear to wall. **Where bars are mounted over back of toilet, General Contractor shall hold flush valve low.**

2. Mirrors: Mirrors shall be ¼" plate glass, mirror quality, with copper backs. Provide polished stainless steel or brass chrome plated frames in sizes indicated on the drawings.
   a. Flat mirrors shall be Bobrick No. B-290 or equivalent by specified manufacturer.

3. Mop Holder: Bobrick B239X34 stainless steel, shelf with mop and broom holders and hooks. Furnished and installed by Contractor.

4. Soap dispensers: Surface Mounted Automatic Soap Dispenser Model B-2012. Furnished and installed by Contractor.

5. Tissue dispensers: ClassicSeries Surface-Mounted Toilet Tissue Dispenser for Two Rolls Model B-265 of Bobrick Washroom Equipment, Inc. Furnished and installed by Contractor.

6. Paper Towel Dispensers: Recessed convertible automatic universal roll paper towel dispenser and waste receptacle shall be Model B-3974 of Bobrick Washroom Equipment, Inc. Furnished and installed by Contractor.

2.2 SOLID PHENOLIC PARTITION SYSTEMS:

A. STILES, PANELS, DOORS, SCREENS, BENCHES

1. Solid phenolic material constructed of solidly fused plastic laminate with matte-finish melamine surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges shall be black. Brown edges shall not be acceptable. Color and pattern as selected by architect from manufacturer's standard colors.

2. Solid phenolic material shall meet National Fire Protection Association and International Build ing Code Interior Wall and Ceiling Finish Class A, Uniform Building Code Class I, ASTM E-84 Fire Resistance Standards; flame spread 20, smoke density 95.

3. Finish Thickness
   a. Stiles and doors shall be 3/4" (19mm).
   b. Panels and benches shall be 1/2" (13mm).

B. HARDWARE

1. All hardware to be 18-8, type-304 stainless steel with satin-finish.

2. All hardware shall be concealed inside compartments with the exception of outswing doors.

3. Hardware of chrome-plated "Zamak" is unacceptable.

C. LATCH

1. Sliding door latch shall be 16-gauge (1.6mm).

2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.

3. Latch track shall be attached to door by flathead machine screws into factory installed threaded brass inserts.

4. Latch handle shall have rubber bumper to act as door stop.

5. Latch shall allow door to be lifted over 16-gauge (1.6mm) keeper for emergency access.

6. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.

D. HINGES

1. Cam shall be adjustable in the field to permit door to be fully closed or partially open when compartment is unoccupied.

2. Hinges shall be attached to door and stile by theft-resistant, one-way stainless steel machine screws into factory-installed metal inserts. Fasteners secured directly into the core are not acceptable.

3. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.

E. Clothes Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29mm) from face of door. Clothes hook shall be secured by theft-resistant, one-way stainless steel screws.

F. Mounting Brackets shall be constructed of stainless steel and shall be mounted inside compartment. Mounting brackets exposed on the exterior of the compartment will not be acceptable. Wall mounted urinal screen brackets shall be 11-gauge (3mm) double thickness.

G. Leveling Device shall be 3/16" (5mm) hot rolled steel bar; chromate-treated and zinc-plated; through bolted to base of solid phenolic stile.

H. Stile Shoe shall be one-piece, 4" (102mm) high, type-304, 22-gauge (0.8mm) stainless steel with satinfinish. Top shall have 90° return to stile. Patented one-piece shoe capable of adapting to 3/4" or 1" stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

I. Headrail (Overhead-Braced) shall be satin finish, extruded anodized aluminum (.065" / 1. 65mm thick) with anti-grip profile. Type: Floor mounted, overhead braced continuously over entire system.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ensure that Contractor has properly installed solid wood blocking between studs at all mounting points.

3.2 INSTALLATION

A. Install accessories and partition systems in accordance with the project drawings, approved shop drawings and as specified herein. Use tamper proof stainless steel fasteners for all items.

B. ACCESSORIES:
1. Install through finished stud walls into solid wood blocking with stainless steel one-way screws. No plastic anchors.
2. Attach to masonry walls using stainless steel machine screws in lead shield anchors.

C. PARTITION SYSTEMS AND URINAL SCREENS:
1. Mount channels using stainless steel one-way screws through finished stud walls into solid wood blocking.
2. Mount channels to masonry walls using stainless steel machine screws in lead shield anchors.
3. Job measure for proper fit and to ensure that the maximum space between edge of any pilaster or panel and its adjacent surface is one inch.
4. Install pilaster, doors and panels plumb and square. Adjust doors for gravity closing.

D. FRAMED MIRRORS:
1. Mirrors shall be installed with theft-proof anchors at height shown on drawings. Furnish tilted mirrors where shown.
2. Install mirrors at other locations in addition to toilet rooms as indicated in the drawings.
3. Unframed mirrors are provided and installed under another section of these specifications.

END OF SECTION

SECTION 10 22 26 OPERABLE PARTITIONS

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Manually operated, paired panel operable partitions.

B. Related Sections include the following:
   1. Division 3 Sections for concrete tolerances required.
   2. Division 5 Sections for primary structural support, including pre-punching of support members by structural steel supplier per operable partition supplier's template.
   3. Division 6 Sections for wood framing and supports, and all blocking at head and jambs as required.
   4. Division 9 Sections for wall and ceiling framing at head and jambs.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 "Standard Practice for Architectural Application and Installation of Operable Partitions."

1.4 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at

openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.6 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Partition Warranty period: Three (3) years from date of shipment.

C. Suspension System Warranty:
   1. OP-01: Twenty (20) years from date of shipment.
   2. OP-02: Twenty (20) years from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATIONS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Modernfold, Inc.

B. Products: Subject to compliance with the requirements, provide the following product:
   1. OP-01: Acousti-Seal Encore - Paired Panel: Manually operated paired panel operable partition. 100 feet wide by 20 feet high.
   2. OP-02: Acousti-Seal Encore - Paired Panel: Manually operated paired panel operable partition. 100 feet wide by 20 feet high.

2.2 OPERATION

A. OP-01: Acousti-Seal Encore - Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals and automatic top seals.

B. OP-02: Acousti-Seal Encore - Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals and automatic top seals.

C. Final Closure:
   1. OP-01: Horizontally expanding panel edge with removable crank
   2. OP-02: Horizontally expanding panel edge with removable crank

2.3 PANEL CONSTRUCTION

A. Nominal 4.25-inch (108mm) thick panels in manufacturer's standard 51-inch (1295mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

B. Panel skin shall be:

1. OP-01: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
    a. 52 STC
2. OP-02: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum:
    a. 52 STC

C. Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be:
1. OP-01: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
2. OP-02: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Panel Trim: No vertical or horizontal trim required or allowed on edges of panels; minimal groove appearance at panel joints.

E. Panel Weights:
1. OP-01: 52 STC - 8.2 lbs./square foot
2. OP-02: 52 STC - 8.2 lbs./square foot

2.4 PANEL FINISH

A. Panel finish shall be factory applied, Class "A" rated material. Finish shall be:
1. OP-01: Reinforced vinyl with woven backing weighing not less than 21 ounces (595 grams) per lineal yard.
2. OP-02: Reinforced vinyl with woven backing weighing not less than 21 ounces (595 grams) per lineal yard.

B. Panel Trim: Exposed panel trim of one consistent color:
1. OP-01: To Be Selected by Architect.
2. OP-02: To Be Selected by Architect.

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Aluminum astragals, with tongue and groove configuration in each panel edge. Rigid plastic astragals are not acceptable.

B. Horizontal Top Seals shall be Modernfold SureSet automatic operable top seals, manually operated top seals not required or permitted.

C. Horizontal bottom floor seals shall be Modernfold Sureset bottom seal:
1. OP-01: Modernfold SM2 Bottom Seal. Manually activated seals providing nominal 2" (51mm) operating clearance with an operating range of + 0.50" (13mm) to -1.50" (38mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (265 kg) downward force to the floor throughout operating range.
2. OP-02: Modernfold SM2 Bottom Seal. Manually activated seals providing nominal 2" (51mm) operating clearance with an operating range of + 0.50" (13mm) to -1.50" (38mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (265 kg) downward force to the floor throughout operating range.

2.6 SUSPENSION SYSTEM

A. OP-01: #14 Suspension System
1. Suspension Tracks: Minimum 7-gauge, 0.18-inch (4.57mm) roll formed steel. Static loading of track with brackets at 48-inch (1220mm) centers shall show no failure of track or brackets at 5,000 pounds (2550kg) point loading at mid-span. Track shall be supported by adjustable steel hanger brackets connected to structural support pairs of 0.50-inch (13mm) diameter threaded rods. Brackets must support the load bearing surface of the track.

a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.

B. OP-02: #14 Suspension System

1. Suspension Tracks: Minimum 7-gauge, 0.18-inch (4.57mm) roll formed steel. Static loading of track with brackets at 48-inch (1220mm) centers shall show no failure of track or brackets at 5,000 pounds (2550kg) point loading at mid-span. Track shall be supported by adjustable steel hanger brackets connected to structural support pairs of 0.50-inch (13mm) diameter threaded rods. Brackets must support the load bearing surface of the track.

a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.

2.7 OPTIONS

A. Available accessories/options:

1. OP-01: Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc., with same construction, finish, and appearance as the adjacent panels.

a. Pocket Door configuration shall be manually operated: Type II double door hinged to a jamb on each side and closing in the center.

2. OP-02: Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc., with same construction, finish, and appearance as the adjacent panels.

a. Pocket Door configuration shall be manually operated: Type II double door hinged to a jamb on each side and closing in the center.

PART 3: EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that insure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.
B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION

SECTION 10 44 00 - FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED SECTIONS

A. Section 04 22 00 – Concrete Masonry Units; CMU walls to receive bracket mounted fire extinguisher.

B. Section 06 10 00 – Rough Carpentry: Wood blocking and framing to receive semi-recessed fire extinguisher cabinets.

C. Section 09 21 16 – Gypsum Drywall Assemblies: Finished openings in walls for semi-recessed fire extinguisher cabinets.

1.03 REFERENCES

A. NFPA 10 – Standard for Portable Fire Extinguishers; National Fire Protection Association; 2002.

B. UL (FPED) – Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittals, procedures and requirements for shop drawings, product data and submittal requirements.

B. Shop Drawings: Indicate cabinet physical dimensions.

C. Product Data: Provide extinguisher operational features.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:
1. JL Industries, Inc; Product 1037B20 with Extinguisher: www.jlindustires.com.
2. Larsen's Manufacturing Co: www.larsensmfg.com.
3. Potter-Roemer: www.potterroemer.com.
4. Substitutions: See Section 01 25 00 – Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Basis of Design: JL Industries, "Cosmic 10E".
B. Type: Multipurpose dry chemical.
C. Rating: Sized for project requirements.
D. Mounting: Refer to floor plans for locations, annotated FEC for cabinets and FE extinguishers alone.
E. Dry Chemical Type: Stainless steel tank, with pressure gage.
1. Class A:B:C.
2. Size 10.
3. Finish: Baked enamel, Red color.

G. ALL fire extinguishers shall be inspected and certified by the local authority having jurisdiction that they are charged and ready for use and shall be "tagged" identifying such.

2.03 FIRE EXTINGUISHER CABINETS

A. Basis of Design:
1. JL Industries, "Cosmopolitan – 1035B20 ADAC with Saf-T-Loc, TAS compliant.
2. Designations: Refer to the floor plans, FEC for Extinguishers in cabinets and FE for surface mounted extinguishers secured to walls.

B. Surface Mounted (Non-Cabinet, FE Type) – Bracket and Extinguisher (non-cabinet): Manufacturer's standard stainless steel strap with enamel finished bracket with locking band retainer.
   1. Bracket shall match the extinguisher type.

C. Metal for Cabinets: Formed stainless steel sheet; 0.036 inch thick base metal; #4 finish stainless steel.

D. Cabinet Configuration: Recessed type.

   1. Sized to accommodate accessories.
   2. Exterior nominal dimensions of 13 7/8 inch wide x 27 3/8 inch high x 6 inch deep.
   3. Trim: Returned to wall surface, with 3 inch projection, 1 1/2 inch wide face.
   4. Form cabinet enclosure with right angle inside corners and seams. Form perimeters trim and door stiles.

E. Door: 0.036 inch thick, reinforced for flatness and rigidity; lock with full glass access. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

F. Door Glazing: Glass, clear, 1/8 inch thick float. Set in resilient channel gasket glazing.

G. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

H. Weld, fill, and grind components smooth.

I. Finish of Cabinet Interior: Enamel, color to select from manufacturer's full color line.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Cabinet Signage: FIRE EXTINGUISHER, vertical up face of cabinet to one side.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, 30 inches from finished floor to inside bottom of cabinet.
C. Secure rigidly in place.
D. Place extinguishers in cabinets.

END OF SECTION

SECTION 11 48 00 – LED BASKETBALL SCOREBOARDS

PART 1 GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SECTION INCLUDES

A. LED basketball scoreboards.

1.02 SUMMARY

A. Provide the equipment specified and denoted on the drawings per the manufacturer's recommendations.

1.03 SUBMITTALS

A. Submit product literature for approval prior to ordering materials for fabrication, modification and subsequent delivery to job site.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Product delivered to site
B. Scoreboard and equipment to be housed in a clean, dry environment

1.05 QUALITY ASSURANCE

A. For indoor use only
B. Obtain each type of scoring equipment and displays through one source from a single manufacturer.
C. ETL listed to UL Standards 48 and 1433
D. CSA listed
E. Scoreboard meets all FCC Class A requirements
F. Optional wireless transmitter FCC Part 15 certified
G. Optional wireless receiver meets all FCC Part 15 requirements

1.06 WARRANTY/SERVICE

A. This product is warranted against defects in materials and workmanship for a period of five (5) years from the date of invoice. This includes factory repair service for parts covered under warranty. Complete warranty details are included in the Instruction Manual shipped with each unit.
B. This scoreboard utilizes long lasting, energy efficient LED displays, which require no maintenance and are rated for over 100,000 hours of continual use. The scoreboard's Home Score panel opens for easy

access to the plug-in electronic module, the only working part of the scoreboard.

C. 24/7 Factory Technical Support.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Sportable Scoreboards Inc.
106 Max Hurt Drive
Murray, KY 42071
(888) 256-4455

B. Substitutions under provisions of Section 01 25 00.

2.02 PRODUCT

A. Sportable Scoreboards Model #2230 equipped to score basketball, volleyball and wrestling.

B. Independent and/or tandem operation

2.03 SCOREBOARD

A. General information
1. Dimensions: 4.0’ tall, 8.0’ wide, 8.0” deep
2. Hanging Weight: 135 lbs
3. Power requirement: 20-amp, 120-volt, 60-hertz, grounded AC circuit connected to an ON/OFF switch or circuit breaker.
4. Color: to be selected by the Architect

B. Construction
1. 22 gauge galvanneal steel
2. Powder-coat finish covering entire scoreboard

C. Electronic Displays
1. TS AlInGaP Super-Bright LED displays
2. 100,000-hour rated
3. Seven bar segments per digit
4. Adjustable LED intensity
5. 180° Visibility
6. Numerical Displays: 15” tall, red and orange
7. Bonus Indicators: 3” tall, red
8. Possession Indicators: 3” tall, red

D. Basketball Scoring
1. HOME Score: 0-199
2. GUEST Score: 0-199
3. CLOCK: 00:00-99:59
4. PERIOD: 0-9
5. BONUS: HOME and/or GUEST Bonus
6. POSS: HOME or GUEST Possession

E. Additional Scoring Features
1. Statistics: controller displays 15 Individual Player #, Points and Fouls for HOME and GUEST
2. Time Outs Left: controller displays Time Outs Left for HOME and GUEST
3. Time Out Display
4. Time Out Alarm
5. Auto Horn
6. 1/10th Second Timing

F. Captions

1. HOME: 8.0” tall
2. GUEST: 8.0” tall
3. PERIOD: 5.0” tall
4. BONUS: 5.0” tall
5. POSS.: 4.0” tall
6. Polymeric calendared vinyl lettering

G. Horn
1. Buzzer horn: internally mounted
2. Automatic and manual operation

2.04 SCORING CONSOLE

A. Universal LCD keyboard controller
B. Molded of high-impact ABS plastic
C. Dimensions: 3.5” tall, 15.5” wide, 7.5” deep
D. Weight: 2 lbs.
E. Capable of scoring all indoor and outdoor sports
F. Capable of controlling all the manufacturer’s permanently mounted scoreboards
G. Fail-safe memory stores all scoring information and option settings for over five years
H. Tactile membrane keypad
I. Large backlit LCD display
J. Custom software
K. Game-specific keypad inserts minimize required input and ensures ease of operation
L. Power Requirements: (1) 20-amp, 120-volt, 60-hertz, grounded AC circuit in a standard duplex outlet.
M. Standard Cable Control System includes:
1. One (1) Universal LCD keyboard controller
2. Nine (9) BASKETBALL/VOLLEYBALL/WRESTLING keypad inserts
3. One (1) 12-volt DC wall transformer
4. One (1) Junction box cover with receptacle (to be installed at scorekeeper's location)
5. One (1) 20-ft. signal cable (connects keyboard to junction box receptacle)
6. One (1) Project specific length of 4 wire twisted pair, shielded control cable

N. Wireless Control System includes:
1. One (1) Universal LCD keyboard controller
2. Nine (9) BASKETBALL/VOLLEYBALL/WRESTLING keypad inserts
3. One (1) 12-volt DC wall transformer
4. One (1) transmitter (connects to keyboard controller via supplied interface cable)
5. One (1) receiver (factory installed to the scoreboard)

2.05 ADDITIONAL EQUIPMENT (TO BE INCLUDED PER BASE BID)

A. Wireless Remote Control Battery Option
B. Controller Carry Case
C. Hand-Held Clock Switch
D. 10-Year Warranty

PART 3 EXECUTION

3.01 EXAMINATION

A. This model may be mounted to virtually any surface using the appropriate mix of wall anchors, washers, bolts, etc. that will hold the hanging weight. Four pre-drilled holes are in the top and bottom flanges of the scoreboard cabinet for easy mounting. *Mounting hardware to be supplied by Contractor.*

3.02 INSTALLATION

A. Power conduit, cable and outlet boxes are to be provided and installed by the contractor. Signal raceways conduit and boxes are to be provided by the contractor. The contractor is responsible for pulling signal wire and terminators between scoreboard and control location.
B. Mount scoreboards, displays and control centers in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 11 66 23.13 - BACKSTOPS

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.1 DESCRIPTION

A. Backstops required for this work include types indicated on the drawings.

1.2 QUALITY ASSURANCE

A. For installation use only personnel who are skilled in the work required.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product data on physical characteristics and durability characteristics for each type of backstop and accessory specified.
C. Shop drawings showing location and extent of backstops. Include plans, elevations, large-scale details of anchorages, and accessory items. Indicate unit conditions at openings, typical and special details, and location and installation requirements for hardware and operators.
D. Template drawings prepared by manufacturer showing location of items supported or anchored by permanent construction.
E. Installation Methods: Submit two copies of manufacturer's recommended installation method showing all requirements for blocking and bracing.

1.4 PRODUCT HANDLING

A. Protection: Protect backstops before, during and after installation. Protect installed work of other trades.
B. Replacements: In event of damage, make necessary replacements.

PART 2 – PRODUCTS

2.1 BACKSTOPS:

A. Manufacturers:

1. Basis of Design: Draper, Inc.
2. Products of the following manufacturers are acceptable provided the original provisions of the specifications are complied with:

a. Draper
b. Porter Equipment
c. Hussey
d. AALCO

B. Type 1: Provide front-folding, Draper TF20 Series. Coordinate with HVAC ductwork and light fixtures.
1. Frame: Steel pipe, with Black enamel finish.
2. Operation: Manufacturer's standard worm gear type electric winch appropriate for installation.
3. Safety Belt and Lock: Provide Draper 503029 Posilok Safety Belt.
a. 1,000 lbs. free fall load resistance
b. Safety lock: Inertia sensitive to automatically lock backstop in position at any time during storage, raising, or lowering. Sudden increase in either tension or speed shall activate lock.
c. Safety belt: 2 inches wide nylon belt rated at 6,000 lbs. breaking strength
d. Belt shall extend 35 feet and shall be automatically retracted and stored on reel equipped with constant force spring. Operation and locking action shall be activated by centrifugal force to lock backstop before unit travels 12 feet of free fall.
e. Unit shall incorporate automatic reset not requiring poles, ropes, levers, or buttons for resetting.
f. Provide manual height adjuster Draper 503092 (8’-0” to 10’-0” height)

C. Glass Backboards at all courts: 72"x42" Rectangular glass #503136 with safety edge padding 5032 (Color to be selected by Architect).
1. Goal: Regulation hoop and nylon net, #503040.

PART 3 – EXECUTION

3.1 Coordinate support of basketball backstops and gymnasium operable partitions with roof structure to ensure proper distribution of loads and adequacy of attachment points. Ensure that building structure has been designed for loads of specific gymnasium divider to be provided. Provide additional structural framing members as required in accordance with Section 05 50 00 and structural drawings.

3.2 Coordinate configuration, size, and installation of basketball backstops and gymnasium folding partitions with height, slope, and type of building structure and lighting fixtures, mechanical equipment, ductwork, fire-suppression system, bleachers, athletic equipment, and other potential obstructions.

3.3 Field-verify dimensions prior to fabrication.

3.4 Coordinate electrical requirements for motorized operating mechanism to ensure proper power source, conduit, wiring, and boxes for keyed switches. Prior to installation, verify type and location of power supply. Electrical Contractor shall provide and install.

3.5 Inspection: Inspect installed work of other trades and verify that such work is complete to a point where this work may commence. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

3.6 Discrepancies: In event of discrepancy, notify Architect. Do not proceed with installation until discrepancies have been resolved.

3.3 Installation: Install where indicated, anchoring all components firmly in place in complete accordance with approved shop drawings and the manufacturer's recommendations.

END OF SECTION

SECTION 11 66 23.23 - VOLLEYBALL EQUIPMENT

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section includes:
1. Volleyball Equipment.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Submittal Procedures.

1. List of proposed products and product data.
2. Shop drawings showing layout, elevations, dimensions, fabrication details, and method of attachment.
3. Samples of colors for selection by Architect.
4. Manufacturer's installation and maintenance instructions.

1.3 QUALITY ASSURANCE

A. Source limitation: All components shall be of a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide volleyball floor sleeves, covers and floor inserts in accordance with requirements of related trades that are responsible for installation. Do not deliver balance of athletic equipment until building is enclosed and other construction within gymnasium is substantially complete.

1.5 WARRANTY

A. Provide manufacturer’s standard warranty from date of substantial installation. Warranty for other items to be as indicated in product specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Draper, Inc., 411 South Pearl Street, Spiceland, Indiana 47385-0425; 765-987-7999.
B. Substitutions: Shall be in accordance with Section 01 25 00 - Substitution Procedures.

2.4 VOLLEYBALL EQUIPMENT

A. Main Gym

1. Elite Volleyball System (3 required).
Volleyball System shall be DRAPER Model 500041 EVS-01 Elite Volleyball System by Draper, Inc. of Spiceland, IN.

The 500041 EVS-01 shall consist of one standard with power winch and one standard with adjustable cable anchor collar. Post shall be telescoping type to meet all FIVB, USVBA, NCAA and NFSHSA requirements for competition. Post shall allow infinite height adjustment from 6' (1.854 m) to 8'4" (2.540 cm) to meet all age group height settings from elementary school use to international competition for both men and women. EVS-01 shall incorporate an internal spring assist mechanism for easy, precise and infinite height adjustments. EVS easily locks in place with a pressure lock hand knob and post is clearly marked at normal competition heights.

The 6' (1.890 cm) bottom upright shall be 3½" O.D. (8.890 cm) schedule 80 aluminum tube, with a wall thickness of .300" (.7620 cm). The bottom upright is provided with a special rubber foot to protect finished floors and to provide precise net height adjustment. The upper telescoping adjustable tube shall be 2-7/8" OD (7.303 cm) schedule 80 aluminum tube, with a wall thickness of .276" (.7010 cm) with a 4" (10.16 cm) diameter pulley and oilite bushing. Both post sections have a clear annodized finish.

The tensioning winch shall incorporate a heavy-duty, self-locking worm gear mechanism. Winch shall be furnished with a heavy 2" (5 cm) wide high tensile nylon strap with heavy-duty snap hook to eliminate the possibility of hook breaking and guarantee safe connection to net top cable. The power winch is furnished complete with a folding handle for player
safety.

Systems shall come complete with DRAPER Model 500004 Power Volleyball Net by Draper, Inc. of Spiceland, IN. Net shall be 32' (9.75 M) long x 39-3/8" (1 M) high. Netting shall be high quality 4" square #36 black nylon cord with vinyl coated polyester hem double stitched around entire perimeter of net. Top hem of net shall be furnished with a 42'6" long x 1/8" diameter 2000 lb. minimum breaking strength galvanized aircraft cable with a nylon coating (3/16" OD) to protect against fraying. Ends of cable to have loops with heavy swaged type fittings for easy installation. Hems in end of net shall be furnished with a pocket for use with a 1/2" diameter fiberglass dowel rod. Ends of net shall have six 1" wide polypropylene tension straps with buckles for providing additional tightening of net. Bottom of net shall be furnished with a 1/4" diameter braided white nylon rope equipped with a spring loaded, pressure type rope tensioner.

System also to include Draper Model 500005 Rope Tensioner and DRAPER Model 500016 Combination Antenna and Boundary Marker.

2. Floor Plate, solid brass, concealed (six required).
Volleyball Cover Plate shall be DRAPER Model 501003 by Draper, Inc. of Spiceland, IN.

Floor plate shall be solid brass alloy with permanently attached hinged cover. Hinge and mounting holes in outer ring shall be completely concealed under the cover when in the closed position, allowing for a completely flat surface with no floor obstructions. Floor plate shall be 6 7/16" outside diameter by 9/16" thick. The diameter of opening shall be 5-1/8". Floor plate shall be supplied with six #10 x 1½" brass flat head wood screws for mounting plate to wood floor, and one Cover Plate Key (one per pair) for easy opening of cover and access to floor sleeve.

3. Floor Sleeve (six required).

Floor Sleeves shall be DRAPER Model 501006 3-1/2" I.D. Floor Sleeve by Draper, Inc. of Spiceland, IN.

Floor sleeve shall be constructed of steel mechanical tubing with an inside diameter of 3-1/2", welded to a 4" x 4" bottom plate. Sleeve shall be 8-1/2" long and designed to be installed with the bottom at 9 ½" below the playing surface.

4. Protective Pads for Standards (2 required per court).

Volleyball Post Padding shall be DRAPER Model 5011XX Official Padding for 3-1/2" O.D. Volleyball Systems by Draper, Inc. of Spiceland, IN.

Pads shall be hinged at corners to fold neatly around posts and tensioning winch to provide maximum player protection. Pads shall be constructed of 11/2" thick polyethylene foam filler covered with polyester reinforced vinyl with three (3) hook and loop fastening straps for quick set-up and take-down, and shall be constructed to accommodate winch, or judges stand when used.

Pad color shall be as selected by Architect from manufacturer’s full range of colors.

PART 3 – EXECUTION

3. 1 PREPARATION

A. Field-verify dimensions prior to fabrication.

B. Coordinate delivery of Volleyball Floor Sleeves and Covers with sub-contractors responsible for installation.

C. For installations made after wood gymnasium flooring is installed, provide protection and exercise care not to damage flooring.

3. 2 INSTALLATION

A. Install in accordance with manufacturer's written instructions and shop drawings.

B. Install even, plumb and level.

3. 3 TESTING AND DEMONSTRATION

A. Demonstrate to Owner's designated representatives’ complete operation and required maintenance.

END OF SECTION

SECTION 11 66 23.53 - GYMNASIUM PROTECTION ACCESSORIES

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section includes: Wall mounted protection pads suitable for gymnasium installations.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 00 - Submittal Procedures:
   1. List of proposed products and product data.
   2. Shop drawings showing elevations, dimensions, fabrication details, and method of attachment.
   3. Samples of protection pad cover fabrics for selection by Architect.
   4. Manufacturer's installation instructions.

PARTS 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Draper, Inc.
   1. Alpha Pro-Fab
   2. Porter Inc

2.2 UL GREENGUARD GOLD CERTIFIED WALL PROTECTION PADS

A. Type: Fabric covered urethane wall protection pads; Wall Pads as manufactured by Draper, Inc.
B. Pad shape and size: Sizes and shapes as indicated on Drawing Elevations.
   1. Flat, rectangular pads: 24 by 72 inches (610 by 1828 mm.)
   2. Other shaped pads: Field dimension to protect existing exposed structure covered with plywood. Protect all columns.
C. Cushioning material: 2 inches (50 mm) thick urethane filler with 3.5 pounds (1588 grams) density.
D. Backer: 7/16 inch (10 mm) Urea-formaldehyde-free Oriented Strand Board. Pads that wrap around columns or are curved shall be provided without solid backer.
E. Cover: Solid vinyl coated polyester fabric with embossed pattern:
   1. Weight: 14 ounces per SY.
   2. Breaking strength: 350 PSI.
   3. Tear resistance: 65 pounds.
   4. Resistant to rot, mildew, and ultraviolet light.
   5. Flammability: Rated self-extinguishing in accordance with California State Fire Code F- 230.

6. Color: Selected by Architect from manufacturer's standard range.

F. UL GREENGUARD Gold Certification: Entire wall pad assembly shall have been submitted to indoor air quality evaluation (IAQ) evaluation in accordance with UL 2811 test method to show compliance with emissions limits on UL 2818 Section 7.1 and 7.2. Materials are tested in accordance with ANSI/BIFMA M7.1-2011 and determined to comply with ANSI/BFMA X7.1-2011 and ANSI/BIFMA e3-2014e credit 7.6.1, 7.6.2 and 7.6.3. Material of emissions of total volatile organic compounds of < 0.22 mg/m3, formaldehyde < 0.0135 ppm, total aldehydes < 0.043 ppm, individual volatile organic compounds < 1/1000 TLV and < ½ chronic REL and total phthalates < 0.01 mg/m3. Manufacturer must be able to provide independent lab and test reports to verify compliance.

G. ASTM: Pads shall meet all requirements of ASTM 2440-04. Manufacturer must be able to provide independent lab and test reports to verify compliance.

H. Construction: Cushioning material adhered to backer and panel fully wrapped with fabric which is stapled to backer such that backer is not exposed on front or sides.

I. Provide 1 inch (25 mm) wide fabric flanges at panel bottom and top for wall mounting panels.

J. Attachment: Provide pads without solid backing with hook and loop strips at top of pad or with Z mounting clips top and bottom. Refer to drawings for wall type construction.

PART 3 – EXECUTION

3.1 PREPARATION

A. Field verify dimensions prior to fabrication.

B. Coordinate fabrication of wall protection pads with size and location of switches, electrical outlets, and other wall mounted items; structural framing and bracing projecting from wall surface; and door and other wall openings.

C. For pads placed around structural columns coordinate required shapes and sizes with actual dimensions of structural members.

D. Coordinate installation of scoreboard protector with size and placement of scoreboard.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions and shop drawings.

B. Protection mats:

1. Mount protection pads 8 inches above finished floor.
2. Secure to wall with fasteners along top and bottom. Type, size and spacing of fasteners as recommended by manufacturer.
3. Neatly make cutouts for switches, electrical outlets, and other items on wall and seal with matching vinyl fabric.

END OF SECTION

SECTION 12 21 13 - 2" PREMIUM FAUX WOOD BLINDS

PART 1 - GENERAL

1.01 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUMMARY

A. Section Includes:
   1. SWF contract 2" Premium Faux Wood Blinds
B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking for mounting window treatments and accessories.
   2. Section 09 29 00 "Gypsum Board" for coordination with installation of brackets and related accessories.
   3. Section 09 5123-Acoustical Tile Ceilings
   4. Section 09 91 23-Interior Painting

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for window treatments.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Mounting Details and installation methods
B. Shop Drawings: Show fabrication and installation details for window treatments.
C. Samples for selection: for each color and texture specified, submit 2 sets of samples representing manufacturer's standard range of finishes for PVC slats at 6 inches (152 mm) long.
   1. Include Samples of accessories involving color selection.
D. Samples for Verification: for each color and texture specified, submit 2 sets of samples representing actual finishes for PVC slats at 6 inches (152 mm) long.
   1. Include Samples of accessories involving color selection.
E. Window treatments Schedule: Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Product Certificates: For each type of window treatments, signed by product manufacturer.
C. Product Test Reports: For each type of window treatments, for tests performed by

manufacturer and witnessed by a qualified testing agency.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For window treatments to include in maintenance manuals.
B. Sample warranty document

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Window Treatments: Provide one extra full-size unit.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.
   1. Installer shall be qualified to install specified products by prior experience and approved by Springs Window Fashions LLC.
   2. Installer shall be responsible for acceptable installation in accordance with instructions published by Springs Window Fashions LLC.
   3. Single Source Requirement: To the greatest extent possible, provide 2” Horizontal Faux Wood Blinds from the same manufacturer for the entire project.
B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.
B. Store product in clean, dry areas indoors, in manufacturer’s unopened packaging, laid flat to prevent sagging and twisting until ready for installation, in accordance with manufacturer’s instructions.
C. Handling: Protect materials and finish from damage during handling and installation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install window treatments until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
B. Field Measurements: Where window treatments are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. SWF contract by Springs Window Fashions, LLC / 7549 Graber Rd / Middleton, WI 53562 / Phone: 1-800-327- 9798 or Email: architectsolutions@SWFcontract.com / Website: https://www.SWFcontract.com/, or architect approved equivalent.
B. Product substitutions must be in accordance with Section 01 25 00.

2.02 2” HORIZONTAL FAUX WOOD BLINDS

A. Product: SWF contract 2” Premium Faux Wood Blinds
   1. Materials:

a. Slats: Surface Appearance: Solid or Textured slats to mimic the look of real wood, straight cut edges or optional No Holes Privacy and light blocking. Slat Width: 2 inches (51 mm) or 2-1/2 inches (64 mm). Slat Type: Standard, Rigid UV stabilized flat PVC, Nominal Width: 2 inches wide or 2-1/2 inches wide, Thickness: .10 inches thick.
b. Headrails: Sure Close Headrail, Size: 1-5/8 inch (41 mm) high x 2-1/4 inch (57 mm) wide x .022 inch (0.56 mm) thick. Cordless lift uses 2" x 2-1/4" (51mm x 57 mm) wide, U-shaped steel with 1/8" (3.2 mm) light blocking lip on the bottom centerline, Phosphate treatment for corrosion resistance, chrome-free sealer, low HAP urethane primer and topcoat with low HAP urethane primer and a topcoat with low HAP, polyester baked enamel.
c. Operation: Tilters, cord tilter, snap-in, low-friction thermoplastic worm and pulley design, nylon gear housing; secured to pulley and treated with wood tassels at tilt end.
d. Cords: shall be made of 100 percent polyester yarn and shall be 1.8mm thick for standard route holes, 1.4mm thick for No Holes option, and 1.2mm thick for cordless lift.
e. Cord Locks: Metal, snap-in design incorporating a floating, shaft-type locking pin. Cord lock shall incorporate a crash proof safety feature that will lock blind automatically upon release of cord. End of lift cords will be treated with tassels.
f. Ladders: Braided ladder, 100 percent polyester yarn incorporating four extra strength rungs per ladder to support slats, ladder Spacing: 44 mm.
g. Bottomrails: Rectangular extruded foam PVC 9/16 inch (14 mm) high x 2 inches (51 mm) wide, color coordinated with slats.
h. Installation Brackets: universal style with hinged front cover, phosphate treated steel for corrosion resistance with primer and polyester baked enamel finish to match headrail. Optional End Support Box Brackets, Extension Brackets, Hold Down Brackets.
i. Valances: 3" Classic or 3" Majestic
j. Additional Options: 2-1/2" Slats, No Holes privacy and light blocking slats, 1" or 1-1/2" Cloth Tapes, Cordless Lift, Ring Lift, Ring Tilt (2" Only), Wand Tilt, Extension Brackets, Hold Down Brackets, Cut Outs

2. Finishes:
   a. Slats: 2" Slat finish selection: As selected by Architect.
   b. Cords: color coordinated with slats.
   c. Tassels: color coordinated with slats.
   d. 1-1/2" Cloth Tapes color selection: As selected by Architect.

PART 3-EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, [accurate locations of connections to building electrical system,] and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 WINDOW TREATMENTS INSTALLATION

A. Install window treatments level, plumb, and aligned with adjacent units per manufacturer's written instructions.
   1. Install with adequate clearance to permit smooth operation of the blinds through the entire operational range.

3.03 ADJUSTING

A. Adjust and balance window coverings to operate smoothly, easily, safely, and free from binding or malfunction throughout the entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean surfaces after installation, per manufacturer's written instructions. Do not use cleaning methods involving heat, bleach, abrasives, or solvents.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, ensuring that window treatments are without damage or deterioration at time of Substantial Completion.
C. Replace damaged window treatments that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain window treatments.

END OF SECTION

SECTION 13 34 19 — PRE-ENGINEERED METAL BUILDINGS

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SCOPE:

A. Provide all pre-engineered metal buildings, complete, as shown on the Drawings, specified herein, or needed for a complete and proper installation and not specifically called for under other Sections of these specifications.

B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual apply to all work required for this section.

PART 2 - PRE ENGINEERED METAL BUILDING SYSTEM:

2.01 GENERAL:

A. The intent of these specifications and drawings is to establish a quality and performance level for structural design, material, durability, and workmanship.

B. All bidders must conform strictly to these specifications in their bid.

C. The building shall be the design of a manufacturer who is regularly engaged in the fabrication of pre-engineered structures. All materials shall be new, unused, free from defects and of American manufacture.

D. The following standards and criteria (of most recent issue) shall be used where applicable in the structural design of the building covered by this specification:

“MANUAL OF STEEL CONSTRUCTION”- American Institute of Steel Construction
“COLD FORMED STEEL DESIGN MANUAL” - American Iron and Steel Institute
“ALUMINUM CONSTRUCTION MANUAL” - The Aluminum Association
“CODE FOR WELDING IN BUILDING CONSTRUCTION” -American Welding Society

The following criteria shall also be applicable in other phases of design: latest edition of the INTERNATIONAL BUILDING CODE.

E. Listing by:

Underwriters' Laboratories Inc.
Factory Mutual System or other recognized testing laboratories

2.02 DESIGN LOADS:

A. GENERAL:

1. The basic design loads shall include live and wind, in addition to dead load. All other design loads, whether they be of static or dynamic nature, shall be considered as auxiliary loads.

B. VERTICAL LIVE LOAD:

1. Roof covering shall be designed for either 50 psf uniformly distributed or a 200-pound concentrated (point) load (over a 1' x 1' area) located at center of maximum roof (panel) span. The most severe conditions shall govern.
2. Purlins shall be designed for 20 psf uniformly distributed over the roof area which they support.
3. Primary framing (frames) shall be designed for 20 psf uniformly distributed over the roof area which it supports.
4. All the above loads to be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

C. WIND LOADS:

1. The wind load on the structure shall be proportioned and applied as horizontal and uplift forces according to and as recommended by the latest edition of the INTERNATIONAL BUILDING CODE.

2. The roof construction shall carry a U.L. Construction (Uplift) Listing of not less than Class 90.

3. Wind load may be proportioned as allowed by the latest edition of the INTERNATIONAL BUILDING CODE. However, such proportioning shall not compromise the UL-Class 90 listing.

D. AUXILIARY (ADDITIONAL COLLATERAL) LOADS:

1. Other superimposed dynamic and/or static loads shall be considered as part of the design requirements and combined with normal design (live and/or wind) loads as prescribed hereafter:

DYNAMIC LOADS: VARIOUS HVAC EQUIPMENT (REFER TO DRAWINGS FOR LOCATIONS).

STATIC LOADS: THE ROOF FRAMING AT 1:12 PITCH SHALL BE DESIGNED FOR AN AUXILIAR LOAD OF 5 PSI.

E. COMBINATION OF LOADS:

1. The combining of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the latest edition of the INTERNATIONAL BUILDING CODE.

F. CERTIFICATION:

1. After the awarding of the Contract, complete structural analysis shall be submitted by the Metal Building Manufacturer to the Architect. Structural design must be sealed by a Texas Registered Professional Structural Engineer.

2.03 DESCRIPTION:

A. The pre-engineered metal buildings covered in this specification are to be rigid frame structure of steel (frames) rafter beams.

B. The roof slope shall be not less than 1”; 12” as indicated on the drawings.

C. Column spacing shall be as indicated on the drawings.

D. Nominal eave height shall be as indicated on the drawings.

2.04 ROOF COVERING AND SUPPORTS:

A. ROOF PANELS – Refer to Section 07 41 13 Insulated Metal Roof Panel.

B. PURLINS (ROOF COVER SUPPORT MEMBERS):

1. The configuration, thickness and spacing of the purlins shall be the Building Manufacturer’s standard. The allowance design capacity of cold-formed purlin members shall be calculated in accordance with the provisions of the AISI Specification for the Design of Cold-Formed Steel Structural Members.
2. The deflection of the purlin or secondary member shall not exceed L/180 of its span when supporting the applicable vertical live loads previously prescribed and any collateral loads required.
3. The standing seam roof does not provide a diaphragm or purlin bracing function. Brace purlins as required to conform with A.I.S.C. and A.I.S.I. specifications.

C. ROOF JACKS AND CURBS:

1. At roof penetrations for plumbing vents, install roof jacks (rubber) DEKTITE type where standing seam roofing is installed.

2. At roof penetrations for mechanical equipment skylights requires curbs; provide custom fabricated roof curbs as manufactured by CUSTOM CURB, INC., LCM INC.

2.05 RAKE, TRIM, GUTTERS, ROOF DOWNSPOUTS, TRIMS AND SOFFIT LINERS:

A. The closures, flashings, fascias, gutters, and trim shall be the Building Manufacturer’s standard, compatible with the material furnished as roof panels.

B. Buildings shall have continuous gutters with downspouts where shown on the drawings.

C. Gutters, downspouts, rake trim, ridge panels, and trim associated with standing seam roof panels shall be a color to be selected by Architect from manufacturer’s KYNAR 500 custom and to be part of base bid colors.

D. WARRANTY:

1. The exterior color finish for the metal panels shall be warranted by the Material Manufacturer and General Contractor for twenty (20) years against blistering, peeling, cracking, flaking, checking, and chipping. Excessive color change and chalking shall be warranted for twenty (20) years. Color change shall not exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking shall not be less than a rating of 8 per ASTM D-659.

E. GIRTS:

1. The girt's configuration and thickness shall be the Building Manufacturer's standard provided all design criteria, including deflection and girt spacing is met.

2. Based on a simple span, the deflection of the girts (supporting the wall covering) shall be proportioned with due regard to that produced by the previously prescribed design (wind) load.

2.06 STRUCTURAL STEEL PRIMER:

A. All uncoated structural steel shall be given one (1) coat of rust inhibitive (primer) paint which meets or exceeds Federal Specifications TT-P-664, or certification shall be submitted that it conforms to a recognized authoritative specification, such as from a Federal or Military authority or the Structural Steel Painting Council.

B. Exposed pre-engineered metal building must be painted with at least one (1) coat of primer and two (2) coats of finish paint.

2.07 INSULATION AND INTERIOR FINISH:

A. ROOF - Refer to Section 07 41 13 Insulated Metal Roof Panel.

PART 3 - EXECUTION

3.01 ERECTION:

A. Erection of metal building, accessories, and insulation shall be performed by one of the following:

1. Authorized systems contractors or builders of the manufacturer.

2. Building manufacturer's crews.

3. Other erectors authorized by the manufacturer as trained and qualified to erect that manufacturer's product. In this case, the manufacturer shall inspect the work and certify its correctness.

END OF SECTION

SECTION 31 10 00 — SITE CLEARING, GRADING AND FILLING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Clearing, filling and grading of the affected areas of the site.

B. Top Soil removal and reuse.

C. Disposal of debris and surplus materials.

D. Protection of trees and vegetation to remain, coordinate with the Architect.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Excation and backfilling for underground site utilities.

B. Paving and sidewalks.

C. Site drainage systems.

1.4 QUALITY ASSURANCE

A. Testing Laboratory Services: Installed materials shall meet specified requirements as determined by the Owner’s Testing Laboratory.

B. Proposed sitework contractor shall be able to provide documentation that he has a minimum of three years of satisfactory experience in the performance of similar operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Existing top soil to be stockpiled and reused.

B. Existing and off-site earth fill as required.

C. TOPSOIL:

1. Rich sandy loam, low in silt, free of trash, rocks, debris and other foreign materials.
2. Topsoil stripped at the site and stockpiled may be used if material meets the above requirements and quantities are sufficient to meet all topsoil needs of the site. Otherwise topsoil meeting specified requirements and approved by the testing laboratory shall be provided from an approved off site source.

D. FERTILIZER AND GRASSING: Provide grass to replace any disturbed areas during regarding. Refer to landscape drawings for planting and other additional requirements.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING TREES AND VEGETATION

A. GENERAL: In addition to any temporary construction fencing provided under Section 01 50 00 Temporary Facilities, provide temporary chain link fencing around existing shrubs, grasses, ground cover and tress indicated to remain. Locate fencing around drip lines of individual trees or groups of trees.

B. REPLACEMENT: Replace damaged existing trees and vegetation indicated to remain with materials of like kind, size and maturity as approved by the architect. Follow supplier's recommended procedures of planting.

3.2 TOPSOIL REMOVAL AND EXCAVATION

A. Strip topsoil to a depth of 4" to 6" under all new site paving, sidewalks, within new building lines and at all site areas which will receive earth fill for grading adjustments.

B. Temporarily store removed topsoil at an on-site location designated by the Architect. Stored topsoil shall be kept free of trash and construction debris.

C. Remove additional existing soil as required to achieve any finish paving grades which may be at or near natural grade elevation.

3.3 EXCAVATING, GRADING AND FILLING

A. GRADE ELEVATIONS: Establish finish grades as indicated on the drawings. Set and maintain grade stakes.

B. ROUGH GRADING:

1. Provide clean earth fill meeting specified requirements from off-site should additional earth fill be required.
2. Provide temporary and permanent drainage swales, pumps, gutters and trenches necessary to dry existing soil and carry off water during construction. As indicated on drawings shape the site around structures to drain away from the building(s) at all times. Do not allow water to stand around trees scheduled to remain.

3. All site fill at unpaved and typical sidewalks areas shall be thoroughly compacted in lifts as specified below. Each layer and subgrade shall be wetted or dried as required to achieve optimum moisture content and then compacted to minimum ninety (90%) percent Proctor density per ASTM D1557. The subgrade shall be thoroughly and completely scarified before wetting and rolling.

C. COMPACTION: Compaction may be obtained by any of the following methods:

1. By sheepsfoot rollers having a unit weight on the contact feet of not less than 300 pounds per square inch with the soil being compacted in layers not exceeding 8" in depth (loose measurement).
2. By pneumatic tired rollers having a minimum compression of 325 pounds per inch of width of tire tread, with the soil being compacted in layers not exceeding 8" in depth (loose measurement).
3. For those portions of fill which cannot be reached with the sheepsfoot roller, such as corners and areas adjacent to columns, beams, etc., mechanical tampers shall be employed to obtain specified compaction.

D. EXISTING UTILITIES:

1. Arrange with utility companies for removal or relocation of any existing utilities.
2. Remove abandoned utilities up to the property line and provide permanent watertight cap.
3. If unknown or uncharted utilities are encountered during excavation, promptly notify the Architect before proceeding. Damage to existing utilities by continuing work without notifying the Architect shall be repaired by the Contractor at no additional cost to the Owner.

E. FINISH GRADING;

1. After rough grading and proof rolling operations are complete, install 2" of topsoil over unpaved open area (within the limits of grading) and fine grade to finish contours and make ready to receive grass planting (whether or not grass planting is required under this contract).
2. Open areas shall be raked smooth and left free of clumps, trash, debris and vegetation. Finish grading shall be uniform in planarity, meeting elevations and slopes as indicated on the drawings, and as required to ensure proper drainage.

3.4 DISPOSAL:

1. Adhere to Federal, State, County and local regulations regarding disposal of removed trees, shrubs, vegetation, soil, and rubble. It is the sole responsibility of the Contractor to determine the regulations regarding on-site burning of removed trees and vegetation.
2. Upon completion of fine grading operations, any excess soil shall be removed from the site, stockpiled at the site, or relocated to any property controlled by the Owner within five miles of the site. The above options shall be as determined by the Owner at no additional cost to the Owner.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 SECTION REQUIREMENTS

A. Submittals: Product Data and product certificates signed by manufacturer certifying that products used comply with U.S. EPA regulations for termiticides. Include application instructions and EPA-Registered Label.

B. Engage a licensed professional pest control operator to apply termite control solution.

PART 2 - PRODUCTS

2.1 TERMITICIDES

A. Provide an EPA-registered termiticide (5 year) complying with requirements of authorities having jurisdiction, in a soluable or emulsible, concentrated formulation that dilutes with water or foaming agent. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare surfaces and apply treatment at rates and concentrations recommended in manufacturer's written instructions.

B. Apply termite control to the following:

1. At foundations. (Piers, mid-span supports)
2. Under sub-floors and flooring materials.

3. Under basement floor slabs.
4. At hollow masonry.
5. At expansion and control joints and slab penetrations.
6. At crawlspaces; treat soil under and adjacent to foundation supports. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment.

C. Post warning signs in areas of application.

D. Reapply soil termiticide treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION

SECTION 32 11 00 — FLEXIBLE BASE

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.01 GENERAL DESCRIPTION OF WORK:

1. This work shall consist of furnishing and placing a foundation course for surface courses or for other base courses.
2. Flexible base shall be composed of either caliche (argillaceous limestone, calcareous or calcareous clay particles, with or without stone, conglomerate, gravel, sand or other granular materials), crushed stone, gravel, iron, or topsoil, shell, or crushed slag.
3. Flexible base shall be constructed as specified herein in one or more courses in conformance with details, lines and grades shown on the plans, and as established by the ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS

1. Materials for flexible base shall be crushed or uncrushed as necessary to comply with the requirements hereinafter specified.
2. Materials shall consist of durable course aggregate particles mixed with approved binding materials.

2.02 LIME STABILIZATION:

1. The material for flexible base shall be lime stabilized.

2.03 TYPES:

1. Type A - Crushed or broken aggregate (excluding gravel aggregate).
2. Type B - Gravel Aggregate
3. Type C - Iron Ore Topsoil
4. Type D - Shell Aggregate with Sand Admixture
5. Type E - Shell Aggregate with Sand and Caliche Ad mixture
6. Type F – Caliche
7. Type G - Crushed Slag
8. Unless otherwise noted on the plans, the CONTRACTOR may use any on type of these types provided the material used meet the requirements set forth in the specification test limits herein.

2.04 GRADES:

1. Unless otherwise shown on the plans or directed by the ENGINEER, the final course of base material shall consist of Grades 1, 2, 3, or 4 as specified in Table 02601-1.
2. Base courses or subbase materials, unless otherwise noted on the plans or directed by the ENGINEER, may consist of Grades 1, 2, 3, or 4 as specified in Table 02601-1.
3. All grades shall, when tested in accordance with standard laboratory test procedures, meet the physical requirements set forth in Table 0260 1 - 1.
4. Testing of flexible base materials shall be in accordance with the following test procedures:

TEST	TESTING PROCEDURE
Preparation for soil constants and sieve analysis	TEX-101-E
Liquid Limit	TEX-104-E
Plastic Limit	TEX-105-E
Plasticity Limit	TEX-106-E
Sieve Analysis	TEX-110-E
Wet Ball Mill	TEX-116-E
Triaxial Test	TEX-117-E (Part I or II)

5. Unless otherwise specified on the plans, samples for testing the material for Soil constants, Graduation and Wet Ball Mill shall be taken prior to the compaction operations.
6. Unless otherwise specified on the plans, samples for triaxial tests shall be taken from the stockpile or from production, as directed by the ENGINEER, where stockpiling is required and from production where stockpiling is not required.

PHYSICAL REQUIREMENTS FOR FLEXIBLE BASE MATERIALS

GRADES				
TYPES	Grade 1:	Grade 2:	Grade 3:	Grade 4:
	(Triaxial class 1 Min. compressive Strength, psi: 45 at 0 psi lateral pressure and 175 at 15 psi lateral pressure	(Triaxial class 1 to 2.3)Min. compress-ive strength, psi: 35 at 0 psi lateral press-ure and 175 at 15 lateral pressure	(Unspecified Triaxial Class)	
TYPE A Crushed or Broken Aggregate (excluding gravel aggregate)	Retained on % Sq. Sieve 1-3/4"……...0 7/8"……..10-35 3/8"……..30-50 No. 4……...45-65 No. 40…….70-85 Max LL……35 Max PI……..10 Wet Ball Mill Max Amt……40 in Passing	Retained on % Sq. Sieve 1-3/4"……....0-10 No. 4……..…45-75 No. 40…….....60-85 Max LL……40 Max PI……..12 Wet Ball Mill Max. Amt…….50 Max increase in passing No. 40…….20	Retained on % Sq. Sieve 1-3/4"……....0-10 No. 40…….....60-85 Max LL……45 Max PI……..15 Wet Ball Mill Max. Amt…….55 Max increase in passing No. 40…….20	As Shown On Plans

	No. 40……..20			
TYPE B Gravel Aggregate		Retained on % Sq. Sieve 12-2/4”……..…0-10 No. 4……...30-75 No. 40……..…70-85 Max LL……....35 Max PI……..12	Retained on % Sq. Sieve 1-3/4”…..…...…0-5 No. 4……...30-75 No. 40……..…65-85 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE C Iron Ore Topsoil		Retained on % Sq. Sieve 2-1/2”……..…...…0 No. 40……..…50-85 Max LL……....35 Max PI……..12	Retained on % Sq. Sieve 2-3/4”……..…...…0 No. 40……..…45-85 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE D Sand-Shell		Retained on % Sq. Sieve 1-3/4”……0-10 No. 4……...45-65 No. 40……..…50-70 Max LL……....35 Max PI……..12	Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…45-65 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE E Shell with Sand and Caliche		Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…45-65 Max LL……....35 Max PI……..10	Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…45-65 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE F Caliche		Retained on % Sq. Sieve 1-3/4”……..…0 No. 4……...45-75 No. 40……..…50-85 Max LL……....40 Max PI……..12	Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…50-85 Max LL……....40 Max PI……..12	As Shown On Plans
TYPE G Crushed Blast Furn-ance Slag				As Shown On Plans

7. The limits establishing reasonable close conformity with the specified gradation and plasticity index are defined by the following:
    1) The ENGINEER may accept the material, providing not more than 2 of 10 consecutive gradation tests performed are outside the specified limits on any

individual or combination of sieves by no more than 5% and where no two consecutive tests are outside the specified limits.

2) The ENGINEER may accept the material providing not more than 2 of 10 consecutive plasticity index samples tested are outside the specified limit by no more than two points and where no two consecutive tests are outside the specified limit.

2.05 STOCKPILING:

1. When specified on the plans, the material shall be stockpiled prior to delivery on the road. The stockpile shall be not less than the height indicated and shall be made up of layers of material not to exceed the depth shown on the plans.
2. After a sufficient stockpile has been constructed as specified on the plans, the CONTRACTOR may proceed with loading from the stock - pile for delivery to the road.
3. In loading form the stockpile for delivery to the road, the material shall be loaded by making successive vertical cuts through the entire depth of the stockpile.
4. If the CONTRACTOR elects to produce the Type a material from more than one material or more than one source, each material shall be crushed separately and placed in separate stockpiles so that at least 75 percent of the material in the course aggregate stockpiles will be retained on the No. 4 sieve and at least 70 percent of the material in the fine aggregate stockpile will pass the No. 4 sieve.
5. The materials shall be combined in a central mixing plant in the proportions determined by the ENGINEER to produce a uniform mixture which meets all of the requirements of the specification. In the event that combinations of the materials produced fail to meet all of the specification requirements, the CONTRACTOR will be required to secure other materials which will meet specifications requirements.
6. The cental mixing plant shall be either the batch or continuous flow type, and shall be equipped with feeding and metering devices which will add the materials into the mixer in the specified quantities.
7. Mixing shall continue until a uniform mixture is obtained.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

1. Type roadbed shall be excavated and shaped in conformity with the typical sections shown on the plans and to the lines and grades as established by the ENGINEER.
2. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material.
3. All holes, ruts and depressions shall be filled with approved material and, if required, the subgrade shall be thoroughly wetted with water and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material.
4. The surface of the subgrade shall be finished to line and grade as established and in conformity with the typical section shown on the plans, and any deviation in excess of 2 inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
5. Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the work.
6. Material excavated in the preparation of the subgrade shall be utilized in the construction of adjacent shoulders and slopes or other-wise disposed on as directed, and any additional material required for the completion of the shoulders and slopes shall be secured from sources indicated on plans or as directed by the ENGINEER.

3.02 PLACEMENT OF FIRST COURSE-TYPE A, TYPE B, TYPE C, TYPE F, AND TYPE G MATERIAL:

1. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section.

2. The material shall be delivered in approved vehicles of a uniform capacity, and it shall be the charge of the CONTRACTOR that the required amount of specified material shall be delivered in each 100-foot station.

3. Material deposited upon the subgrade shall be spread and shaped the same day.

4. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period, the material shall be scarified and spread as directed ENGINEER.

5. The material shall be sprinkled, if directed, and shall than be bladed, dragged and shaped to conform to typical sections as shown on plans.

6. All areas and Nests of segregated coarse or fine material shall be corrected to removed and replaced with well graded material, as directed by the ENGINEER.

7. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and supplies in the amount directed by the ENGINEER. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming or by other approved methods.

8. The course shall be compacted by method of compaction hereinafter specified as the Ordinary Compaction method or the Density Control method of compaction as indicated on the plans, or as directed by the ENGINEER.

    1. When the Ordinary Compaction method is to be used, the following provisions shall apply:
        1) The course shall be sprinkled as required and rolled as directed until a uniform compaction is secured. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to established lines and grades.
        2) In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping, and recompacting by sprinkling and rolling.
        3) All irregularities, depressions or weal spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.
    2. When the Density Control method of compaction is to be used, the following provisions shall apply:
        1) The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the percent density as hereinafter specified under Density.
        2) In addition to the requirement specified for density, the full depth of the flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment.
        3) After each section of flexible base is completed, tests as necessary will be made by the ENGINEER. If the material fails to meet the density requirements, it shall be reworked as necessary to meet this requirements.
        4) Throughout this entire operation, the shape of the course shall be maintained blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to established lined and grades.
        5) In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16 feet measured longitudinally shall be corrected by

loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

6) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

9. Should the base course, due to any reason or cause, lose the required stability, density or finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the CONTRACTOR.
10. Where Type C material is used, the material shall be scarified, thoroughly wetted, mixed, manipulated, and bladed so as to secure a uniformly wetted material, and pulled in over the subgrade in courses and set under the action of blading and rolling. The work of mixing, blading, rolling, shaping and subsequent maintenance shall be performed by the continuous use of sufficient number of satisfactory rollers and power maintainers with adequate scarifier attachments.

3.03 PLACEMENT OF FIRST COURSE – TYPE D MATERIAL:

1. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section, and corrections made if necessary.
2. All materials shall be delivered in approved vehicles of a uniform capacity.
3. The required amount of shell shall be uniformly spread across the section and allowed to dry sufficiently to insure proper slaking and mixing of the binder material. Immediately upon completion of the drying period, as determined by the ENGINEER, the specified amount of sand admixture as produce a combined material meeting the requirements hereinbefore specified, shall be spread uniformly across the shell.
4. The material shall then be sprinkled as required and thoroughly mixed by blading and harrowing, or other approved methods.
5. Failure to proceed with the placing of sand admixtures or mixing and placing operations will be grounds for the suspension of placing of shell.
6. Under no condition will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.
7. The course shall be compacted by the method of compaction hereinafter specified as the Ordinary Compaction method of the Density Control method of compaction as indicated on the plans, or as directed by the ENGINEER.
    1. When the plans indicate that the Ordinary Compaction method is to be used, the following provisions shall apply:
        1) After mixing, all material shall be windrowed, and then spread over the section in layers.
        2) The layer shall not exceed 2 inches in loose depth.
        3) If necessary to prevent segregation, the material shall be wetted in the window prior to spreading.
        4) After each lift is spread, it shall be sprinkled and rolled to secure maximum compaction as directed by the ENGINEER. Succeeding layers shall then be placed similarly until the course is completed.
        5) All areas and nest of segregated coarse or fine material shall be corrected or removed and replaced with well graded material, as directed by the ENGINEER.
        6) The course shall then be sprinkled as required and rolled as directed until a uniform compaction is secured.
        7) Throughout this entire operation, the shape of the course shall be maintained by blading,; and the surface, upon completion, shall be smooth and in conformity with the typical sections shown on the plans, and to the established lines and grades.
        8) In that area on which pavement is to be place, any deviation in excess of 1/4 inch in cross section in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

9) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

2. When the plans indicate that the Density Control method of compaction is to be used, the compaction method shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G materials.

8. When indicated on the plans or permitted by the ENGINEER, Type D material may be mixed in a central mixing plant and delivered to the road as a combined mixture. When this method is used, the combined mixture shall meet the requirements for Type D material as hereinbefore specified and the placing and compaction requirement shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G material.

3.04 PLACEMENT OF FIRST COURSE-TYPE E MATERIAL

1. The construction methods for placing the first course of Type E material shall be the same as prescribed for Type D material except that after the shell and sand have been placed, the prescribed amount of caliche shall then be spread across the sand and shell.
2. The composite mixture shall than be sprinkled as required and thoroughly mixed by blading and harrowing or other approved methods.
3. Compaction of the first course of Type E material shall be the same as prescribed above for Type D material.
4. Failure to proceed with placing the sand and caliche admixture or mixing and placing operations will be grounds for the suspension of placing the shell.
5. Under no conditions will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.

3.05 PLACEMENT OF SUCCEEDING COURSES – ALL MATERIAL TYPES:

1. Construction methods shall be the same as prescribed for the first course.
2. Prior to placing the surfacing on the completed base, the base shall be dry cured to the extent directed by the ENGINEER.

3.06 DENSITY CONTROL:

1. When the Density Control method of compaction is indicated on the plans, each course of flexible base shall be compacted to the percent density shown on the plans.
2. The testing will be as outlined in Test Method Tex- I 14-E.
3. It is the intent of this specification to provide in that part of the base included in the top 8 inches immediately below the finished surface of the roadway not less than 100 percent of the density as determined by the compaction ratio method.
4. Field density determination shall be made in accordance with Test Method Tex115-E.

3.07 TOLERANCES:

1. Flexible base will be measured by the square yard of surface area of completed and accepted work based on the width of flexible base as shown on the plans.
    1. The ENGINEER may accept the work providing not more than 25 percent of the density tests performed each day are outside the specified density by no more than three pounds per cubic foot and where no two consecutive tests on continuous work are outside the specified limits.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

1. Flexible base will be measure by the square yard of surface area of completed and accepted work based on the width of flexible base as shown on the plans.
    1. The flexible base shall be measured for depth by the units of 2000 square yards, with one measurement taken at location selected by the ENGINEER.
    2. In that unit where flexible base is deficient by more than 2 inch in thickness, the deficiency shall be corrected by scarifying, adding material as required, reshaping and recompacting by sprinkling and rolling.
    3. No additional payment over the contract unit price will be made for any flexible base of a thickness exceeding that required by plans.
2. The CONTRACTOR shall schedule his operations in such a manner as to facilitate the measurement of the pay item.
3. The ENGINEER may accept the work provided no more than 2 out of 10 depth tests performed are deficient by not more 2 inch and where no two consecutive tests on continuous work are outside the specified depth.

4.02 PAYMENT:

1. The accepted quantities of flexible base of the type, grade, and compaction method specified will be paid at the contract unit bid price per square yard, complete in place.
2. Where ordinary Compaction is used, all sprinkling, rolling, and manipulation required will not be paid for directly, but will be incidental to other bid items.
3. The unit prices bid shall each be full compensation for shaping and fine grading the roadbed; for securing and furnishing all materials, including all royalty and freight involved, for furnishing scales and labor involved in weighing the material when required; for loosening, blasting, excavating, screening, crushing and temporary stockpiling when required; for loading all materials for all hauling and delivering on the road; for spreading, mixing, blading, dragging, shaping and finishing and for all manipulation, labor, tools, and incidentals necessary to complete the work.

END OF SECTION

SECTION 32 12 00 — PRIME COAT

PART 1 - GENERAL

1.01 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 GENERAL DESCRIPTION

1. Prime coat shall consist of application of asphaltic materials on completed base course and/or other approved area, which shall be applied in accordance with these specifications, as shown on the plans, and as directed by the ENGINEER.

1.03 QUALITY ASSURANCE

1. Test and Certification of Bituminous Materials.
    1. Bituminous material is to be tested in accordance with the requirements of AASHTO M-82 and sampled in conformance with AASHTO T-40.
    2. Supply, at the time of delivery of each shipment of asphalt, two certified copies of test reports, from supplying vendor, to the ENGINEER.
    3. Test reports shall indicate name of vendor, type and grade of asphalt delivered, date and point of delivery, quantity delivered, delivery ticket number, purchase order number, and result of specified tests.
    4. The test report, signed by an authorized representative of the vendor, shall certify that the product delivered conforms to the specifications for type and grade indicated.
    5. Certified test reports and the testing required in the preparation of such report shall be at no cost to the City.
    6. Final acceptance of bituminous materials shall be dependent on the determination by the ENGINEER that the material meets prescribed standards.

PART 2 - PRODUCTS

2.01 MEDIUM CURING CUTBACK ASPHALT

1. Medium-curing liquid asphalt, designated by the letters MC, shall consist of an uncracked petroleum bast stock, produced by the processing of asphaltic or semi asphaltic base crude petroleum, blended with a kerosene-type solvent. The base stock for all MC materials shall be straight run asphalt produced within the penetration range of 100 to 300, and the end point of the kerosene type solvent shall not exceed 525 degrees F. Medium curing liquid cutback asphalt shall be free from water and show no separation.

2. Medium curing cutback asphalt shall consist of materials specified above and conforming to the requirements set forth in Table 26 10- 1.
3. Unless otherwise noted on the plans or directed by the ENGINEER, cutback asphalt Grade MC-30 shall be used.

2.02 BLOTTER MATERIAL:

1. Supply blotter material consisting of native and/or sweeping from base course.
2. Native sand shall be local material obtained from approved sources as approved by the ENGINEER.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

1. Unless otherwise specified on the plans or, required by the ENGINEER, only asphaltic material shall be used. Where required, a combination of asphaltic and blotter material shall be used.
2. Application of Asphaltic Materials Only.
    1. Apply prime coat to prepared surface when ambient air temperature is above 40 degrees F. and raising and shall not be applied when the ambient air temperature is below 50 degrees F. and falling.
    2. Apply prime coat to surfaces that have been cleaned by sweeping or other approved methods and where base is thoroughly dry and satisfactory for receiving prime coat.
    3. Apply prime coat to cleaned base, at a rate of 0.2 to 0.5 gallons per square yard of surface area, using an approved type of self-propelled pressure distributor so constructed and operated to distribute the material evenly and smoothly.
    4. Provide necessary facilities for the determination of temperature of asphaltic material in all heating equipment and distributors; and for determination of rate at which it is applied; and for securing uniformity at the junction of two distributor loads.
    5. Keep in clean and good working condition all storage tanks, piping, reports, booster tanks and distributors used in the storage and handling of asphaltic materials.
    6. Operate all associated equipment in a manner such that there is no contamination of asphaltic material with foreign material.
    7. Calibrate distributor and furnish ENGINEER with an accurate and satisfactory record of such calibrations.

TABLE 2610-1

Specification Designation	AASHTO Test Method	ASTM Test Method	MC 30	MC 70	MC 250	MC 800	MC 3000
Flash Point (Open Cleve) oF, Min.	T 48	D 92	100	100	150	150	150
Viscosity 140oF, Kinematic, CS	T 201	D2170	30 to 60	70 to 140	250 to 500	800 to 1600	3000 to 6000
Furol Viscosity at 77 F. (Secs.)	T 72	D 88	75-150				
at 122 F. (Secs.)				60-120			300 to 600
at 140 F. (Secs.)					125-250		
at 180 F. (Secs.)						100-200	
Distillation Distillate (% of	T 78	D 402					

Total Distilate) to 680 F. to 437 F. to 500 F. to 600 F.			 0-25 40-70 75-93	 0-20 25-60 75-90	 0-10 20-55 70-85	 -0- 10-35 65-80	 -0- 0-15 50-75
Residue from Distillation to 680 F Volume % by Difference Min.			50	55	67	75	80
Test on Residue From Distillation Penetration at 77 F.	T 49	D 5	120 to 250	120 to 250	120 to 250	120 to 250	120 to 250
*Ductility 77 F cm., Min.	T 51	D 113	100	100	100	100	100
Solubility in CC14, % Min.	T 44	NONE	99.5	99.5	99.5	99.5	99.5
Water, % Min.	T 55	D 95	0.2	0.2	0.2	0.2	0.2
Reaction to Spot Test	T 102**	-0-		-0-	-0-	-0-	-0-

* If penetration of residue is more than 200 and its ductility at 77° F is less than 100, the material will be acceptable if the ductility at 60° F is greater than 100.

** Using 85% Standard Nephtha and 15% Xylene

NOTE: Viscosity tests may be made by either Kinematic or Furol test methods.

8. Recalibrates distributor, in a manner satisfactory to the ENGINEER, after the beginning of work, should the yield on the asphaltic material applied appear to be in error.
9. No traffic, hauling or placing of subsequent courses shall be permitted over fleshy applied prime coat until authorized by the ENGINEER.
10. Apply asphaltic material at a temperature within 15° F of temperature of application selected by the ENGINEER based on temperature viscosity relationship noted in Table 2610- 1.
11. Maintain surface until work is Blotter Material.

3. Application of Asphaltic and Blotter Material.
   1. Haul blotter material in vehicles of uniform capacity and placedon shoulders at spacings designated by the ENGINEER.
   2. After application of asphaltic material as specified above, cover surface with blotter material as directed by the ENGINEER.
   3. After application of blotter material, drag surface with approved drag broom, evenly and smoothly distributing the blotter material. Brooming or dragging operation shall continue, as directed by the ENGINEER, until the course has properly cured under traffic.

PART 4 - MEASUREMENT AND PAYMENT

4.01 PRIME COAT

1. Asphaltic material for prime coat will be measured for payment at point of delivery on the project in gallons at applied temperature.

2. When not listed as a separate contract pay item, prime coat shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.
3. Compensation, whether by contract pay item or incidental work will be for furnishing all material, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

4.02 BLOTTER MATERIALS

1. Blotter mater will be considered to asphaltic material for prime coat with no direct payment or payment therefore.

END OF SECTION

SECTION 32 12 16 — HOT MIX ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 DESCRIPTION

1. Hot mix asphalt concrete (HMAC) pavement shall consist of a binder course, a leveling up course, a surface course or a combination of the courses as shown on the plans, or as directed by the ENGINEER.
2. HMAC pavement shall be composed of a compacted mixture of mineral aggregated and asphaltic material, constructed on previously completed and approved subgrade, subbase course, base course, or existing pavement.
3. HMAC pavement shall be in accordance with the specifications herein and in conformity with the lines, grades, quantities, and typical sections in the contract and/or as directed by the ENGINEER.

1.03 QUALITY CONTROL

1. HMAC pavement and its constituent part shall conform to the ASTM, AASHTO and/or Texas SDHPT test methods noted below.

PART 2 - PRODUCTS

2.01 ASPHALTIC MATERIALS

1. Asphalt cement binders shall be uncracked petroleum asphalt and shall be carefully refined, be steam, vacuum, or solvent, from asphaltic or semiasphaltic base crude petroleum at a temperature not to exceed 700 degrees F. Asphalt cements shall be free from thermal decomposition products and shall not be blended with any materials which have been subject to cracking or produced from a crude petroleum source other than that of the original sources. Asphalt cement shall be homogeneous, free from water, and shall not foam when heated to 347 degrees F.
2. Paving asphalt shall be classified by penetration or viscosity and shall conform to the requirements set fort in one of the following tables as designated by the ENGINEER. The CONTRACTOR may supply asphalt meeting the requirements of one of the following tables provided that he obtains prior approval of the ENGINEER and with the provision that once approval has been obtained, that the CONTRACTOR will remain with that grade throughout the project.

TABLE 02612-1								
Specification Designation	AASHTO Test Method	ASTM Test Method	40 to 50	60 to 70	85 to 100	120 to 150	150 to 200	200 to 250
Flash Point (Open Cup) Min.	T 48	D 92		450	450	450	425	350
Penetration of Orig. Sample at 77 F	T 49	D 5	40 to 50	60 to 70	85 to 100	120 to 150	150 to 200	200 to 250
Thin-Film Oven Loss, Hours at 325 F, % Max	T 179	D 1754	0.75	0.75	0.75	0.75	1.00	1.00
Test of Residue from Thin-Film Oven Test: % of Orig. Pen., Min.	T 49	D 5	52	50	50	50	50	50
Ductility at 77 F, cm. after Loss at 325 F, Min.	T 51	D 113	50	50	100	100	100	100
Solubility in CC14, % Min.	T 44*	NONE	99.5	99.5	99.5	99.5	99.5	99.5
Reaction to Spot Test	T 102**	NONE	-0-	-0-	-0-	-0-	-0-	-0-

*Procedure No. 1 with CC1 4 substituted for CS2.

**Using 85% Standard Nephtha and 15% Xylene.

TABLE 02612-2						
TYPE-GRADE	OA-30		OA-175*		OA-400	
	Min.	Max.	Min.	Max.	Min.	Max.
Penetration at 32 F, 200g., 60 sec.	15	--	B	B	B	B
Penetration at 77 F, 100g., 5 sec.	25	35	150	200	B	B
Penetration at 115 F, 50g., 5 sec.	B	65	B	B	B	B
Ductility at 77 F, 5 Original OA	2	B	70	B	B	B
Flash Point C.O.C., F.	450	B	425	B	425	B
Softening Point, R & B.,F.	185	B	95	130	B	B
Thin Film Oven Test, 1/8 in Film 50 g., 5hrs., 325 F, % Loss by wt	B	0.4	B	1.4	B	2.0
Penetration of Residue, at 77 F, 100g., 5 sec. % of Original Pen	B	B	40	B	B	B
Ductility of Residue at 77 F, 5 cm/min., cms	B	B	B	100	B	B
Solubility in Trichloroethylene, %	99.0	B	99.0	B	99.0	B
Spot Test on Original OA	Neg.		Neg.		Neg.	
Float Test at 122 F, sec	B	B	B	B	120	150
Test on 85 to 115 Pen. Residue* Residue by Wt., %	B	B	B	B	75	B
Ductility, 77 F, 5 cm/min: Original Res., cms	B	B	B	B	100	B
Subjected to Thin Film Test, cms	B	B	B	B	100	B

*Determined by Vacuum Distillation (by evaporation if unable to reduce by vacuum).
**For use with Latex Additive only.

TABLE 02612-3						
PROPERTIES	AC-1.5 MIN.MAX.	AC-3 MIN.MAX.	AC-5 MIN.MAX.	AC-10 MIN.MAX.	AC-20 MIN.MAX.	AC-200 MIN.MAX.
Viscosity, 140 F stokes	150 50	300 100	500 100	1000 200	2000 400	4000 800
Vistrosity, 275 F stokes	0.7 B	1.1 B	1.4 C	1.9 B	2.5 B	3.5 B
Penetration 77 F 100 g, 5 sec.	250 B	210 B	135 B	85 B	55 B	35 B
Flash Point, C.O.C., F.	425 B	425 B	425 B	450 B	450 B	450 B
Solubility in trichloroethylene, percent	99.0 B	99.0 B	99.0 B	99.0 B	99.0 B	99.0 B
Test on residues from thin film oven test: Viscosity, 140 F stokes	B 450	B 900	1500 B	3000 B	6000 B	B 12000
Ductility, 77 F, 5 cms per min, cms	100 B	100 B	100 B	70 B	50 B	30 B
Spot Test	Negative on all grades					

3. A minimum of two percent, by weight, latex additive (solids basis) shall be added to the OA- 175 Asphalt or to AC-5 Asphalt when specified in the contract. The latex additive shall be governed by the following specifications.

   The latex is to be an anionic emulsion of butadiene-styrene low-temperature copolymer in water, stabilized with fatty-acid soap so as to have good storage stability, and possessing the following properties:

   Monomer ratio, B/S …….. 70/30
   Minimum solids content .....…….....… 76%
   Solids content per gal. @ 67%……..... 5.3lbs
   Coagulum on 80-mesh screen ……... 0.01% max.
   Type Anti-oxidant…….. Staining
   Mooney viscosity of Polymer (M/L4@212F)…….100min.
   pH of Latex .....……. 9.4-10.5
   Surface tention…… 28-42 dynes/cm2

   The finished latex-asphalt blend shall met the following requirements:

   Viscosity at 140 F, stokes …… 1500 max.
   Ductility at 39.2 F 1cm per., cm……...…… 100 min.

1. Asphalt content shall be within the limits noted below:

HMAC Type	Percent of Mixture by Weight	Percent of Mixture by Volume
AA@	3.5-7.0	8.0-16.0
AB@	3.5-7.0	8.0-16.0
AC@	3.5-7.0	8.0-16.0
AD@	4.0-8.0	9.0-19.0
AF@	3.5-6.5	8.0-16.0

2. At the time of delivery of each shipment of asphalt, the vendor supplying the material shall deliver to the purchaser certified copies of the test report which shall indicate the name of the vendor, type and grade of asphalt delivered, date and point of delivery, quantity delivered, delivery ticket number, and results of the above specified tests. The test report shall be certified and signed by an authorized representative of the vendor that the product delivered conforms to the specifications for the type and grade indicated.
3. Until the certified test reports and samples of the material have been checked by the ENGINEER to determine their conformity with the prescribed requirement, the material to which such report relates and any work in which it may have been incorporated as in integral component will be only tentatively accepted by the Owner. Final acceptance will be dependent upon the determination of the ENGINEER that the material involved fulfills the requirements prescribed therefore. The certified test reports and the testing required in connection with the reports will be at the expense to the Owner.
4. Unless otherwise specified in these specifications or in the Supplementary Specifications, the various grades of paving asphalt shall be applied at a temperature range between 225 to 350E F, the exact temperature to be determined by the ENGINEER.
5. Paving asphalt shall be heated in such a manner that stream or hot oils will not be introduced directly into the paving asphalt during heating. The CONTRACTOR shall furnish and keep on the site, at all times, an accurate thermometer suitable for determining the temperature of the paving asphalt.
6. HMAC asphalt shall be the grade having the highest penetration, within specified limits, to produce a mix having a maximum stability of the compacted mixtures.
7. Only one (1) grade of asphalt shall be required unless otherwise shown on the plans or as required by the ENGINEER.

2.02 AGGREGATES

1. HMAC aggregate will be tested in accordance with the following test.

AASHTO T-30	Mechanic Testing
AASHTO T-27	Passing No. 200 Sieve
AASHTO T-89	Liquid Limit
AASHTO T-96	Los Angeles Abrasion
AASHTO T-104	Soundness (Magnesium Sulfate)
ASTM C – 131	Resistance to Degradation
ASTM C – 136	Sieve Analysis
ASTM C – 2419	Sand Equivalence Value
SDHPT Tex-106-E	Method of Calculating Plasticity Index of Solids
SDHPT Tex-217-F	(I & II) Determination of Deleterious Materials and Decantation Test
SDHPT Tex-203-F	Quality Tests for Mineral Aggregates

2. Aggregates shall have an abrasion of not more than 40 for all course except the non-skid surface course, which shall have an abrasion of not more than 35.
3. When property proportioned, HMAC aggregate shall produce a gradation, which will conform to the limitations for classification for HMAC type shown below, or as directed by the ENGINEER.
4. Course aggregate to be crushed limestone rock or crushed gravel with hydrated lime or limestone filler. (Crushed gravel shall be per Highway Department Specifications.)

5. Binder aggregate to be composed of 15% crushed limestone screening or as directed by the ENGINEER.

1. Type AA@ - Course Graded Base Course

	Percent Aggregate by Weight or Volume
Passing 2" sieve	100
Passing 1-3/4" sieve	95 to 100
Passing 1-3/4"sieve, retained on 7/8" sieve	16 to 42
Passing 7/8" sieve, retained on 3/8" sieve	16 to 42
Passing 3/8" sieve, retained on No. 4 sieve	5 to 21
Total retained on No. 10 sieve	68 to 84
Passing No. 10 sieve, retained on No. 40 sieve	5 to 21
Passing No. 40 sieve, retained on No. 80 sieve	3 to 16
Passing No. 80 sieve, retained on No. 200 sieve	2 to 16
Passing No. 200 sieve	1 to 8

2. Type AB@ - Fine Graded or Leveling-Up Course

	Percent Aggregate by Weight or Volume
Passing 1" sieve	100
Passing 7/8" sieve	95 to 100
Passing 1-3/4" sieve, retained on 7/8" sieve	16 to 42
Passing 7/8" sieve, retained on 3/8" sieve	16 to 42
Passing 3/8" sieve, retained on No. 4 sieve	10 to 26
Passing No. 40 sieve, retained on No. 10 sieve	5 to 21
Total retained on No. 10 sieve	68 to 84
Passing No. 10 sieve, retained on No. 40 sieve	5 to 21
Passing No. 40 sieve, retained on No. 80 sieve	3 to 16
Passing No. 80 sieve, retained on No. 200 sieve	2 to 16
Passing No. 200 sieve	1 to 8

3. Type AC@ - Course Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 7/8" sieve	100
Passing5/8" sieve	95 to 100
Passing 5/8" sieve, retained on 3/8" sieve	16 to 42
Passing 3/8" sieve, retained on No. 4 sieve	11 to 37
Passing No. 4 sieve, retained on No. 10 sieve	11 to 32
Total retained on No. 10 sieve	54 to 74
Passing No. 10 sieve, retained on No. 40 sieve	6 to 32
Passing No. 40 sieve, retained on No. 80 sieve	4 to 27
Passing No. 80 sieve, retained on No. 200 sieve	3 to 27
Passing No. 200 sieve	1 to 8

4. Type AD@ - Fine Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 2" sieve	100
Passing3/8" sieve	85 to 100
Passing 3/8" sieve, retained on No. 4 sieve	21 to 53

Passing No. 4 sieve, retained on No. 10 sieve ……..	11 to 32
Total retained on No. 10 sieve ……..	54 to 74
Passing No. 10 sieve, retained on No. 40 sieve ……	6 to 32
Passing No. 40 sieve, retained on No. 80 sieve ……	4 to 27
Passing No. 80 sieve, retained on No. 200 sieve ……..	3 to 27
Passing No. 200 sieve ……..….	1 to 8

5. Type AF@ - Fine Graded Surface Course

	Percent Aggregate by Weight or Volume
Passing 3/8" sieve ……..	100
Passing No. 4 sieve ……	95 to 100
Passing No. 4 sieve, retained on No. 10 sieve ……...	58 to 73
Passing No. 10 sieve, retained on No. 40 sieve …….	6 to 26
Passing No. 40 sieve, retained on No. 80 sieve …….	3 to 13
Passing No. 80 sieve, retained on No. 200 sieve ……...	2 to 11
Passing No. 200 sieve ……	1 to 8

2.03 PRIME COAT

1. Prime coat, when specified on the plans, or as directed by the ENGINEER, shall be in accordance with Section 02610 - Prime Coat, and as specified herein.
2. Prime coat shall be applied to surfaced of based at least 12 hours prior to placing the HMAC unless otherwise directed by the ENGINEER.
3. Asphalt prime shall be applied uniformly at the rate of 0. 10 to 0.30 gallon per square yard or as directed by the ENGINEER. It shall be applied only when permitted by the ENGINEER and when the air temperature is not less than 40 F.
4. In order to prevent lapping at the junction of two applications, the distributor shall be promptly shut off. A hand spray shall be used to touch up all spots unavoidably missed by the distributor.
5. Immediately prior to application of the asphalt prime, an inspection will be made by the ENGINEER to verify that the base course has been constructed as specified. Also, all loose and foreign material shall be removed by light sweeping. Material so removed shall not be mixed with cover aggregate.
6. The surface to be primed shall be in a smooth and well-compacted condition, true to grade and cross section, and free from ruts and inequalities.
7. The pressure distributor used for applying prime coat material shall be equipped with pneumatic tires and shall be so designed and operated as to distribute the prime material in a uniform spray without atomization, in the amount and between the limits of temperature specified. It shall be equipped with a speed tachometer registering feet per minute and so located as to be visible to the truck driver to enable him to maintain the constant speed required for application at the specified rate.
8. The pressure distributor shall be equipped with a tachometer registering the pump seed, pressure gauge, and a volume gauge. The rates of application shall not vary from the rates specified by the ENGINEER by more than 10%. Suitable means for accuracy indicating at all times the temperature of the prime material shall be provided. The thermometer well shall be so placed as not to be in contact with a heating tube.
9. The distributor shall be so designed that the normal width of application shall be not less than 6 feet, with provisions for the application of lesser width when necessary. If provided with heating attachments, the distributor shall be so equipped and operated that the prime material shall be circulated or agitated through the entire heating process.
10. The asphalt prime coat should preferably be entirely absorbed by the base course and, therefore, require no sand cover. If, however, it has not been completely absorbed prior to the start of placing

the asphalt concrete mixture and in the meantime it is necessary to permit traffic thereon, just sufficient sand shall be spread over the surface to blot up the excess liquid asphalt and prevent picking it up under traffic. Also, sand shall be used in areas where traffic may pass over the prime coat. Prior to placing the asphalt concrete, loose or excess sand shall be swept from the base. If a sand cover is specified in the Supplementary Specifications or noted on the plans to cover asphalt prime, it shall be applied within 4 hours after the application of said prime coat, unless otherwise ordered by the ENGINEER.

11. Liquid asphalt shall be prevented from spraying upon adjacent pavements, structures, guard rails, guide posts, culvert markers, trees, and shrubbery that are not to be removed; adjacent property and improvements; and other facilities or that portion of the traveled way being used by traffic.
12. The CONTRACTOR shall protect the prime coat against all damage and markings, both form other traffic. Barricades shall be placed where necessary to protect the prime coat. If, after prime coat has been applied satisfaction on the ENGINEER and has been accepted by him, it is distributed by negligence on the part of the CONTRACTOR, it shall be restored at his expense to its condition at the time of acceptance. No material shall be placed until the prime coat is in a condition satisfactory to the ENGINEER.

2.04 TACK COAT:

1. It the asphalt concrete pavement is being constructed directly upon an existing hard-surfaced pavement, a tack coat shall be evenly and uniformly applied to such existing pavement preceding the placing of the asphalt concrete. The surface shall be free of water, all foreign material, or dust when the tack coat is applied. No greater area shall be treated in any one day than will be covered by the asphalt concrete during the same day. Traffic will not be permitted over tack coating.
2. Tack coat for HMAC shall consist of either rapid curing cut-back asphalt RC-2 diluted by addition of (not to exceed 15 percent by volume) an approved grade of gasoline and/or kerosene; emulsified asphalt, EA- 11 M diluted with 50 percent water, or a cut-back asphalt made by combining 50 to 70 percent of the asphaltic materials specified for the paving mixture with 30 to 50 percent gasoline and/or kerosene by volume.
3. Tack coat shall conform to the requirements of Section 02620 - Tack Coat or as specified herein.
4. Application rate shall be 0. 10 to 0. 15 gallons per square yard as directed by the ENGINEER.
5. A similar tack coat shall be applied to the surface of any course if, in the opinion of the ENGINEER, the surface is such that a satisfactory bond cannot be obtained between it and the succeeding course.
6. When required, the contact surfaces of all cold pavement joints, curbs, gutters, manholes, and the like shall be painted with a tack coat immediately before the joining asphalt concrete is placed. Asphalt tack coat shall be applied in controlled amounts as shown on the plans or determined by the ENGINEER. Surfaces where tack coat is required shall be cleaned to the satisfaction of the ENGINEER before the tack coat is applied.

2.05 MINERAL FILLER:

1. Mineral filler, other than hydrated lime, shall consist of a thoroughly dry stone dust, portland cement or other mineral dust approved by the ENGINEER.
2. The mineral filler shall be free from foreign or other deleterious matter.
3. When tested by the method outlined in SDHPT Test Method Tex-200 F (Part 102 3), mineral filler shall meet the following gradations by weight:

Passing No. 30 Sieve	95-100%
Passing No. 80 Sieve	75%
Passing No. 200 Sieve	55%

2.06 Anti- striping compound, as required in the job mix formula, shall be furnished in the amounts calculated therein.

2.07 JOB MIX FORMULA:

1. A job mix formula based on representative samples, including filler if required, shall be determined by the ENGINEER, or submitted by the CONTRACTOR for approval of the ENGINEER.
2. The resultant job mix formula for shall be within the master range for the specified type of HMAC.
3. The job mix formula for each mixture shall established a single percentage of aggregate passing each required sieve size, and a single percentage of bituminous material to be added to the aggregate and shall provide for 3 to 5% air avoids in the resultant design mix. During the mix design process the ENGINEER will consider other factors, in addition to air voids and Marshall stability, such a durability, water resistance and asphalt film thickness when developing the mix design.
4. After the job mix formula is established, mixtures for the project shall conform thereto within the following tolerance, which may fall outside of the specified master range.

Percent by Weight or Volume as Applicable

Passing 1-3/4" sieve, retained on 7/8" sieve ……..…….. Plus or minus 5
Passing 7/8" sieve, retained on 3/8" sieve ……...……. Plus or minus 5
Passing 5/8" sieve, retained on 3/8 ……...…… Plus or minus 5
Passing 3/8" sieve, retained on No. 4 sieve ……..…. Plus or minus 5
Passing No. 4 sieve, retained on No. 10 sieve ……..…… Plus or minus 5
Total retained on No. 10 sieve ……..…… Plus or minus 5
Passing No. 10 sieve, retained on No. 40 sieve ……..…….. Plus or minus 3
Passing No. 40 sieve, retained on No. 80 sieve ……..…….. Plus or minus 3
Passing No. 80 sieve, retained on No. 200 sieve ……..…… Plus or minus 3
Passing No. 200 sieve ……... Plus or minus 3

Asphaltic Material ……..…...… Plus or minus 0.05 by wt or 1.2 by vol.

Mixing Temperature ……..…… Plus or minus 20 F

5. Asphaltic mixture shall be tested in accordance with SDHPT Test Method Tex200-4 (Part I or Part 111) and shall have the following laboratory values:

	Surface Course	**Base Course**
Density - Minimum	95%	95%
- Maximum	99%	99%
- Optimum	97%	97%
Stability – (Hveenm)		
Minimum	30%	30%
Maximum	45%	45%
Stability (Marshall – 75 Blow Briquette)	1500 lbs.	1500 lbs.
Voids	3 - 7%	4 - 7%
Voids Filled With Asphalt	75-85%	65-80%
Sand Equivalent	40	40

2.08 EQUIPMENT:

1. All equipment for the handling of all material, mixing, and placing of HMAC shall be in accordance with the provisions of Texas SDHPT Item 340.

2.09 STOCKPILING, STORAGE, PROPORTIONING AND MIXING:

1. Stockpiling, storage, proportioning and mixing operations shall be in accordance with the Provisions of Texas SDHPT Item 340.

PART 3 - EXECUTION

3.01 WEATHER AND TEMPERATURE LIMITATIONS:

1. Asphaltic mixture, when placed with a spreading and finishing machine, or the tack coat shall not be placed when the air temperature is 50 F and falling, but may be placed when the air temperature is 40 F and rising.
2. Asphaltic mixture, when placed with a motor grader, shall not be placed when the air temperature is 60 F and falling, but may be placed when the air temperature is 50 F and rising.
3. Mat thickness of I> inches or less shall not be placed when the temperature on which the mat is to be laid is below 50 F.
4. No tack or asphaltic mixture shall be placed when the humidity, general weather conditions and temperature and moisture condition of the base, in the opinion of the ENGINEER, are unsuitable.
5. If, after being discharged from the mixer and prior to placing, the temperature of the asphaltic mixture is 50 F or more below the temperature established by the ENGINEER, all or any part of the load may be rejected and payment will not be made for the rejected material.

3.02 EQUIPMENT:

1. Hauling Equipment:
    1. Trucks used for hauling asphaltic mixtures shall have tight, clean, smooth metal beds, which have been thinly coated with a minimal amount of paraffin oil, lime, slurry, tine solution or other approved material to prevent mixture adhesion to the bed.
    2. The dispatching of hauling equipment shall be arranged so that all material delivered may be placed and all rolling completed during daylight hours, unless otherwise directed by the ENGINEER.
    3. All trucks shall be equipped with a cover of canvas, or other suitable material to protect the mixture from weather or on hauls where the temperature of the mixture will fall below specified level. Use of covers will be as directed by the ENGINEER.
2. Rollers:
    1. Pneumatic Tile Roller. This roller shall consist of not less than seven pneumatic tire wheels, running on axles in such a manner that the rear group of tires shall cover the entire gap between adjacent tires of the forward group; mounted in a rigid frame; and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle. The tire shall afford surface contact pressures up to 90 pounds per square inch or more. The roller shall be so constructed as to operate in both a forward and a reverse direction with suitable provisions for moistening the surface of the tires while suitable provisions for moistening the surface of the tires while operating; and shall be approved by the ENGINEER.
    2. Two Axle Tandem Roller. This roller shall be acceptable power-driver, steel-wheel, tandem roller weighing not less than eight tons. It must operate in forward and reverse directions; contain provision for moistening the surface of the wheels while in motion; and shall be approved by the ENGINEER.
    3. Three Wheel Roller. This roller shall be an acceptable power-driven, all steel three-wheel roller weighing not less than 10 tons. It must operate in forward and reverse directions; contain provisions for moistening the surface of the wheel while in motion; and shall be approved by the ENGINEER.

4. Vibratory Steel Wheel Roller. If approved for use by the OWNER, this roller shall have a minimum weight of six tons. The compactor shall be equipped with amplitude and frequency controls and shall be specifically designed to compact the material on which it is used. If shall be operated in accordance with a manufacturers recommendations.

3. Straight Edges:
   1. The CONTRACTOR shall provide an acceptable 16-foot straight-edges for surface testing. Satisfactory templates shall be provided as required by the ENGINEER.

4. Spreading and Finishing Machine:
   1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or a strike-off assembly, heated if necessary, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the plans.
   2. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. Design will be such that no part of the truck weight will be supported by the paver.
   3. The screed of strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture. The screed shall be adjustable for both height and crown and shall be equipped with a controlled heating device.
   4. The bituminous paver shall be equipped with an automatic leveling device controlled from an external guide. The initial pass for each course shall be made using a paver equipped with a 40-foot minimum external reference, except that this requirements will not apply when asphalt concrete is placed adjacent to portland cement concrete pavement. Subsequent passes may utilize the matching device of one-foot minimum length riding on the adjacent lay.

3.03 CONSTRUCTION METHODS:

1. Spreading and Finishing:
   1. The asphalt concrete mixture shall be laid on the approved surface, spread and struck off the grade and elevation established. It shall be spread and compacted in layers as shown on the plans or as directed by the ENGINEER. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.
   2. The ENGINEER will determine a minimum placement temperature within a range from 220 F to 300 F which will produce the required density. The established placement temperature, which is measured immediately behind the laydown machine, shall not vary more than 20 F.
   3. A conventional paver or suitable equipment approved by the ENGINEER may be used to place asphalt concrete material on shoulders depressed from the traveled lanes in order to establish a uniform typical section. Approval of the equipments used will be based upon the result obtained.
   4. The asphalt concrete may be dumped from the hauling vehicles directly into the paving machine or it may be dumped upon the surface being paved and subsequently loaded into the paving machine; however, no asphaltic concrete shall be dumped from the hauling vehicles at a distance greater than 250 feet in front of the paving machine. When asphaltic concrete is dumped first upon the surface being paved, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphaltic concrete dumped all be picked up and loaded into the paving machine.
   5. To achieve, as far as practicable, a continuous operation, the speed of the paving machine shall be coordinated with the production of the plant. Sufficient hauling equipment shall be available to insure continuous operation.
   6. The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other end indirectly either through controlling the transverse slope or alternately when directed, by controlling the elevation of each end

independently, including any screed attachment used for widening, etc. Failure of the control system to function properly shall be cause for the suspension of the asphaltic concrete operations.

7. When dumping directly into the paving machine from trucks, care shall be taken to avoid jarring the machine or moving it out of alignment.
8. All course of asphaltic concrete shall be placed and finished by means of self-propelled paving machines except under certain conditions or at certain locations where the ENGINEER deems the use of self-propelled paving machines impracticable.
9. Self-propelled paving machines shall spread the asphaltic concrete without segregation or tearing within the specified tolerances, true to the line, grade, and crown indicated on the plans. Pavers shall be equipped with hoppers and augers which will place the asphaltic concrete evenly in from of adjustable screeds without segregation. Screeds shall include any strike-off device without tearing, shoving or gouging the asphaltic concrete and which produces a finished surface of an even and uniform texture for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.
10. On areas where irregularities or unavoidable obstacles make use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, fluted and compacted with had tools. For such areas the mixture shall be dumped, spread and screed to give the required compacted thickness.

2. Compaction
   1. Rolling with the 3-wheel and tandem roller shall start longitudinally at the sides and proceed toward the center of the surface course, overlapping on successive trips by at least half the width of the rear wheels.
   2. Alternate trips of the roller shall be slightly different in length.
   3. Rolling with a pneumatic tired roller shall be as directed by the ENGINEER.
   4. Rolling shall continue with no further compression can be obtained and all roller marks are eliminated.
   5. The motion of the roller shall be slow enough at all times to avoid displacement of asphaltic materials. If displacement occurs, it shall be corrected immediately by use of rakes and fresh asphaltic mixtures, where required.
   6. The roller shall not be allowed to stand on the surface coarse when it has not been fully compacted and allowed to cool.
   7. To prevent adhesion of the surface course to the roller, the wheels shall be kept thoroughly moistened with water; however, excess water shall not be allowed.
   8. All precautions shall be taken to prevent dripping of gasoline, oil, grease, or other foreign substances on the surface or base courses during rolling operations or while rollers are standing.
   9. With the approval of the ENGINEER, a vibratory steel wheeled roller by be substituted for the 3-wheel roller and tandem roller.
   10. Along forms, curbs, headers, walls and other places are accessible to the rollers, the mixture shall be thoroughly compacted with not hand tampers, smoothing irons, or with mechanical tampers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.
   11. Any mixture that becomes loose, broken, mixed with dirt, segregated, or is in any way defective shall be removed and replaced with fresh hot bituminous mixture, which shall be compacted to conform with the surrounding area. Any area showing excess or deficiency of bituminous material shall be corrected immediately as directed by the ENGINEER.
3. In-Place Density
   1. In-place density shall be required for all mixtures except thin irregular depth leveling courses.
   2. Each course, after final compaction, shall have a density of not less than 95 percent of the density developed in the laboratory lest method outlined in Texas SDHPT Bulletin C- 14.
   3. Density shall be determined with a portable nuclear test device in conformity with ASTM D-2950, 76.

4. Calibration of the portable nuclear device will be established by the ENGINEER from cut pavement samples tested in accordance with AASHTO T- 166 (weight, volume method). The density readings of the cut pavement samples determined in accordance with AASHTO T- 166 (weight, volume method), and the density readings of the pavement samples determined by the portable nuclear test device in conformity with ASTM D 2950 will be correlated by the ENGINEER.
5. Other methods of determining in-place density may be used as deemed necessary by the ENGINEER.
6. It is intended that acceptance density testing will be done while the bituminous mixture is hot enough to permit further compaction if necessary. If the density of an acceptance section does not meet the specified requirements, the CONTRACTOR shall continue the compaction effort until the optimum density is obtained, but rolling for any compaction effort will not be allowed when the temperature of the mix is below 175 F unless authorized in writing by the ENGINEER. Rerolling the paved surface after it has initially cooled will not be allowed.
7. If in-place density test of the mixture produce a value lower than specified and in the opinion of the ENGINEER is not due to a change in the quality of the material, production may proceed with subsequent changes in the mix and/or construction procedures until in-place density equals or exceeds the specified density.
8. In-place density tests will be provided by the ENGINEER unless otherwise specified.

4. Joints
   1. Placing of asphalt concrete shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the ENGINEER.
   2. When plant mix bituminous pavement is placed over plant mix bituminous treated base or when plant mix seal coat is placed over plat mix bituminous pavement, longitudinal joints shall be staggered at least 6 inches with relation to the longitudinal joints of the underlying course.
   3. Transverse joints shall have a two-foot or 12:1 minimum taper. Longitudinal joints shall have a one-foot or 6:1 minimum taper. All traverse tapers shall be cut and squared off prior to commencing new work. Tapered longitudinal joints from previous operations shall be cleaned and tack coated if directed by the ENGINEER. All joints shall be completely bonded. The surface of each course at all joints shall be smooth and shall not show any deviations in excess of 3/16 of an inch when tested with a 10-foot straightedge in any direction.
   4. When paving under traffic the CONTRACTOR shall plan his daily surfacing operations on a schedule which will result in not more than one (1) day=s operation of exposed longitudinal joints. The longitudinal joints shall not have a height greater than two (2) inches and shall not be left exposed longer than 24 hours.
5. Surface Tolerance:
   1. Upon completion, the pavement shall be true to grade and cross section. Expect at intersections or any changes of grade, when a 16 foot straight edge is laid on the finished surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straight edge more that I/ I 6-inch per foot. Areas that are not within this tolerance shall not be brought to grade immediately following the initial rolling. After the completion of final rolling, the smoothness of the course shall be checked, and the irregularities that exceed the specified tolerances or that retain water on the surface shall be corrected by removing the defective work and replacing with new material as directed by the ENGINEER at the expense of the CONTRACTOR.
6. Manholes and Valve Covers
   1. Manhole frames and valve covers shall be adjusted prior to placing the surface course.
7. Compacted Thickness of HMAC and Base Courses
   1. Surface Courses. The completed thickness or depth of the asphaltic concrete surface shall be shown on the plans. Where the plans require a depth or thickness of the surface course

greater than two inches compacted depth, same shall be placed in multiple coursed of equal depth, each of which shall be exceed two inches compacted depth. If, in the opinion of the ENGINEER, an additional tack coat is considered necessary between any multiple courses, it shall be applied at a rate as directed.

2. Base Courses. The compacted thickness or depth of each base course shall not be shown on the plans. Where the plans require a depth or thickness of the course greater than 4 inches, same shall be accomplished by constructing multiple lifts of approximately equal depth, each of which shall not exceed these maximum compacted depths. If, in the opinion of the ENGINEER, an additional tack coat is considered necessary between any of the multiple lifts, it shall be applied as herein before specified at the rate as directed.

8. Pavement Thickness Tests
   1. Pavement Thickness Test. Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the ENGINEER or his authorized representative unless otherwise specified in the special provisions or in the plans. The number and location of tests shall be at the discretion of the OWNER. The cost of the initial pavement thickness test shall be at the expense of the ENGINEER. In the event a deficiency in the thickness of pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the CONTRACTOR=S expense. The cost for the additional coring test shall be at the same rate charged be commercial laboratories.
9. Price Adjustment of Roadway Density
   1. The payment of the unit price will be adjusted for roadway density as outlined in the following table. The adjustment will be applied on a lot-by-lot basis for each lift. The adjustment will be based on the average of five density tests. The price adjustment will be applied to the entire asphalt concrete mix which includes the HMAC aggregate, the asphalt cement and anti-stripping compound, if used.

Average Density % of Lab Density	Percent of Contract Price to be Paid
Above 95.9	100%
94.0 to 94.99	96%
93.0 to 93.99	91%
92.0 to 92.99	85%
Less than 92.00	*

*This lot shall be removed and replaced to meet specification requirements as ordered by the ENGINEER. In lieu thereof, the CONTRACTOR and the ENGINEER may agree in writing that for practical purposes, the lost shall not be removed and will be paid for at 50% of the contract price.

PART 4 - MEASUREMENT AND PAYMENT

4.01 INCIDENTAL WORK

1. Prime coat, anti-stripping compound, where used and tack coat shall not be measured for direct payment, but shall be considered as subsidiary work pertaining to the placing of asphaltic mixtures of the contract price.

4.02 MEASUREMENT

1. Hot-mix asphalt concrete material shall be measured by the ton of 2,000 pounds or by the square yard of the type used in the completed and accepted work.

2. Weight shall be determined by a certified scale approved by the OWNER and recorded serially numbered weight tickets, identifying the vehicle and presented to the ENGINEER's representative on the job.

4.03 PAYMENT

1. Work performed and materials furnished, as prescribed by this item, measured as provided herein, shall be paid at the unit bid price per ton or square yard for the type or types of hot mix asphalt concrete pavement shown on the proposal.
2. Unit bid price shall be payment in full for quarrying; furnishing all materials; for all heating; mixing; hauling; cleaning existing base course or pavement; placing asphaltic mixtures; rolling and finishing; and for all labor, tools, equipment and incidentals necessary to complete the work, including the work and materials involved in the application of price coat and tack coat.

END OF SECTION

SECTION 32 13 13 — CONCRETE PAVING, CURBS AND SIDEWALK

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. All site concrete work, including sidewalks, paving, equipment slabs, ramps, and other miscellaneous concrete.

B. All form work.

C. Reinforcing steel.

D. Installation of sleeves provided by plumbing, heating, and electrical contractors for work under site concrete. Sleeves for irrigation system.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Testing Laboratory services.

B. Excavation and fill.

C. Soil stabilization.

1.4 DRAWING REFERENCES: See drawings for reinforcing sizes and placement.

1.5 SUBMITTALS

A. DESIGN MIX: Submit six (6) copies directly to the Owners Testing Laboratory the proposed concrete mix for concrete paving and sidewalks. Include cement brand and type, aggregate identification, admixtures, proportions and anticipated strengths.

B. PLASTIC CHAIR SUPPORT: Submit manufacturer's literature indicating dimensions, configuration, and performance data. Submit sample for approval by the Architect.

C. JOINT FORMS: Submit manufacturer's literature indicating dimensions, configuration, reinforcing and accessories related to load transfer units.

D. ADMIXTURES: Submit manufacturer's literature indicating composition and mix proportions.

E. CURING COMPOUND: Submit manufacturer's literature indicating composition and recommended application procedures.

F. JOINT SEALANT: Submit manufacturer's literature indicating sealant type(s), performance, recommended application procedures, and recommending open or closed cell backer material for the application.

G. DELIVERY TICKETS: Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information as follows:

1. Ambient temperature.
2. Any modifications and dispositions of the load.
3. Driver's identification.
4. Identification of placement location at jobsite.
5. Ingredients by weight.
6. Number of cubic yards.
7. Time emptied.
8. Time loaded.

H. TEST REPORTS: Arrange for the Owner's Testing Laboratory to submit reports to the Owner, Architect and Contractor indicating compressive strength, aggregate type and slump for samples taken at the site.

1.6 SAMPLES

A. Plastic chair support.

B. Minimum 36" x 36" finish samples at the job site for Architects approval. Provide sample for each type of finish (smooth, light broom, medium broom, etc.) and each type of joint.

1.7 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.8 QUALITY ASSURANCE

A. Cast-in-place concrete shall be installed by technicians specially trained in the proper handling, placing and protection of concrete and reinforcing steel. If required by the Architect, installer shall submit for approval a list of similar installations successfully completed.

B. Cast-in-place concrete shall be mixed and installed in strict accordance with applicable written recommendations and requirements of the Texas State Department of Highways and Public Transportation (TSDHPT) and the American Concrete Association (ACI) including but not necessarily

limited to the following where documents conflict, the most stringent of the requirements as determined by the Architect shall apply:

1. TSDHPT, item 360.
2. ACI 302.
3. Building Code Requirements for Reinforced Concrete, ACI 318.
4. Recommended Practice for Hot Weather Concreting, ACI 305.
5. Recommended Practice for Cold Weather Concreting, ACI 306

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL: All materials used in the Work shall be stored or handled in a manner which will prevent deteriorations; any materials that have been damaged shall be immediately and completely removed from the Work. All manufactured materials, such as cement, shall be delivered and stored in their original packages, plainly marked with the brand and manufacturer's name. Broken packages or packages that show marks or other evidence of damage shall be wholly rejected.

B. CEMENT: Portland cement shall conform to standard specifications of ASTM,C-150, Type l, latest edition. The brand shall be one approved by the Architect, and this one brand shall be used throughout the project.

C. AGGREGATES: Aggregates for concrete of normal weight shall be clean, hard, strong, uncoated, free of loam, fine sand, clay dust, organic or other deleterious matter and shall conform to ASTM C-33.

FINE AGGREGATE				COARSE AGGREGATE	
Sieve Size	Percent Passing	Sieve Size	1-1/2	Percent	3/4
4	95-100	1-1/2	95-100	-	-
16	50- 88	1”	-	90-100	-
50	10-30	3/4"	40-70	-	90-100
100	0- 5	1/2"	-	25- 60	
		3/8"	10-30	-	20-55
		#4	0- 5	0- 10	0- 10

D. Clay - 3% Maximum Clay - 1 % Maximum

E. WATER: Water shall be clean and potable, free from injurious amounts of oil, acid, Alkali, organic matter or other deleterious substances.

F. REINFORCING STEEL: All reinforcing steel shall be high bond, new billet stock, and shall conform with ASTM A-615, except that mesh shall conform with ASTM A-1 85. All materials must be free from seams, flaws, scale or an excessive amount of rust. The supplier shall furnish Architect with a certificate certifying the reinforcing steel is domestic, or supply laboratory tests acceptable to the Architect, that foreign steel meets these tests. Laboratory tests shall be made on each size of steel. Samples for testing shall be taken from jobsite. The samples shall be replaced with bar of like size and length, plus 40 diameter.

G. ANCHORS: Install all necessary anchors, wire loops or other miscellaneous fasteners to be installed in concrete for anchoring masonry or other work.

H. WOOD JOINT FORMS:

1. Sidewalk Joints: Expansion joints at concrete walks shall be 1X Redwood.
2. Paving Joints: 3/4" thick redwood form with minimum 1" deep removable top strip, 3/4" x 1 0" steel reinforcing bars at 24" o.c. with bond-breaker sleeve on one side, and 3/16" thick steel rebar support plates each side. Provide custom size as required for full depth of paving as manufactured by Shepler Equipment Co., or equivalent by Commercial Lumber Supply, Marine Lumber Co., or Southern States Lumber.

I. TRANSIT MIX CONCRETE: Contractor shall provide concrete meeting the specifications with regard to compressive strength, method of handling, and controlled by testing lab at batch plant. Concrete shall meet ASTM C-94; Certificate from supplier shall be furnished to Architect.

J. CURING COMPOUND: Shall be Southform 4-way (cures, seals, dustproofs, and hardens), or equivalent product by Gifford-Hill, Nox-Chem, Sonneborn, or W.R. Grace.

K. ADMIXTURES:

1. General: All admixtures shall be added at the plant during mixing and must be prior approved by the Testing Laboratory. Admixtures shall comply with requirements of ASTM C-260 and C-494. Admixtures containing calcium chloride are not acceptable. **Do not use admixtures in footings or seal slabs.**
2. Water Reducing Agents: All design mixes must test with the required slumps prior to the addition of a water reducing agent. Each specified maximum slump may be increased by a maximum of 2" at the plant by the addition of a maximum of 3 ounces of water reducing agent per 94 pound bag of cement. Meet requirements of ASTM C494, Type F.

    a. "PSI Super" as manufactured by Cormix Construction Chemicals.
    b. "WRDA-1 9" as manufactured by W.R. Grace.
    c. "Sikament" as manufactured by Sika Chemical Corp.

3. Set-Controlling Agents: Under 40 degrees F., add accelerating agent Over 80 degrees F., add retarding agent.

    a. Cormix Construction Chemicals.
    b. Master Builders
    c. Protex Industries
    d. Sika Chemical Corp.

4. Air Entrainment: All structural concrete shall contain an air entraining agent compatible with other approved admixtures. Agent added at the plant shall produce 4-5% air entrainment - not required at drilled footings.

L. REINFORCING BAR SUPPORTS: Heavy-duty type four-legged plastic chair supports with sand plate. Series "G" or "B" (as determined by job conditions) as manufactured by W.H.C. Products, Inc. or approved equivalent by Aztec Concrete Accessories. Provide sand plate for slab on grade. Space at a maximum of 45" centers each way. Provide closer spacing where required to prevent excessive sag, or to support the weight of concrete pump hose.

M. METAL REINFORCEMENT:

1. Bars

    a. General: Detailing conform to ACI detailing manual.
    b. Grade 60: Comply with ASTM A 615.
    c. Grade 40 (#3 bars): Comply with ASTM A 615.

2. Mesh

    a. Comply with ASTM A 185.
    b. Mesh shall be type which is fabricated and delivered in flat sheets.
    c. Use mesh only where specifically indicated in the drawings for sidewalks or equipment pads.

N. PAVING JOINT SEALANT: Polyurethane base, multi-component, chemical curing, self-leveling Type 1, conforming to requirements of FS TT-S-00227E, Class A (provide equivalent non-sagging Type 2 at vertical joints in curbs), as manufactured by Tremco or equivalent by Sonneborn, Sheplers, or Pecora. Use with flat strip, non-absorbent polyethylene joint backer-open or closed cell type as recommended by the sealant manufacturer.

2.2 MIX DESIGNS

A. The concrete mix shall be designed by the concrete supplier and approved by the Owner's Testing Laboratory. Contractor shall furnish to the laboratory samples of the aggregate he proposes to use in the concrete work. Concrete mixes shall achieve twenty eight (28) day compressive strengths indicated below, and shall be so proportioned as to obtain a workable mix in accordance with the following limits:

B. Compressive Strength	Minimum Cement	Maximum Total
C. at 28 days	Content 94#	SacksWater Per Sack of Cement
D. Minimum P.S.I.	Cubic Yard	Gallons
E. Paving 3,500	5.5	7.0

F. SLUMPS: Slumps greater than specified can adversely affect concrete performance due to excessive shrinkage. Slumps specified below are based upon concrete design mix prior to addition of any approved water reducing agent.

1. 5"+/-1": Sidewalks
2. 3"+/-1": Paving,curbs

G. The use of fly ash in the concrete mix is not acceptable.

H. MIXING

1. Comply with ASTM C 94.
2. Mix concrete to a uniform distribution of materials. Mix at least two minutes after materials are in mixer. Discharge concrete completely before mixer is recharged.
3. Mix each batch not less than 70 or more than 100 revolutions of the drum at mixing speed. Additional mixing is to be done at agitating speed.

I. ADJUSTMENTS TO MIX DESIGN: Submit for approval by the Owner's Testing Laboratory any proposed adjustments to the approved mix design due to job conditions, weather or testing results. Necessary adjustments to the mix design shall be at the Contractor's expense.

PART 3 - EXECUTION

3.1 PREPARATION

A. Any portions of the subgrade or fill that are below optimum moisture content shall be wetted at least one (1) week prior to placing concrete in order to achieve a proper uniform distribution of moisture.

B. All preliminary work shall be carefully checked, all trash and debris removed, and the approval of the Architect obtained before any concrete is placed. The Architect shall be notified twenty-four (24) hours before any concrete is scheduled to be placed.

C. SUBGRADE APPROVAL- The bearing grade of slab-on-grade concrete shall require approval of the Owner's testing laboratory immediately prior to the placement of concrete regardless of any previous test results. Bearing grade which is overly dry, saturated, exhibits standing water, contaminants, irregularities or other properties which may tend to be deleterious to the performance of the cast-in-place concrete will not be approved by the Owner's testing laboratory as suitable for concrete placement.

D. Coordinate and provide for plumbing, electrical, carpentry, masonry, miscellaneous metals and other installation requirements, which must be completed prior to concrete work or which may require special forming or block-outs.

E. CLEANING: Clean all forms of debris and thoroughly wet wood forms before placing concrete.

F. Inspect subgrade to determine that uniform thickness of concrete paving and walks will result in proper drainage and no standing water. Notify Architect prior to beginning work of any no slope areas or potential standing water conditions.

G. HOT WEATHER CONDITIONS: Where ambient temperature exceeds 95 degrees F. with a wind velocity exceeding 5 MPH or temperature exceeds 90 degrees F. with a wind velocity exceeding 15 MPH, follow recommendations in ACI publication "SLABS ON GRADE" to protect against rapid drying.

H. Do not place concrete when air temperature is 40 degrees F. or below or when the air temperature is expected to go below 30 degrees F. in the following 48 hours after placing of concrete unless the concrete is protected from such temperature.

I. Install all anchors, fasteners, junction boxes, curb dowels collection boxes or other construction to be installed within concrete paving.

3.2 INSTALLATION

A. TRANSIT: Concrete shall be agitated continuously with slow revolutions of the drum white in transit. No concrete shall be deposited after being in the mixer more than 90 minutes. Testing laboratory shall check each delivery ticket and notify Contractor immediately of any concrete arriving more than 90 minutes after plant loading.

B. HANDLING: Concrete shall be deposited in the forms as rapidly as practicable by methods which will prevent loss or separation. It shall be deposited as nearly as practicable in its final position to avoid rehandling. Provide runways, or other means for wheeled equipment to carry concrete to points of deposit.

C. PLACING REINFORCEMENT:

1. A thin film of rust will not be considered objectional, but no loose or scaly rust, dirt, mud or cement will be allowed. Steel must be cleaned with wire brushes or replaced if pitted from rust.
2. Accurately position, secure against displacement with #18 gauge wire ties or suitable clips, support by heavy duty plastic chairs with sand plates. Do not use "brick batts" or rubble for support.
3. Follow recommendations of Concrete Reinforcing Steel Institute as to type of steel, splicing, location and placement.

D. PLACING CONCRETE:

1. Deposit and consolidate concrete in a continuous operation, within the limits of joint forms, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement, other embedded items, and into corners.
3. Maintain reinforcing steel in the proper position continuously during concrete placement operations.
4. Bring slab surfaces to the correct plane with a straight edge or vibrating screed and strike off. Use bull floats or derbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle

water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Concrete surface shall be true to plane within 1/4" against a 10' straight edge.

3.3 JOINTS

A. LOAD TRANSFER UNITS:

1. Install wood joint form in accordance with manufacturer's printed directions prior to concrete pour. All plastic sleeves at reinforcing bars shall be placed running in same direction.
2. Install manufacturers stakes at 48" o.c. maximum where concrete is to be placed on both sides of form simultaneously. Install at 36" o.c. maximum at cold joints.
3. Longitudinal joint forms shall be continuous through transverse joint forms.
4. Pre-wet form boards prior to placement to ensure against dry wood forms removing water at edges of concrete.
5. Leave removable top strip in place and protect until sealant operations begin.

B. WOOD FORMS:

1. Install similar to load transfer units. Use at radiused areas and sidewalks.
2. Kerf where required for radius.
3. Leave removable top strip in place at paving and protect until sealant operations begin. Top strip and sealant not required at sidewalks.

C. KEYED JOINTS:

1. Align metal joint forms and install manufacturer's splice clip at ends to keep joints in alignment during concrete placement.
2. Set all stakes securely to keep joint form from moving during concrete placement.
3. Do not remove forms until concrete has obtained sufficient strength. When removing forms, apply no vertical uplift which may damage or weaken concrete key.

3.4 CURBS

A. Provide machine laid (extruded) reinforced concrete curbs unless monolithic or formed curbs are indicated in the drawings.

B. Apply epoxy to cured concrete paving and continuously lay curb over installed dowels.

3.5 FINISHING

A. GENERAL: Concrete finishes shall match approved jobsite samples approved by the Architect. Spreading of dry cement for finishing is not acceptable. Begin finishing operations as soon as water sheen has disappeared from surface.

B. PAVING FINISHES: Slabs shall be true to plane within 1/4" in a length of 10' machine finish and provide light to medium broom finish (across the direction of traffic) at all paving as approved by the Architect.

C. SIDEWALKS: Provide light broom finish perpendicular to walk. Provide Architect with sample panel of proposed finish for approval prior to beginning work.

D. STEPS AND RAMPS: Shall be constructed as detailed. Exterior steps, landings, and ramps shall be medium broom finished.

E. PAVING JOINTS: Provide tooled eased edges along both sides of redwood joint form to ensure neat appearance, sealant adhesion, and to facilitate removal of top strip. Use 1/8" radius jointing tool.

F. OPEN TOOLED JOINT: Provide scored lines on concrete sidewalks 5'-0" o.c. unless spaced otherwise on the drawings. Joint size shall be 1/4" wide x 1/4 depth of concrete.

G. All concrete paving and walks shall be uniform in color and consistent in finish. Remove and replace any areas dimpled by rain or discolored (concrete mix).

3.6 CURING

A. Apply complete covering of curing compound as soon as concrete is finished and in accordance with manufacturer's instructions. Curing compound shall be applied as it comes from the can, at the rate of 200 to 300 square feet per gallon.

B. To avoid sealant adhesion problems ensure that curing compound does not seep into paving joints that receive sealant.

3.7 CAP SEALANT

A. Remove redwood top strip from joint forms. Take care to avoid damaging concrete edges. Clean sealant cavity and inspect for proper depth as recommended by sealant manufacturer.

B. Ensure that sealant cavity is clean, dry, and free of dust, dirt, and small stones. Ensure that edges are not contaminated with curing compound, oil or other agents, which might cause adhesion failure. Prime side walls in accordance with sealant manufacturer's recommendations.

C. Install flat ethafoam strip in bottom of sealant cavity to provide bond-breaker at bottom of sealant and to ensure against sealant loss past the joint form. Install strip in thickness required to provide sealant cavity size as recommended by sealant manufacturer. Use no sand or other loose material in joint cavity.

D. Mix sealant thoroughly in accordance with manufacturer's recommendations and pour to within 1/8" of top of paving. Where sealant must be repoured due to run off or improper level, remove completely all traces of sealant on side walls before next application.

E. At concrete curbs rake joint filler to minimum 1" depth and install sealant manufacturer's vertical joint grade sealant.

3.8 CLEANING AND PROTECTION

A. Paving is to be kept free of any foreign substances (wax, oil, paint, etc.) or surface irregularities, which may affect the final appearance of the completed installation.

B. Unless otherwise approved by the Architect, no vehicular traffic will be allowed on any concrete slab, paving or drive until after the 7 day concrete tests have been made by the laboratory indicating that the concrete has attained 3,000 psi compressive strength.

C. Contractor shall coordinate with Architect and Owner to determine a suitable on-site "wash-out" area for concrete trucks. Contractor shall be responsible for clean up of the designated area.

D. Contractor shall keep clean all adjacent public streets and rights of way. Wash down daily or more often as needed to maintain a safe condition at entrances/exits to site.

3.9 TESTING LABORATORY CONTROL

A. Contractor shall contact Owner's Testing Laboratory at least 24 hours prior to time of anticipated concrete placement.

B. Contractor shall require the manufacturers of the cement and metal reinforcement to be used in the work to furnish mill certificates showing that such materials meet ASTM standards as specified.

C. Contractor shall follow all requirements of ASTM C 31 concerning the proper handling and protection of concrete test cylinders. Contractor shall provide locked storage facilities for test cylinders with all heat, insulation and protection as required by ASTM C 31.

END OF SECTION

SECTION 32 31 13 — CHAIN LINK FENCING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide all labor, equipment, and materials for the construction of galvanized chain link fencing and gates at the locations shown on the drawings.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Temporary construction fencing

B. Concrete

1.4 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer’s literature indicating the performance, fabrication procedures, product variations and accessories.

B. SUBMITTALS: Submit shop drawings including details illustrating fence height, size of posts, rails, braces, gates, and footings, accessories and erection procedures.

C. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 QUALITY ASSURANCE

A. GENERAL: Provide fences and gates as complete units produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

B. EXAMINATION OF CONDITIONS: Installer shall examine the conditions under which the fences and gates are to be installed. Notify the Owner in writing of all conditions detrimental to the proper and timely completion of the work.

C. QUALIFICATIONS FOR INSTALLER: Erection of the work of this section shall be done by qualified, experienced personnel under direct supervision of fencing manufacturer's field representative.

D. PRODUCT DELIVERY, STORAGE AND HANDLING: Deliver material in manufacturer's original packaging with all tags and labels intact and legible. Handle and store material in such a manner as to avoid damage.

E. PRODUCT REPLACEMENTS: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 MATERIALS

A. GENERAL:
1. All materials, fabric fittings, appurtenances, hardware, fasteners, and fabrications (other than aluminum of stainless steel ties) to be hot-dipped galvanized after fabrication; posts and rails may be field cut only when the cut ends will be covered completely and protected by concrete or fittings.
2. Zinc for galvanizing shall conform with the requirements A.S.T.M. B6. Galvanizing of materials shall conform with the following requirements:
   (a) Pipe: A.S.T.M. A-120 (1.8 oz zinc psf)
   (b) Hardware and Accessories: A.S.T.M. A-153 (2 oz zinc psf)
   (c) Chain link fabric: A.S.T.M. A-392, Class II (not less than 1.2 oz zinc psf)

B. CHAIN LINK FABRIC: One piece of fabric widths, No. 9 gauge wires, 2" mesh typical. Copper bearing steel wire, tensile strength 80,000 psi. Hot dipped galvanized after weaving. Top and bottom selvages shall be knuckled for all chain link fabric.

C. POSTS, RAILS AND BRACES:
1. End, Corner and Pull Posts: 2-1/2" I.D. standard weight, Schedule 40 round galvanized steel pipe; weight 5.79 lbs./linear foot. Install one pull post at the center of FENCE Line and one terminal post at each end and/or change of direction.

2. Line Posts: Typical line posts up to 6' high shall be 2" I.D. standard weight, schedule 40 round galvanized steel pipe, weight 3.65 lbs./linear foot, spaced on 10' centers, maximum. Fabric shall be attached to posts with 9 gauge zinc coated wire ties 12" o.c. maximum. For posts up to 12' high, use 2-1/2" I.D. x 9.11 lbs./linear foot.

3. Top Rail: 1-1/4" I.D. Schedule 40 galvanized steel pipe, weight 2.27 lbs./linear foot furnished in manufacturer's standard lengths of approximately 21'-0" with couplings approximately 6" long for each joint, one coupling in each 5 to have expansion spring. Provide means for attaching top rail to each gate, corner, pull and end posts. Top rail shall form continuous brace from end to end of each run of fence.

4. Post Brace Assembly: Provide bracing assemblies at terminal and gate posts and at both sides of corner and pull posts , with the horizontal brace located at mid-height of the fabric. Use 1-1/4" I.D. Schedule 40 galvanized pipe for horizontal brace and 3/8" diameter rod with turnbuckle for diagonal truss.

5. Tension Wire: 7 gauge galvanized steel spring wire at bottom of fence.

6. Post Tops: Pressed steel, or malleable iron designed as a weathertight closure top for tubular posts. Provide one cap for each post. Provide tops to permit through passage of top rail.

7. Stretcher Bars: One piece lengths steel equal to full height of fabric with minimum cross-section of 3/16" x ¾. Provide one stretcher bar for each gate and end post and 2 for each corner or pull post.

8. Stretcher Bar Bands: Heavy pressed steel or malleable iron, spaced not over 15" o.c. to secure stretcher bars to end, corner and gate posts.

9. Wire Ties: For tying fabric line posts, use minimum 9 gauge aluminum or galvanized steel wire ties for tubular posts spaced 14" o.c. For tying fabric to rails and braces, use 9 gauge aluminum wire ties spaced 24" o.c. For tying fabric to tension wire, use 11 gauge hog rings spaced 24" o.c.

10. Privacy Fence Slats: Provide Lock-Top PVC slats designed to provide about 75% privacy once installed.

11. Concrete: Conform with requirements of ASTM C-92, 1" maximum size aggregate and at least 4 sacks cement per cubic yard, 3% to 6% entrained air, 3,000 psi at 28 days, maximum 3"slump.

D. SWINGING GATES:

1. Fabricate gate perimeter frames of 1-1/2" I.D. Schedule 40 galvanized pipe; weight 2.72 pounds per linear foot. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Assemble gate frames by welding or fittings and rivets for rigid connections. Use same fabric as for fence. Install fabric with stretchers bars at vertical edges and tie wires at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" o.c. Attach hardware with rivets. Provide diagonal cross-bracing of gate frames by means of 3/8" diameter adjustable length truss rods.
2. Gate Posts:
   (a) Single leaf 6 ft. or double leaf 12 ft.: 3 inch o.d. 7.58 pounds per foot, ASTM A120, galvanized schedule 50 pipe or 3 inch x 3 inch roll section, ASTM A501, hot dipped galvanized.
   (b) Single leaf 10 ft. or double leaf 20 ft.: 4 inch o.d. pipe 9.11 pounds per foot, ASTM A120, galvanized schedule 50 or 3 inch x 3 inch roll section ASTM A501.
   (c) Single leaf 16 ft. or double leaf 32 ft.: 6-5/8 inch o.d. pipe 18.97 pounds per foot, galvanized schedule 50 pipe.

E. GATE HARDWARE:

1. Pressed steel or malleable iron hinges to suit gate size, non-lift off type, offset to permit 180 degree gate opening. Provide 1 pair of hinges for each leaf.
2. Latch: Forked type or plunger-type to permit operation from either side of gates. Provide padlock eye as integral part of latch.
3. Keeper: Provide keeper which automatically engages gate leaf and holds in open position until manually released.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Obtain approval from Architect for fencing layout, gate locations, direction of gate swings, and corner and end post locations prior to beginning work.

B. INSTALLING POSTS: All posts shall be spaced not more than 10' apart. Drill holes for post footings in firm undisturbed or compacted soil. The holes shall have a diameter equal to 3 times the diameter of the

post (9" minimum). Excavate hole depths approximately 3" lower than post bottom for concrete coverage of post bottom. Set the posts and place concrete around posts in a continuous pour, tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operation. Set top of concrete footing 2" above proposed finish grade and finish trowel top of footings with slope or dome to direct water away from posts. Set keepers, stops, sleeves and other accessories into concrete as required.

C. FOOTING DEPTHS:
   1. Typical 4' to 6' high fencing
      (a) Terminal and line posts: Minimum 36" deep.
      (b) Corner and pull posts: Minimum 48" deep.
   2. Gates
      (a) 36" to 48" wide leaf: Minimum 48" deep.
      (b) 54" to 72" wide leaf: Minimum 60" deep.
      (c) 78" to 96" wide leaf: Minimum 72" deep.
      (d) Tie each pair of gate posts together with 12" x 12" reinforced concrete beam poured with footings. Provide minimum 6" earth coverage over tie beam.

D. CONCRETE STRENGTH: Allow concrete to attain at least 75% of its minimum 28 day compressive strength, but in no case sooner than 7 days after placement, before rails, tension wires, barbed wire, or fabric is installed. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength, minimum design strength for concrete of 3,000 pounds per square inch at 28 days.

E. INSTALLING TOP AND MID RAILS: To start the installation, a length of top rail shall be run through the first couple of post tops; a rail clamp shall be assembled on the end, corner or gate posts, as the case may be. The end of the rail already placed shall be butted into the clamp and fastened. The top rail shall be installed along the run of the fence and the various sections joined with sleeve couplings. At no more than every 100' an expansion coupling shall be placed to allow for expansion and contractions of the rail. The rail shall be clamped in the end, corner or gate posts at the end of the run of the installation of the top rail.

F. BRACE ASSEMBLIES: Install braces so posts are plumb when diagonal rod is under proper tension. Provide one brace assembly for each gate and end post and two for each corner and pull posts.

G. TENSION WIRE: Install tension wire before stretching fabric and tie to each post with tie ties or clips.

H. INSTALLING FABRIC: Leave approximately 1" between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails and tension wires. Install fabric on the outside of the fence and anchor to framework so that fabric remains in tension after pulling fence is released. Stretcher bars shall be threaded through the fabric for seaming it to end, corner, pull and gate posts. The stretcher bars shall be secured to the posts with metal bands spaced not over 15" o.c.

I. GATES: Install gates plumb, level and secure for full opening without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

J. CLEAN-UP: The Contractor shall remove from the site all tools, equipment, trash, etc, used in this work. Remove all markings from posts and rails.

END OF SECTION

SECTION 33 05 00 — SITE DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install storm sewer piping, collection boxes, grates, manholes, culverts, inlets and headwalls as indicated in the Architectural drawings and specified herein.

B. Related trenching, pipe bedding, backfill, and compaction as indicated in the Civil and MEP documents drawings and specified herein.

C. Trench safety in accordance with OSHA requirements and as specified **under Trench Safety Section.**

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Piping indicated on pluming drawings.

B. Site clearing, grading and filling.

1.4 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer’s literature for piping precast drainage structures and grates illustrating performance, fabrication procedures, materials and sizes.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. CONCRETE SEWER PIPING: Extra strength tongue and groove pipe conforming to ASTM C-76, Class III for reinforced pipe.

B. JOINT SEALS:

1. Under 42" diameter: Provide Talcote Asphalt Primer No. 041 and Talcote Cold Plastic No. 052 joint compound.
2. 42" diameter and larger: Bell and rubber gasketed joints.

C. CONCRETE: Minimum compressive strength of 3,000 psi. Conform to requirements of Cast in Place Concrete Section 3.

D. POLYVINYL CHLORIDE (PVC) SDR 26 PIPING: Provide PVC piping where indicated on the drawings. Jointing shall be solvent weld or bell and gasket meeting requirements of A.S.T.M. 3212. Piping shall meet requirements of A.S.T.M. D-3034.

E. INLETS:

1. Precast concrete, cast in place concrete or brick collection boxes as indicated in the drawings. Brooks Products, or equivalent. Form both inner and outer walls for cast-in-place items.
2. Brick: ASTM C-32 sewer brick, Grade SS, 2-1/4" x 3-3/4" x 8".
3. Gratings, Covers and Frames: Cast iron, McKinley, Neenah or approved equal. Heavy duty in paving. Medium duty in walks. Light duty in grass or planting areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. INLETS:

1. All storm sewer inlets shall be constructed to the line and grade and at location shown on the drawings. Inlets shall be constructed in strict accordance with details as indicated in the drawings.
2. When the box section of the inlet has been completed, the floor of the inlet shall be shaped by filling with one-two mortar to conform to the section shown on the detail drawings.
3. Cast iron inlet frames and grates shall be accurately adjusted to line, grade and slope and grouted in place with mortar consisting of one part Portland Cement to two parts sand.

B. PIPING:

1. Inspection: Review drawings and job conditions and verify all inverts before trenching to avoid conflict with other below grade utilities either planned or existing. Immediately notify Architect of any apparent conflicts before beginning work.
2. Trenching: Provide trenching in strict compliance with current OSHA regulations and in accordance with **Trench Safety Section. Do not trench ahead of pipe laying unless trench is protected.**
3. Begin excavation work at the lower end of flow line and proceed to higher flow line. Avoid over-excavating; return over-excavated bed to grade and thoroughly compact. Remove large rocks, foreign or organic material; return bed to grade and thoroughly compact.
4. Lay all pipe on required bedding to a true line slope as indicated in the drawings. Hand excavate at joints to ensure that full length of pipe lays on a solid bed. Install tongue end of pipes facing direction of drainage flow.
5. Bedding and backfilling of pipe:

    a. Bed and backfill all piping in accordance with the details indicated on the drawings. Where local or other applicable codes require more stringent specifications, those codes shall govern.

b. All piping located in County Flood Control District right of way shall be bedded and backfilled with cement stabilized sand in accordance with Flood control District requirements.
c. Cement stabilized sand shall be a homogeneous mixture of 1-1/2 sacks Portland Cement per cu. yd. of mixed material. Provide greater cement content where required by City or County Requirements.

END OF SECTION

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete wet-pipe fire sprinkler system as specified in Contract Documents.
   2. Furnish and install Firestop Penetration Systems for fire sprinkler system penetrations as described in Contract Documents.

1.2 REFERENCES

A. Association Publications:
   1. Underwriters Laboratories, Inc.:
      a. UL Directory B, 'Fire Protection Equipment Directory' (2011).

B. Reference Standards:
   1. American National Standards Institute / American Society of Mechanical Engineers:
      a. ANSI/ASME B1.20.1-1983(R2006), ‘Pipe Threads, General Purpose (Inch)’.
      b. ANSI/ASME B16.1-2010, ‘Cast Iron Pipe Flanges and Flanged Fittings’.
      c. ANSI/ASME B16.3-2011, ‘Malleable Iron Threaded Fittings: Classes 150 and 300’.
      d. ANSI/ASME B16.4-2011, ‘Gray Iron Threaded Fittings, Classes 125 and 250’.
      e. ANSI/ASME B16.5-2009, ‘Pipe Flanges and Flanged Fittings’.
   2. American National Standards Institute / American Water Works Association:
      a. ANSI/AWWA C606-11, ‘Grooved and Shouldered Joints’.
   3. American National Standards Institute / American Welding Society:
      a. ANSI/AWA B2.1/B2.1M-2009, ‘Specification for Welding Procedure and Performance Qualification’.
   4. ASTM International:
      a. ASTM A53/A53M-12, ‘Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless’.
      b. ASTM A135/A135M-09, ‘Standard Specification for Electric-Resistance-Welded Steel Pipe’.
      c. ASTM A234/A234M-11a, ‘Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service’.
      d. ASTM A395/A395M-99(2009), ‘Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures’.
      e. ASTM A536-84(2009), ‘Standard Specification for Ductile Iron Castings’.
      f. ASTM A795/A795M-08, ‘Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use’.
   5. National Fire Protection Association / American National Standards Institute:
      a. NFPA 13: ‘Standard for the Installation of Sprinkler Systems’, (2010 Edition).
      b. NFPA 24: ‘Installation of Private Fire Service Mains and their Appurtenances’, (2010 Edition).
      c. NFPA 25: ‘Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems’, (2011 Edition).
      d. NFPA 101: ‘Life Safety Code’, (2012 Edition).

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:

a. Size sprinkler system by one of following methods:
   1) Hydraulic calculation design method based on water supply evaluation performed at building site.
b. On submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable.
c. Submittal Procedure:
   1) After award of Contract and before purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations to Architect and two sets to local jurisdiction having authority for fire prevention for review.
   2) After integrating Architect's and AHJ's comments into drawings, licensed certified fire protection engineer of record who designed fire protection system shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.
   3) Submit stamped documents to Owner and to AHJ for fire prevention for final approval.
   4) After final approval, submit four copies of approved stamped documents to Architect.
   5) Failure of system to meet requirements of authority having jurisdiction and/or approved stamped construction documents shall be corrected at no additional cost to Owner.

B. Informational Submittals:
1. Qualification Statement:
   a. Licensed fire protection engineers or fire protection system designer:
      1) Licensed for area of Project.
      2) Certified by NICET to level three minimum.
      3) Provide Qualification documentation if requested by Architect or Owner.
   b. Installer:
      1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Operations and Maintenance Data:
      1) Maintenance and instructions.
         a) List of system components used to indicate name and model of each item.
         b) Manufacturer's maintenance instructions for each component installed in Project.
         c) Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
   b. Warranty Documentation:
      1) Include copies of required warranties.
   c. Record Documentation:
      1) Include copies of approved shop drawings.
      2) Provide master index showing items included.
      3) Provide name, address, and phone number of Architect, Architect's Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
      4) Provide operating instructions to include:
         a) General description of fire protection system.
         b) Step by step procedure to follow for shutting down system or putting system into operation.
      5) Provide copy of system's above ground and below ground hydrostatic tests. Provide separate copies for Architect and Owner.
      6) Provide copy of 'Contractor's Material and Testing Certificate for Above Ground Piping' NFPA 13, Figure 24.1 (2010 edition).
2. Inspection:
   a. Provide Owner with latest version of NFPA 25.

D. Maintenance Material Submittals;
1. Extra Stock Materials:
   a. Spare sprinkler heads in the quantity recommended by NFPA 13 selected in representative proportion to quantity used in Project and in accordance with NFPA 13 (Six (6) spare sprinkler heads minimum).
   b. Provide spare heads in cabinet with sprinkler head wrench for each type of head used. After approval of cabinet and contents, mount cabinet in convenient location in Riser Room.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
1. Unless noted otherwise, system shall conform to:
a. NFPA 13, 'Light & Ordinary Hazard Occupancies'.
b. NFPA 24, 'Service Mains and Their Appurtenances, Private'.
c. NFPA 25, 'Inspection, Testing, and Maintenance.
d. NFPA 101, 'Life Safety Code'.
e. Requirements of local water department and local authority having jurisdiction for fire protection.
f. Underwriters Laboratories Publication, UL Directory B, 'Fire Protection Equipment Directory', current edition at time of Pre-Bid Meeting.
g. Comply with backflow prevention requirements and, if required, include device in hydraulic calculations.
h. Applicable rules, regulations, laws, and ordinances.

B. Qualifications:
1. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer / designer shall:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
e. Make complete inspection of installation.
f. Provide corrected record drawings to Owner with letter of acceptance.
g. Certify that installation is in accordance with Contract Documents.
h. Upon request, submit documentation.
2. Installer:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Upon request, submit documentation.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
a. Croker Corp, Elmsford, NY www.croker.com.
b. Gruvlock by Anvil International, Portsmouth, NH www.anvilintl.com.
c. HO Trerice Company, Oak Park, MI www.hotco.com.
d. Kennedy Valve, Elmira, NY www.kennedyvalve.com.
e. Milwaukee Valve Co, New Berlin, WI www.milwaukeevalve.com.
f. Mueller Company, Decatur, IL www.muellerflo.com.
g. Nibco Inc, Elkhart, IN www.nibco.com.

B. Description:
1. Automatic wet-pipe fire sprinkler system starting at flange in Fire Riser Room and extending throughout heated portions of building.
2. Dry sprinkler heads preferred over and into Vestibules.

C. Performance:
1. Design Criteria:

a. Area of Application and Corresponding Design Density:
   1) Serving Area and Mechanical, Electrical, and Janitorial Areas:
      a) Ordinary Hazard Group 1.
      b) Design density = 0.15 gpm per sq ft over 1,500 sq ft (140 sq m).
   2) Storage Areas:
      a) Ordinary Hazard Group 2.
      b) Design density = 0.20 gpm per sq ft over 1,500 sq ft (140 sq m).
   3) All Other Areas:
      a) Light Hazard.
      b) Design density = 0.10 gpm per sq ft over 1,500 sq ft (140 sq m).
   4) Increase remote areas by 30 percent where ceiling / roof is sloped more than 2 inches (50 mm) per ft.
   5) Remote areas may be reduced within parameters indicated in NFPA 13 for use of quick response sprinklers throughout.
b. Maximum Coverage per Sprinkler Head:
   1) Ordinary Hazard Areas: 130 sq ft (12.1 sq meters).
   2) Attic Areas: 120 sq ft (11.2 sq meters).
   3) Light Hazard Areas: 225 sq ft (20.1 sq meters).
c. Design Area shall be hydraulically most remote area in accordance with NFPA 13.
   1) Provide a 10 PSI safety allowance under adjusted water flow supply curve.
d. Maximum velocity of water flow within piping: 20 feet (6.1 m) per sec.

D. Components:
1. General: Use only domestically manufactured cast iron pipe fittings, valves, sprinkler heads, and other components.
   a. Pipe of foreign manufacture that meets ASTM Standards is acceptable.
   b. Ductile iron fittings of foreign manufacture are acceptable.
2. Pipe:
   a. Schedule 40 Welded Steel:
      1) Exterior, Above Ground: Schedule 40 hot-dip galvanized welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
      2) Interior, Above Ground: Schedule 40 black welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
      3) Connections:
         a) 2 inches (50 mm) And Smaller: Screwed, flanged, or roll grooved coupling system.
         b) 2-1/2 inches (64 mm) And Larger: Flanged or roll grooved coupling system.
3. Fittings:
   a. Usage:
      1) 2 inches (50 mm) And Smaller: Welded, screwed, flanged, or roll grooved coupling system. For use with schedule 40 carbon steel pipe.
      2) 2-1/2 inches (64 mm) And Larger: Welded, flanged, or roll grooved coupling system.
   b. Types And Quality:
      1) Screwed:
         a) Cast iron meeting requirements of ANSI B16.4 or ductile iron meeting requirements of ANSI B16.3 and ASTM A536, Grade 65-45-12.
         b) Threaded fittings and pipe shall have threads cut to ANSI B1.20.1.
         c) Do not extend pipe into fittings to reduce waterway.
         d) Ream pipe after cutting to remove burrs and fins.
      2) Flanged: Steel meeting requirements of ANSI B16.5.
      3) Welded:
         a) Carbon steel meeting requirements of ASTM A234/A234M.
         b) Weld pipe using methods complying with AWS B2.1, level AR-3. Welding procedures and performance of welders shall comply with AWS B2.1, level AR3.
      4) Roll Grooved Pipe Coupling System:
         a) Ductile iron meeting requirements of ASTM A395/A395M and ASTM A536, and UL listed.
         b) Grooved products used on Project shall be from same manufacturer. Grooving tools shall be as recommended by manufacturer of grooved products.
         c) Category Four Approved Products: See Section 01 6200 for definition of Categories:

	Gruvlok	Tyco (Grinnell)	Victaulic
Rigid Couplings	7401	772	Style 005
Flexible Couplings [1]	7000	705	Style 75
Flange Adaptors [2]	7012	71	Style 744
Grooved Coupling Gaskets [3]	'E' EPDM	Grade 'E' EPDM	'E' EPDM [4]

[1] Use in locations where vibration attenuation, stress relief, thermal expansion, or seismic design is required / needed.
[2] Class 125 or 150.
[3] Temperature rated 30 to 150 deg F (minus one to plus 65 deg C). NSF-61 certified.
[4] Grade 'A'.

c. Use of saddle or hole cut type mechanical tees is NOT APPROVED.

4. Valves:
   a. Butterfly Valves:
      1) Design Criteria:
         a) UL / CASA approved.
         b) Indicating type.
      2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
         a) Milwaukee:
            (1) Model BB-SCS02 threaded ends with tamper switch one inch (25 mm) to 2 inches (50 mm).
            (2) Model BBVSCS02 Grooved ends with tamper switch 2 inches (50 mm) to 2-1/2 inch (64 mm).
         b) Nibco:
            (1) Model WD3510-8 Wafer type with valve tamper switch.
            (2) Model GD4765-8N Grooved type with valve tamper switch, 2-1/2 inches (64 mm) to 8 inches (200 mm).
         c) Tyco (Grinnell):
            (1) Model BFV-N wafer.
            (2) Model BFV-N grooved.
         d) Victaulic: Series 705W Grooved end type with internal supv. switches.
         e) Kennedy:
            (1) Model 01W wafer.
            (2) Model G300 grooved.
   b. Gate Valves:
      1) Design Criteria:
         a) UL / CASA approved.
         b) Outside Screw and Yoke Type (O.S.&Y).
         c) Class 150 psi.
      2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
         a) Nibco:
            (1) T-104-0 with Threaded Ends 1/2 inch (12.7 mm) to 2 inches (50 mm).
            (2) F-637-31 Flanged Ends.
         b) Mueller: R-2360-6 Flanged Ends.
         c) Victaulic: Series 771 Grooved Ends
   c. Ball Valves:
      1) Design Criteria:
         a) UL / CASA approved.
         b) Valve tamper switch.
      2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
         a) Milwaukee: BB-SCS02 with threaded ends.
         b) Nibco: KT-505 with threaded ends.
         c) Nibco: KG-505 with grooved ends.
         d) Victaulic: Series 728 with grooved or threaded ends.
   d. Swing Check Valves:
      1) 1/2 to 3 inch (13 to 75 mm) horizontal check.
         a) Design Criteria:
            (1) Regrinding type.

(2) Renewable disk.
(3) Bronze Class 125 with threaded ends.
b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
(1) Nibco: KT-403-W.
(2) Victaulic: Series 712.
(3) Viking: G-1 Grooved ends.
2) 2 to 4 inch (50 to 100 mm) Horizontal check:
a) Design Criteria:
(1) Grooved ends.
(2) Ductile iron body.
(3) Rated 300 psi (2.07 MPa).
b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
(1) Tyco (Grinnell): CV-1F Grooved ends.
(2) Victaulic: Series 712.
(3) Viking: G-1 Grooved ends.
3) 3 to 12 inch (76 to 300 mm) Horizontal check:
a) Design Criteria:
(1) Bolted bonnet.
(2) Raised face flanges.
(3) Bronze mounted with ductile iron body.
(4) 125 lb (56.7 kg) Class A.
b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
(1) Nibco: F-938-31.
(2) Mueller: A-2120-6.
(3) Viking: F-1 grooved and flanged.

e. Wafer Type Check Valves:
1) Design Criteria:
a) 4 to 8 inch (100 to 300 mm) cast iron body.
b) 175 psi (1.21 MPa) minimum working pressure.
c) Rubber Seat.
2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
a) Nibco: KW-900-W.
b) Mueller: A-2102.
c) Kennedy: Fig.706.

f. Grooved-End Check Valves:
1) Design Criteria:
a) UL / CASA listed and approved to 250 psi (1.72 MPa) maximum operating pressure.
b) 2-1/2 to 12 inch (64 to 300 mm) ductile iron body.
c) Disc And Seat:
(1) 2-1/2 And 3 Inch (64 to 75 mm): Aluminum bronze disc with mounted elastomer seal and PPS (polyphenylene sulfide) coated seat.
(2) 4 Inch (100 mm) And Larger: Elastomer encapsulated ductile iron disc with welded in nickel seat.
(3) Viking: Model VK462.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Nibco: KG-900-W grooved ends.
b) Victaulic: Series 717.
c) Kennedy: Fig.426.

g. Alarm Check Valves:
1) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
a) Reliable: E with gauges and drain.
b) Tyco (Grinnell): Model AV-1-300.
c) Victaulic: Series 751 with gauges and drain.
d) Viking: J-1 with gauges and drain.

h. Backflow Preventer: Make and model shown on Drawings or as required by local codes.

i. Retard Chamber:
1) Design Criteria:
a) Self-draining.
2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:

a) Reliable: E-1.
b) Victaulic: Series 752.
c) Viking: C-1.

j. Inspector's Test Valve:
1) Design Criteria:
a) Bronze body with threaded or grooved ends.
b) Combination sight glass / orifice.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Tyco (Grinnell): Model F350.
b) Victaulic: Testmaster Alarm Test Module Style 720.

5. Sprinkler Heads:
a. Concealed Pendant:
1) Design Criteria:
a) Adjustable cover.
b) UL / CASA listed and approved.
c) Coordinate concealed cover finish with Architect.
2) Type One Acceptable Products:
a) Wet Pendant, Flat Profile:
(1) Reliable: F4FR.
(2) Victaulic: Model 3802.
(3) Viking: Model VK462.
(4) Tyco (Grinnell): Model RF11.
(5) Equal as approved by Architect before bidding. See Section 01 6200.
b) Dry Pendant:
(1) Flat Profile:
(a) Tyco (Grinnell): DS-C.
(b) Victaulic: V3618.
(2) Equal as approved by Architect before bidding. See Section 01 6200.

b. Horizontal Sidewall Sprinkler:
1) Design Criteria:
a) UL / CASA listed and approved.
b) Recess adjustable.
c) Where guards are required, use chrome plated sprinkler guards that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.
2) Type One Acceptable Products:
a) Wet System:
(1) Reliable: F1FR.
(2) Tyco (Grinnell): Model TY-FRB.
(3) Victualic: Model V2710.
(4) Viking: VK305.
(5) Equal as approved by Architect before bidding. See Section 01 6200.
b) Dry System:
(1) Reliable: F3QR.
(2) Tyco (Grinnell): DS-1.
(3) Victualic: Model V3610.
(4) Viking: VK162.
(5) Equal as approved by Architect before bidding. See Section 01 6200.

c. Attic Sprinklers, Upright:
1) Design Criteria:
a) UL / CASA listed and approved.
b) Approved for use in roof structures, combustible and non-combustible, with ceiling below.
2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
a) Tyco: BB, SD, or HIP.

d. Pendant Sprinklers:
1) Design Criteria:
a) UL / CASA listed and approved.

b) Where guards or escutcheons are required, use chrome plated sprinkler guards and escutcheons that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.

2) Type One Acceptable Products:
a) Reliable: F1FR.
b) Tyco: TY-FRB.
c) Victaulic: Model V2704.
d) Viking: VK302.
e) Equal as approved by Architect before bidding. See Section 01 6200.

e. Upright Sprinklers:
1) Design Criteria:
a) UL / CASA listed and approved.
2) Type One Acceptable Products:
a) Reliable: F1FR.
b) Tyco: TY-FRB.
c) Victaulic: Models V2704.
d) Viking: VK300.
e) Equal as approved by Architect before bidding. See Section 01 6200.

6. Water Flow Alarm:
a. Electric Flow Alarm:
1) Design Criteria:
a) UL / CASA listed and approved.
2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
a) Potter Electric: Horn Strobe, SASH-120, 120VAC.
b) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.

7. Waterflow Detectors:
a. Electrical Water Flow Switch:
1) Design Criteria:
a) UL / CASA listed.
b) Switch activates with flow of 10 gpm (37.85 lpm) or more.
c) Two single pole double throw switches.
d) Automatic reset.
2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
a) Potter-Roemer: Model 6201 thru 6208.
b) System Sensor: WFD20 thru WFD80.
c) Viking: VSR-F.

8. Tamper Switch
a. Weather and Tamper Resistant Switch.
1) Design Criteria:
a) UL / CASA listed.
b) Mount to monitor valve and not interfere with operation.
c) Shall operate in horizontal and vertical position.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
a) Control Valves, Butterfly Valves, Post Indicator Valves:
(1) Potter Electric: Model PCVS.
(2) Notifier: Model PIBV2.
(3) System Sensor: Model PIBV2.
b) O.S. & Y Valves:
(1) Potter Electric: Model OSYSU.
(2) System sensor: Model OSY2.

9. Automatic Drain Device:
a. Design Criteria:
1) Straight Design, 3/4 inch: (19 mm).
b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
1) Nibco: Ball-Drip.
2) Potter-Roemer: Figure 5982.
3) Viking: B-1.

10. Fire Department Connection:
a. One Way Inlet with 5” Stortzguard Cap:

1) Class One Quality Standards: See Section 01 6200:
   a) Round 'AUTO SPKR' identification plate, red enamel finish aluminum plate:
      (1) Croker: Fig 6766.
      (2) Potter-Roemer Fig. 5966.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a) Rough chrome plated:
      (1) Croker: 6405-RC.
      (2) Potter-Roemer: Fig. 5710-C.
   b) Caps and Chains:
      (1) Croker: 6747 RC.
      (2) Potter-Roemer: 4625.

11. Indicating Post Valve:
    a. Design Criteria:
       1) As specified in Section 33 1119: 'Fire Suppression Water Distribution Piping'.
       2) Prefer exposed parts non-brass, for theft protection.
       3) Supervisory switch.
    b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
       1) As required by Authority Having Jurisdiction (AHJ).
12. Riser Manifold Assembly:
    a. Design Criteria:
       1) Groove x Groove Manifold Body.
       2) Water Flow Alarm Switch, VSC with Vane, UL / CASA listed and approved.
       3) 300 psi (2.07 MPa) Water Pressure Gauge.
       4) Test and Drain Valve with Manifold Drain Trim and 1/2 inch (12.7 mm) diameter test Orifice.
       5) Pressure Relief Valve, 175 psi (1.21 MPa), non adjustable, pipe discharge to test Drain Valve.
    b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
       1) Tyco: Model 513.
       2) Victaulic: Style 747P.

2.2 ACCESSORIES

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Anvil International, Portsmouth, NH www.anvilintl.com.
      b. Cooper B-Line, Highland, IL www.b-line.com.

B. Hangers, Rods, And Clamps:
   1. Design Criteria:
      a. Galvanized, unless specified otherwise, and UL / CASA approved for service intended.
   2. Class One Quality Standard:
      a. Hangers and accessories shall be Anvil numbers specified or equals by Cooper B-Line.
      b. Pipe Ring Hangers: Equal to Anvil Fig 69.
      c. Riser Clamps: Equal to Anvil Fig. 261.

C. Posted System Diagram:
   1. Provide single, color-coded floor plan diagram showing total system. Color antifreeze pipe system elements BLUE and wet pipe system elements RED. Indicate locations of antifreeze system drains and sample test station.
   2. Include following information on diagram sheet:
      a. Explanation of how to test an antifreeze system.
      b. Step by step shut down procedure.
      c. Step by step system drainage procedure.
      d. Step by step start-up procedure.
      e. Step by step procedure for protection of system from freezing.
   3. Laminate diagram with plastic and mat or frame suitable for hanging near riser.

D. Steel Deck Bracket:
   1. Class Two Quality Standard: See Section 01 6200.

a. Unistrut P1000 with clamp nut, minimum 6 inch (150 mm) length.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers. See Section 01 4301:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Drawings:
   1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual building construction and work of other trades will permit. Install system so it drains.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These Drawings take precedence over Fire Protection Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions and to enable system to drain.

3.3 INSTALLATION

A. Interface With Other Work: Provide inserts for attaching hangers in concrete floor construction at time floors are placed.

B. Connect system to flange provided under Section 33 1119. After installation of riser, fill annular space between pipe and slab with flexible mastic.

C. Install sprinkler systems in accordance with requirements of latest editions of NFPA 13 and as specified below:
   1. Provide maintenance access to equipment
   2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Attic.
   3. Install to enable drainage of system.
      a. Install main drain from riser according to NFPA 13, paragraph 8.17.4.
   4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
   5. Do not use dropped, damaged, or used sprinkler heads.
   6. Install tamper switches and flow detectors where located by Architect.
   7. Except for Siamese connection, install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.
   8. Brace and support system to meet seismic zone requirements for building site.
   9. Inspector’s Test and Drain to be placed in a location approved by the architect.

D. Flush system at full design flow rate for minimum five minutes. Route water to outside of building. Protect landscaping and other exterior elements from damage during flow tests.

3.4 FIELD QUALITY CONTROL

A. Field Tests:
   1. Pressure Test:

a. Hydrostatically test system to 200 psi (1.38 MPa) minimum for 2 hours as required by 'Contractor's Material And Testing certificate for Above Ground Piping' NFPA-13, Figure Figure 24.1 (2010) Edition).
b. If system or part of system is to have a glycol solution, hydrostatic test is to be performed using approved glycol solution. Do not hydrostatically test any section of system that is to be filled with a glycol solution with plain water.

2. Water Flow Test:
   a. Test to determine static and residual pressures and corresponding flow rate at point of connection to utility water main.
   b. Adjust water flow test data for seasonal fluctuations and future growth as recommended by Water Utility and AHJ.
   c. At point of connection to utility water main, combine inside and outside hose stream allowances.
3. Check piping in relation to insulation envelope to be certain piping and auxiliary drains are properly enclosed inside building insulation envelope. Report unsatisfactory conditions to Architect.
4. Tests shall be witnessed by Architect and representative of local jurisdiction over fire prevention.

3.5 CLOSE-OUT ACTIVITIES

A. Instruction of Owner:
   1. Instruction Sessions:
      a. Instruct Owner's personnel in operation and maintenance of system utilizing 'Operation And Maintenance Manual' when so doing. Minimum instruction period shall be four (4) hours.
         1) Include antifreeze system requirement to be tested at least once a year.
      b. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.
      c. Provide Owner with latest version of NFPA 25.

B. Training:
   1. Installer required to provide FM Training from latest version of NFPA 25 with checklist and brief explanation of following inspections:
      a. Weekly Inspection.
      b. Monthly Inspection.
      c. Quarterly Inspection.
      d. Semi-Annual Inspection.
      e. Annual Inspection.

END OF SECTION

SECTION 22 00 00 - SUMMARY OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Plumbing Contract Documents were prepared for the Project by:

Trinity MEP Engineering, LLC
3533 Moreland Dr. Ste. A
Weslaco, Texas 78596
Phone Number: (956) 973-0500
Contact Person: Leonardo Munoz, P.E.

C. General Scope of Work:

1. Install systems and equipment as shown on the contract documents. Refer to drawings for schedule of equipment that will be installed. After installing equipment, connect all water, sewer, and/or power to fixtures.
2. Provide all materials and labor associated with a complete operational installation of new systems including, but not limited to:
   - Fixtures for facility
   - Piping for Sanitary Sewer and Vent Systems
   - Piping for Domestic water and Hot Water Systems.

1.2 COORDINATION

A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, even in areas where only plumbing work is to take place.

B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.

C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.

D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

E. Fully coordinate with electrical contractor for providing power to plumbing equipment.

1.3 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.4 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

1.5 SUBMITTALS

1. All equipment and fixtures shall be provided with a submittal.
2. To extradite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire plumbing or in a bound enclosure. This will eliminate delays in the submittal process.

END OF SECTION

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for plumbing systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Furnish and install sealants relating to installation of systems installed under this Division.
   4. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.

B. Informational Submittals:
   1. Qualification Statement:
      a. Plumbing Subcontractor:
         1) Provide Qualification documentation if requested by Architect or Owner.
      b. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
         1) At beginning of PLUMBING section of Operations And Maintenance Manual, provide master index showing items included:
            a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and Plumbing subcontractor.
            b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
               (1) List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
               (2) Manufacturer’s maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance instructions.
            c) Provide operating instructions to include:
               (1) General description of fire protection system.
               (2) Step by step procedure to follow for shutting down system or putting system into operation.

b. Warranty Documentation:
1) Include copies of warranties required in individual Sections of Division 22.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

B. Qualifications.
1. Plumbing Subcontractor:
a. Company specializing in performing work of this section.
1) Minimum five (5) years experience in plumbing installations.
2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
b. Upon request, submit documentation.
2. Installer:
a. Licensed for area of Project.
b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
c. Upon request, submit documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Accept valves on site in shipping containers with labeling in place.
2. Provide temporary protective coating on cast iron and steel valves.
3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage And Handling Requirements:
1. In addition to requirements specified within, stored material shall be readily accessible for inspection by Architect/engineer until installed.
2. Store items subject to moisture damage in dry, heated spaces.

1.5 WARRANTY

A. Manufacturer Warranty:
1. Provide certificates of warranty for each piece of equipment made out in favor of Owner.

B. Special Warranty:
1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
2. If plumbing sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe And Pipe Fittings:
1. Weld-O-Let and Screw-O-Let fittings are acceptable.
2. Use domestic made pipe and pipe fittings on Project, except non-domestic made cast iron pipe and fittings by MATCO-NORCA are acceptable.

C. Sleeves:
1. General:
a. Two sizes larger than bare pipe or insulation on insulated pipe.
2. In Concrete And Masonry:
a. Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.
3. In Framing And Suspended Floor Slabs:
a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal.

D. Valves:
1. Valves of same type shall be of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:

3.2 Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.3 EXAMINATION

A. Drawings:
1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification Of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.4 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

3.5 PREPARATION

A. Demolition Requirements:

B. Changes Due To Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

3.6 INSTALLATION

A. Interface With Other Work:

1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.
3. Furnish inserts for attaching hangers that are to be cast in concrete floor construction at time floors are poured.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:

1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe before fabrication.
   a. Right-Of-Way:
      1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
      2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Penetration Firestops:

1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.

E. Sealants:

1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

F. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:

1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.
2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
   a. Arrange so as to facilitate removal of tube bundles.
   b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
      1) Make connections of dissimilar metals with di-electric unions.
      2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
   c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch (19 mm) in diameter and smaller.
   d. Install piping systems so they may be easily drained
   e. Install piping to insure noiseless circulation.
   f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
3. Do not install piping in shear walls.

4. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.
5. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
6. Make changes in direction with proper fittings.
7. Expansion of Thermoplastic Pipe:
   a. Provide for expansion in every 30 feet of straight run.
   b. Provide 12 inch offset below roof line in each vent line penetrating roof.
8. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.

G. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade (unless noted on plans).
2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer's recommendations for PEX pipe (if used) penetrations through studs and floor slabs.
3. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
4. Sleeves through floors and foundation walls shall be watertight.

H. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

3.7 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

3.8 FIELD QUALITY CONTROL

A. Field Tests:
1. Perform tests on plumbing piping systems. Furnish devices required for testing purposes.

B. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

3.9 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

3.10 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
1. Instruct building maintenance personnel in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
2. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

3.11 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common hanger and support requirements and procedures for plumbing systems.

B. Products Installed But Not Furnished Under This Section:
   1. Paint identification for gas piping used in HVAC equipment.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Anvil International,
      b. Cooper B-Line,
      c. Unistrut, Wayne,

B. Materials:
   1. Hangers, Rods, And Inserts
      a. Galvanized and UL approved for service intended.
      b. Support horizontal piping from hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
         1) Support insulated pipes 2 inches in diameter and smaller with adjustable swivel ring hanger with insulation protection shield. Gauge and length of shield shall be in accordance with Anvil design data.
         2) Type Two Acceptable Products:
            (1) Swivel Ring Hanger: Anvil Fig. 69.
            (2) Insulation Protection Shield: Anvil Fig. 167.
            (3) Equals by Cooper B-Line.
         3) Support insulated pipes 2-1/2 inches in diameter and larger with clevis hanger or roller assembly with an insulation protection shield. Gauge and length of shield shall be according to Anvil design data.
            a) Type Two Acceptable Products:
               (1) Clevis Hanger: Anvil Fig. 260.
               (2) Roller Assembly: Anvil Fig. 171.
               (3) Insulation Protection Shield: Anvil Fig. 167.
               (4) Equals by Cooper B-Line.
         4) Support uninsulated copper pipe 2 inches in diameter and smaller from swivel ring hanger, copper plated and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from swivel ring hanger.
            a) Type Two Acceptable Products:
               (1) Swivel Ring Hanger For Copper Pipe: Anvil Fig. CT-69.
               (2) Swivel Ring Hanger For Other Pipe: Anvil Fig. 69.
               (3) Equals by Cooper B-Line.
         5) Support uninsulated copper pipe 2-1/2 inches in diameter and larger from clevis hanger, copper plated hangers and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from clevis hanger.
            a) Type Two Acceptable Products:
               (1) Clevis Hanger For Copper Pipe: Anvil Fig. CT-65.
               (2) Clevis Hanger For Other Pipe: Anvil Fig. 260.
               (3) Equals by Cooper B-Line.

c. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller
1/2 inch	2-1/2 to 3-1/2 inches
5/8 inch	4 to 5 inches
3/4 inch	6 inches
7/8 inch	8 to 12 inches

d. Support rods for multiple pipe supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
Number	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch
2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

1) Size trapeze angles so bending stress is less than 10,000 psi

e. Riser Clamps For Vertical Piping:
1) Type Two Acceptable Products:
a) Anvil Fig. 261.
b) Equals by Cooper B-Line.

f. Concrete Inserts:
1) Individual Inserts:
a) Suitable for special nuts size 3/8 inch through 7/8 inch with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
b) Type Two Acceptable Products:
(1) Anvil Fig. 282.
(2) Equals by Cooper B-Line.
2) Continuous Inserts:
a) Class Two Quality Standard: Equal to Unistrut P-3200 series.

g. Steel Deck Bracket:
1) Class Two Quality Standard: Equal to Unistrut P1000 with clamp nut, minimum 6 inch length.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: If project contains concrete structural system.
1. Furnish inserts for attaching hangers that are to be cast in concrete floor construction at time floors are poured.

B. Piping:
1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
b. Supports For Horizontal Piping:
1) Support metal piping at 96 inches on center maximum for pipe 1-1/4 inches or larger and 72 inches on center maximum for pipe 1-1/8 inch or less.
2) Support thermoplastic pipe at 48 inches on center maximum.
3) Support PEX pipe at 32 inches minimum on center.
4) Provide support at each elbow. Install additional support as required.

c. Supports for Vertical Piping:
   1) Place riser clamps at each floor or ceiling level.
   2) Securely support clamps by structural members, which in turn are supported directly from building structure.
   3) Provide clamps as necessary to brace pipe to wall.
d. If Structural concrete systems are used: Install supports from inserts cast into concrete floor system, including concrete joists and floor slabs. Where inserts cannot be used, provide expansion shields and support hangers from angles held in place by expansion bolts, never directly from expansion bolt itself. Provide calculations necessary to determine number of expansion bolts required to equal capacity of cast-in-place insert.
e. Attach Unistrut to structural steel roof supporting structure. Spacing and support as described above.
f. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

2. Gas piping Identification:
   a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

END OF SECTION

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install identification of plumbing piping and equipment as described in Contract Documents.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
1. Labels:
a. Equipment Identification:
1) Black formica, with white reveal when engraved.
2) Lettering to be 3/16 inch high minimum.
2. Paint:
a. One Coat Primer:
1) 6-2 Quick Drying Latex Primer Sealer over fabric covers.
2) 6-205 Metal Primer under dark color paint.
3) 6-6 Metal Primer under light color paint.
b. Finish Coats: Two coats 53 Line Acrylic Enamel.
c. Type Two Acceptable Products.
1) Paint of equal quality from following Manufacturers may be submitted for Architect's approval before use. Maintain specified colors, shades, and contrasts.
a) Benjamin Moore,
b) ICI Dulux,
c) Sherwin Williams,

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:
1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
2. Water Heaters.
3. Engrave following data from Equipment Schedules on Drawings onto labels:
a. Equipment mark.
b. Room(s) served.
c. Panel and breaker from which unit is powered.

B. Painting:
1. Only painted legends, directional arrows, and color bands are acceptable.
2. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
a. Adjacent to each item of equipment.
b. At point of entry and exit where piping goes through wall.
c. On each riser and junction.
d. Every 25 feet on long continuous lines.
e. Stenciled symbols shall be one inch high and black.

3.2 ATTACHMENTS

A. Schedules:
1. Pipe Identification Schedule:
a. Apply stenciled symbols as follows:

Pipe Use	Abbreviation
Domestic Cold Water	CW
Domestic Hot Water	HW

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART1- GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install insulation on hot and cold water lines, fittings, valves, and accessories as described in Contract Documents.
   2. Furnish and install insulation on roof drain piping as described in Contract Documents.

B. Related Requirements:
   1. Section 22 1116: 'Domestic Water Piping'.
   2. Section 22 1400: 'Facility Storm Drainage'.(if provided on plans)

1.2 SUBMITTALS

A. Informational Submittals:
   1. Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

Service Water Temperature	Pipe Sizes		
	Up to 1-1/4 In	1-1/2 to 2 In	Over 2 In
170 - 180 Deg F	One In	1-1/2 In	2 In
140 - 160 Deg F	1/2 In	One In	1-1/2 In
45 - 130 Deg F	1/2 In	1/2 In	One In

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of steam or electric heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Armacell, Mebane, NC www.armaflex.com.
      b. Childers Products Co, Eastlake, OH www.fosterproducts.com.
      c. IMCOA, Youngsville, NC www.nomacokflex.com.
      d. Johns-Manville, Denver, CO www.jm.com.
      e. Knauf, Shelbyville, IN www.knauffiberglass.com.
      f. Manson, Brossard, PQ, Canada www.isolationmanson.com.
      g. Nomaco Inc, Yopungsville, NC www.nomacokflex.com.

h. Owens-Corning, Toledo, OH www.owenscorning.com.
i. Speedline Corp, Solon, OH www.speedlinepvc.com.
j. CertainTeed Manson.
k. Knauf FiberGlass GmbH.
l. Owens-Corning Fiberglas Corp.
m. Schuller International, Inc.
n. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
o. Armstrong World Industries, Inc.
p. Rubatex Corp.

B. Materials:
1. Above Grade Metal Piping:
a. Insulation For Piping:
1) Snap-on glass fiber or melamine foam pipe insulation, or heavy density pipe insulation with factory vapor jacket.
2) Insulation Thickness:
3) Performance Standards: Fiberglas ASJ by Owens-Corning.
4) Type One Acceptable Manufacturers:
a) Childers Products.
b) Knauf.
c) Manson.
d) Owens-Corning.
e) Johns-Manville.
f) Equal as approved by Architect before bidding. See Section 01 6200.
b. Fitting, Valve, And Accessory Covers:
1) PVC.
2) Performance Standard: Zeston by Johns-Manville.
3) Type One Acceptable Manufacturers:
a) Knauf.
b) Speedline.
c) Johns-Manville.
d) Equal as approved by Architect before bidding. See Section 01 6200.
2. Below Grade Metal Piping:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) SS Tubolit by Armacell.
b) ImcoLock by Imcoa.
c) Nomalock or Therma-Cel by Nomaco.
b. Joint Sealant:
1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) Armacell 520.
b) Nomaco K-Flex R-373.
3. Pex Piping, Above And Below Grade:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) SS Tubolit
b) by Armacell.
c) ImcoLock by Imcoa.
d) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) Armacell 520.
b) Nomaco K-Flex R-373.
c)

4. PP-R Piping, Above And Below Grade:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) SS Tubolit by Armacell.
b) ImcoLock by Imcoa.
c) Nomalock or Therma-Cel by Nomaco.
b. Joint Sealant:
1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) Armacell 520.
b) Nomaco K-Flex R-373.

5. PVC or ABS Piping, Above And Below Grade - Facility Storm Drain:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) SS Tubolit by Armacell.
b) ImcoLock by Imcoa.
c) Nomalock or Therma-Cel by Nomaco.
b. Joint Sealant:
1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
a) Armacell 520.
b) Nomaco K-Flex R-373.

PART 3 - EXECUTION

3.1 APPLICATION

A. Above Grade Piping:
1. Apply insulation to clean, dry piping with joints tightly butted.
2. Install insulation in manner to facilitate removal for repairs. Place sections or blocks so least possible damage to insulation will result from inspection or repairs of piping or equipment.
3. Piping up to 1-1/4 inch Diameter:
a. Adhere 'factory applied vapor barrier jacket lap' smoothly and securely at longitudinal laps with white vapor barrier adhesive.
b. Adhere 3 inch wide self-sealing butt joint strips over end joints.
4. Piping 1-1/2 inches Diameter And Larger:
a. Use broken-joint construction in application of two-layer covering.
b. Fill cracks and depressions with insulating cement mixed to thick plastic paste.
1) Apply by hand in several layers to make up total specified thickness.
2) Final layer shall have smooth uniform finish before application of covering.
5. Fittings, Valves, And Accessories:
a. Do not apply insulation over flanged joints or victaulic couplings until piping has been brought up to operating temperature and flange bolts have been fully tightened. Insulate valves so wheel, stem, and packing nut are exposed.
b. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
c. Piping Up To 1-1/4 Inch Diameter:
1) Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
2) Alternate Method:

a) Insulate fittings, valves, and accessories with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending 2 inches onto adjacent insulation.

d. Piping 1-1/2 inches To 2 Inches :
   1) Insulate with hydraulic setting insulating cement or equal, to thickness equal to adjoining pipe insulation.
   2) Apply final coat of fitting mastic over insulating cement.
e. Piping 2-1/2 inch And Larger:
   1) Insulate with segments of molded insulation securely wired in place and coated with skim coat of insulating cement.
   2) Apply fitting mastic, fitting tape and finish with final coat of fitting mastic.

6. Pipe Hangers:
   a. Do not allow pipes to come in contact with hangers.
   b. Pipe Shield:
      1) Provide schedule 40 PVC by 6 inch ong at each clevis and/or unistrut type hanger.
      2) Provide 16 ga by 6 inch long galvanized shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.
      3) Provide 22 ga by 6 inch long galvanized shield at each pipe hanger to protect insulation from crushing by Unistrut type hanger.
   c. At Pipe Hangers:
      1) Provide rigid calcium silicate insulation (100 psi compressive strength) at least 2 inches beyond shield.
7. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

B. Below Grade Piping:
   1. Slip underground pipe insulation onto pipe and seal butt joints.
   2. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.4 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
G. Keep insulation materials dry during application and finishing.
H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
I. Apply insulation with the least number of joints practical.
J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

K. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
   1. Apply insulation continuously through hangers and around anchor attachments. Insulation around hanger or pipe clamp will not be acceptable.
   2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
   3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

L. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

N. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
   3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
      a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
   4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
   5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
   1. Seal penetrations with vapor-retarder mastic.
   2. Apply insulation for exterior applications tightly joined to interior insulation ends.
   3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
   4. Seal metal jacket to roof flashing with vapor-retarder mastic.

P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
   1. Firestopping and fire-resistive joint sealers are specified in Section "Firestopping."

3.5 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:
   1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
   2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
   3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

3.6 Apply insulation to flanges as follows:
   1. Apply preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

B. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

C. Apply insulation to valves and specialties as follows:
1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
4. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.7 CLOSED-CELL PHENOLIC-FOAM INSUALTION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:
1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer’s recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturers written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer’s attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:
1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer’s written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without

disturbing insulation. For check valves, arrange insulation for access to stainer basket without distributing insulation.

3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.8 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:
   1. Follow manufacturer's written instructions for applying insulation.
   2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
B. Apply insulation to flanges as follows:
   1. Apply pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
C. Apply insulation to fittings and elbows as follows:
   1. Apply mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
D. Apply insulation to valves and specialties as follows:
   1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
   2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
   3. Apply insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.9 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
   1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
   3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
   1. Draw jacket material smooth and tight.
   2. Apply lap or joint strips with the same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
C. Apply metal jacket where indicated, with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Fire-suppression piping.
3. Drainage piping located in crawl spaces, unless otherwise indicated.
4. Below-grade piping, unless otherwise indicated.
5. Chrome-plated pipes and fittings, unless potential for personnel injury.
6. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.11 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic water piping.

1. Operating Temperature: 60 to 80 deg F
2. Insulation Material: Mineral Fiber
3. Insulation Thickness: 1” thick.
4. Field-Applied Jacket: Foil and Paper(ASJ)
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
2. Insulation Material: Mineral fiber
3. Insulation Thickness: 1” thick
4. Field-Applied Jacket: Foil and Paper(ASJ)
5. Vapor Retarder Required: No
6. Finish: None.

C. Service: Condensate and equipment drain piping.

1. Operating Temperature: 40 to 60 deg F
2. Insulation Material: Flexible elastomeric, only on first ten feet of pipe from trap.
3. Insulation Thickness: 3/4”
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: Two coats of the insulation manufacturer’s recommended protective coating.

D. Service: Refrigerant suction and hot-gas piping.

1. Operating Temperature: 35 to 50 deg F
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: 1” thick.
4. Field-Applied Jacket: Aluminum Jacket on building exterior application only.
5. Vapor Retarder Required: Yes.
6. Finish: None.

E. Service: For obtaining fire/smoke rating in return air plenum (calbes, PE, PB, PP, ABS, PVC, CPVC, etc).

1. Operating Temperature: 35 to 90 deg F
2. Insulation Material: 3M Fire Barrier Plenum Wrap 5 A or equal.
3. Insulation Thickness: larger of 1” or mfr’s recommendations.
4. Field-Applied Jacket: scrim reinforced foil
5. Vapor Retarder Required: None.
6. Finish: None.

3.12 EXTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic water.

1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).

2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses: 1”
4. Field-Applied Jacket: Aluminum.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Refrigerant suction.
1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses: ½”
4. Field-Applied Jacket: Aluminum
5. Vapor Retarder Required: Yes.
6. Finish: None.

END OF SECTION

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform excavating and backfilling required by work of this Section.
   2. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5 feet from building perimeter as described in Contract Documents.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
   1. Domestic Water Distribution Piping: 125 psig..

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For pipe, tube, fittings, and couplings.
   2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

B. Informational Submittals:
   1. Test And Evaluation Reports:
      b. Written report of sterilization test.

C. Shop Drawings:
      b. Piping Layout:
         1) Provide as-built drawings at end of project.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
   2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components.

D. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
1. Manufacturer Contact List:
b. Aquatherm, Inc.,
c. Cash Acme,
d. Cla-Val Company,
e. Conbraco Industries Inc,
f. Hammond Valve,
g. Handy & Harmon Products Div,
h. Honeywell Inc,
i. Leonard Valve Co,
j. Milwaukee Valve Co,
k. Nibco Inc,
l. Rehau,
m. Sloan Valve Co,
n. Spence Engineering Co,
o. Symmons Industries, Braintree,
p. Uponor Inc,
q. Viega ProPress, Wic
r. Watts Regulator Co,
s. Wilkins (Zurn Wilkins),
t. Zurn PEX, Inc.

B. Materials:
1. Design Criteria:
b. All drinking water products, components, and materials above and below grade used in drinking water systems must meet NSF International Standards for Lead Free.
c. No CPVC allowed.
2. Pipe:
b. Copper:
3) Above-Grade:
a) Meet requirements of ASTM B88, Type K & L.
b) Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn tempered.
c) Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
d) Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
e) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
f) Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
g) Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
4) Below-Grade:
a) Meet requirements of ASTM B88, Type K. 3/4 inch minimum under slabs.
b) 2 inches And Smaller: Annealed soft drawn.
c) 2-1/2 inches And Larger: Hard Drawn.

5) Fittings:
a) For Copper Pipe: Wrought copper.

3. Connections For Copper Pipe:
b. Above-Grade:
3) Sweat copper type with 95/5 or 96/4 Tin-Antimony solder, Bridgit solder, or Silvabrite 100 solder. Use only lead-free solder.
4) Viega ProPress System
c. Below Grade:
3) Brazed using following type rods:
a) Copper to Copper Connections:
2) AWS Classification BCuP-4 Copper Phosphorus (6 percent silver).
3) AWS Classification BCuP-5 Copper Phosphorus (15 percent silver).
4) Copper to Brass or Copper to Steel Connections: AWS Classification BAg-5 Silver (45 percent silver).
5) Do not use rods containing Cadmium.
6) Brazing Flux:
a) Approved Products:
1) Stay-Silv white brazing flux by Harris Product Group.
2) High quality silver solder flux by Handy & Harmon.
7) Joints under slabs acceptable only if allowed by local codes.

4. Ball Valves:
b. Use ball valves exclusively unless otherwise specified. Ball valves shall be by single manufacturer from approved list below.
c. Valves shall be two-piece, full port for 150 psi SWP.
3) Operate with flow in either direction, suitable for throttling and tight shut-off.
4) Body: Bronze, 150 psig wsp at 350 deg F and 400 psig wog.
5) Seat: Bubble tight at 100 psig under water.
d. Class One Quality Standard: Nibco T585 or S585.
3) Equal by Conbraco 'Apollo,' Hammond, Milwaukee, or Watts.

5. Combination Pressure Reducing Valve / Strainer:
b. Integral stainless steel strainer, or separate 'Y' strainer installed upstream of pressure reducing valve.
c. Built-in thermal expansion bypass check valve.
d. Class One Quality Standard: Watts LFU5B:
3) Equal by Cash Acme, Cla-Val Hi Capacity, Conbraco 36C, Honeywell-Braukmann, Spence Hi Capacity, Watts, or Wilkins. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Below Grade:
1. Install piping under slabs without joints where possible.
2. Insulate water piping buried within building perimeter.
3. Bury water piping 6 inches minimum below bottom of slab and encase in 2 inches minimum of sand.

B. Locate cold water lines a minimum of 6 inches from hot water line.

3.2 FIELD QUALITY CONTROL

A. Field Tests:
1. Before pipes are covered, test systems in presence of Architect/Engineer at 125 psig hydrostatic pressure for four (4) hours and show no leaks.

2. Disconnect equipment not suitable for 125 psig pressure from piping system during test period.

3.3 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   2. Adjust calibrated balancing valves to flows indicated.

3.4 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
      b. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      c. Fill and isolate system according to either of the following:
         3) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
         4) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
      d. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      e. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

D. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Balancing valves.
   2. Washer-supply outlets.
   3. Key-operation hydrants.
   4. Trap seal primer valves.
   5. Drain valves.
   6. Miscellaneous piping specialties.
   7. Sleeve penetration systems.
   8. Flashing materials.

1.2 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.

PART 2 - PRODUCTS

2.1 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

B. Manufacturers:
   1. Armstrong Pumps, Inc.
   2. Flow Design, Inc.
   3. ITT Industries; Bell & Gossett Div.
   4. Taco, Inc.
   5. Watts Industries, Inc.; Water Products Div.
   6. 2” and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
   7. 2” and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
   8. 2.5” and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

C. B. Memory-Stop Balancing Valves, NPS 2 (DN 50) and smaller: MSS SP-110, ball valve, rated for 400-psig (2760-kPa) mininmum CWP. Include two-piece, copper-alloy body with full-port, chrome-plated brass ball, replaceable seats and seals, threaded or solder-joint ends, and vinyl-covered steel handle with memory-stop device.

D. Manufacturers:
   1. Conbraco Industries, Inc.
   2. Crane Co., Crane Valve Group; Crane Valves.
   3. Grinnell Corporation.
   4. NIBCO INC.
   5. Red-White Valve Corp.

2.2 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.
   1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
   2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.

3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

2.3 OUTLET BOXES

A. Manufacturers:
   1. Acorn Engineering Company.
   2. Gray, Guy Manufacturing Co., Inc.
   3. Symmons Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections, drain, and the following:
   1. Box and Faceplate: [Stainless steel] [Enameled or epoxy-painted steel].
   2. Shutoff Fitting: Two hose bibbs.
   3. Supply Fittings: Two NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
   4. Drain: NPS 2 (DN 50) standpipe, P-trap, and direct waste connection to drainage piping.
   5. Inlet Hoses: Two ASTM D 3571, 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female hose-thread couplings.
   6. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

D. Icemaker Outlet Boxes: With hose connection and the following:
   1. Box and Faceplate: Stainless steel.
   2. Shutoff Fitting: Hose bibb.
   3. Supply Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.4 KEY-OPERATION HYDRANTS

A. Manufacturers:
   1. Josam Co.
   2. Smith, Jay R. Mfg. Co.
   3. Woodford Manufacturing Co.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.
   1. Inlet: 3/4 “ or NPS 1” threaded or solder joint.
   2. Outlet: ASME B1.20.7, garden-hose threads.
   3. Operating Keys: One with each key-operation hydrant.

C. Moderate-Climate, Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, and concealed outlet.
   1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.

D. Hot and Cold, Nonfreeze Concealed-Outlet Wall Hydrants: With deep flush-mounting box with cover; hot- and cold-water casings and operating rods to match wall thickness; concealed outlet; wall clamps; and factory- or field-installed, nonremovable and manual drain-type, hose-connection vacuum breaker complying with ASSE 1011.

2.5 ROOF HYDRANTS

A. Design Criteria:
   1. Provide dual check backflow preventer.
   2. Non-freeze.
   3. Drain port - connect to drain

2.6 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

B. Manufacturers:

   1. Josam Co.
   2. MIFAB Manufacturing, Inc.
   3. Precision Plumbing Products, Inc.
   4. Smith, Jay R. Mfg. Co.
   5. 125-psig (860-kPa) minimum working pressure.

6. Bronze body with atmospheric-vented drain chamber.
7. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
8. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
9. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.7 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

B. Manufacturers:
1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Zurn Industries, Inc.; Specification Drainage Operation.

C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral [or field-installed,] nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

D. Roof Flashing Assemblies: Manufactured assembly made of [4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-)] [6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-)] thick, lead flashing collar and skirt extending at least [6 inches (150 mm)] [8 inches (200 mm)] [10 inches (250 mm)] from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

E. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

F. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

G. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

H. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

I. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

J. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.8 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:
1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
3. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.9 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
C. Fasteners: Metal compatible with material and substrate being fastened.
D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
E. Solder: ASTM B 32, lead-free alloy.
F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.
1. Not required to meet NSF International Standards for Lead Free.
2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Jay R. Smith: 5907.
2) Prier: P-RH2.
3) Woodford: RHY2-MS.
3. Water Hammer Arrestors:
1. Design Criteria:
1) Meet NSF International Standards for Lead Free.
2) Nesting type, air pre-charged bellows with casing.
3) Bellows constructed of stabilized 18-8 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
B. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
D. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
E. Install expansion joints on vertical risers, stacks, and conductors if indicated.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.
B. Ground equipment.
C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
D. Connect plumbing specialties and devices that require power.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.
D. Secure flashing into sleeve and specialty clamping ring or device.
E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to "Sheet Metal Flashing and Trim."
F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 22 13 13 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building where applicable.
2. Perform excavation and backfill required by work of this Section.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Cover Observation.

1. Contact Architect/Engineer prior to covering any section of pipe.
2. All piping all be under pressure during observation

1.3 REFERENCES

A. Reference Standards:

1. International Code Council:
   a. ICC IPC-2012, 'International Plumbing Code'.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings: For solvent drainage system, include plans, elevations, sections, and details.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PVC PIPING

A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

C. Plenum Vent Lines: In areas of building with a return air plenum.

1. Approved Types:
   a. Service weight, single-hub or no-hub type cast iron soil pipe meeting requirements of ASTM A74.
   b. Vent lines 2-1/2 inches or smaller may be Schedule 40 galvanized steel.
   c. Joint Material:
      1) Single-Hub: Rubber gaskets meeting requirements of ASTM C564.
      2) No-Hub Pipe: Neoprene gaskets with stainless steel cinch bands.
   d. Fittings:
   e. Cast Iron Pipe: Hub and spigot, except fittings for no-hub pipe shall be no-hub, and meet requirements of ASTM A74.
      1) Joint Material: Rubber gaskets meeting requirements of ASTM C564.
      2) Galvanized Pipe: Screwed Durham tarred drainage type.

2.2 EXECUTION

2.3 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8- bend fittings if 2 fixture are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

E. Re-verify building drainage piping slope before covering pipe in trench if left uncovered over a 24 hour period of subjected to exterior water. If slope of piping has changed, provide new shoring material to maintain original slope after trench has been covered.

F. Install soil and waste drainage and vent piping at the code required minimum slopes, unless otherwise indicated:

G. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

2.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger

2.5 FIELD QUALITY CONTROL

A. Field Tests:

1. Conduct tests for leaks and defective work. Notify Architect before testing.
2. Thermoplastic Pipe System:
   a. Before backfilling and compacting of trenches, Fill waste and vent system with water to roof level or 10 feet minimum, and show no leaks for two hours. Correct leaks and defective work.

b. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

B. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
   5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   6. Prepare reports for tests and required corrective action.

2.6 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under this Section as described in Contract Documents.
   1. Cleanouts.
   2. Floor drains.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
   1. Sanitary Waste and Vent Piping: 10-foot head of water.
   2. Storm Drainage Piping: 10-foot head of water.

1.3 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
   1. Cleanouts, floor drains, and roof drains.
   2. Roof flashing assemblies.
   3. Grease interceptors(if applicable)
   4. Sleeve penetration systems.

PART 2 - PRODUCTS

2.1 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:
   1. ProSet Systems, Inc.
B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
   1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
      a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.2 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
   2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
   3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
C. Fasteners: Metal compatible with material and substrate being fastened.
D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
E. Solder: ASTM B 32, lead-free alloy.
F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.3 CLEANOUTS

A. Cleanouts: Comply with [ASME A112.36.2M] [ASME A112.3.1] <Insert other>.
   1. Application: [Floor cleanout] [Wall cleanout] [For installation in exposed piping].

2. Products:
   a. Josam Co.
   b. Mifab
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Zurn Industries, Inc., Specification Drainage Operation.

2.4 FLOOR DRAINS

A. Floor Drains.
   1. Products:
      a. Josam Co.
      b. Mifab
      c. Smith, Jay R. Mfg. Co.
      d. Tyler Pipe, Wade Div.
      e. Zurn Industries, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
C. Install expansion joints on vertical risers, stacks, and conductors if indicated.
D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
   4. Locate at base of each vertical soil and waste stack.
E. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
F. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
G. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
H. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
I. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
J. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
      b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
      c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

K. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
   1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Position roof drains for easy access and maintenance.

L. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

   1. Flush with In-Ground Installation: Set unit and extension, if required, with cover flush with finished grade.
   2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

M. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

N. Fasten recessed-type plumbing specialties to reinforcement built into walls.

O. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Ground equipment.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Connect plumbing specialties and devices that require power according to Division Sections.

E. Interceptor Connections: Connect piping, flow-control fittings, and accessories.
   1. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install electric water heater as specified in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: 'Common Plumbing Requirements'.
   2. Section 22 1116: 'Domestic Water Piping'.

1.2 REFERENCES

A. Reference Standard:
   1. NSF International Standard / American National Standards Institute:
      a. NSF/ANSI 61-2012, 'Drinking Water System Components - Health Effects'.
      b. NSF/ANSI 372-2011, 'Drinking Water System Components - Lead Content'.

B. SUBMITTALS

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance and operational instructions.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty.
      c. Record Documentation:
         1) Manufacturers documentation:
            a) Manufacturer's literature or cut sheet.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
   2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free.

1.4 WARRANTY

A. Special Warranty:
   1. Three-year non-prorated warranty on water heaters of 20 gallon capacity and larger.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      a. A O Smith Water Products Co,
      b. Bradford-White Corp, Ambler,.
      c. Rheem / Ruud Water Heater Div
      d. Ruud Manufacturing Co.,
      e. State Industries Inc,

B. Materials:
   1. Design Criteria:
      a. All (wetted) drinking water products, components, and materials used in drinking water systems must meet NSF International Standards for Lead Free.
      b. All water heaters require 'Tempered Water Temperature Control' (mixing valves) as specified in Section 22 1116.
   2. 30 Gallon to 50 Gallon Regular Height:
      a. Glass lined storage tank pressure tested and rated for 125 psi (862 kPa) working pressure.

b. Water heaters shall each have ASME rated temperature-pressure relief valve rated at MBH input of heater minimum set to relieve at 120 psi (827 kPa).
c. 9 Kw.
d. 3 inches (75 mm) minimum glass fiber or polyurethane foam insulation.
e. Complete with two stage thermostat, magnesium anode, electric sheath rod type heating element, and high limit control.
f. Heater shall be pre-wired and entire unit bear UL label.
g. Manufactures
   1) American:
   2) A O Smith:
   3) Bradford White:
   4) Rheem
   5) State Industries: SB6-40.

2.2 ACCESSORIES

A. Anchoring Components:
   1. One inch (25 mm) by 18 ga (1.2 mm) galvanized steel straps.
   2. No. 10 by 2-1/2 inch (64 mm) screws.

B. Thermal Expansion Absorbers:
   1. Bladder type for use with potable water systems.

C. Type One Acceptable Products.
   a. Therm-X-Trol ST-12-C by Amtrol Inc, West Warwick, RI www.amtrol.com.
   b. Equal as approved by Architect before bidding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor drain.

3.2 ADJUSTING

A. Set discharge water temperature at 140 deg F (60 deg C). Final hot water temperature shall be 110 deg F (43 deg C) after missing valve. If no mixing valve set discharge temperature at 110 deg F (43 deg C).

END OF SECTION

SECTION 22 42 00 - COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. TAS: Texas Accessibility Standards.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.

2.2 LAVATORY FAUCETS

A. Lavatory Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Products:
   a. American Standard.
   b. Eljer.
   c. Kohler.

2.3 SINK FAUCETS

A. Sink Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.
   1. Manufacturers:
      a. American Standard.
      b. Eljer
      c. Kohler

2.4 TOILET SEATS

A. Toilet Seat: Solid plastic.
   1. Manufacturers:
      a. Bemis.
      b. Beneke.
      c. Centoco.
      d. Church.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard, Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.
   1. Manufacturers:
      a. Engineered Brass Co.
      b. Plumerex
      c. Truebro.

2.6 FIXTURE SUPPORTS

A. Water-Closet Support: Water-closet combination carrier designed for accessible and standard mounting heights. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
   1. Manufacturers:
      a. Mifab
      b. Josam.
      c. Wade.
      d. Zurn

B. Urinal Support: Not required

C. Lavatory Support: Not required

D. Sink Support: Type II, sink carrier with hanger plate, bearing studs, and tie rod. Include steel uprights with feet.
   1. Manufacturers:
      a. Josam.
      b. J.R. Smith
      c. Zurn.

2.7 WATER CLOSETS

A. Water Closets: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   1. Products:
   2. American Standard, Inc.
   3. Kohler Co.
   4. TOTO USA, Inc.

B. Water Closets: Ligature Resistant Institutional Combination Lavatory/Toilet
   1. Products:
      a. ACORN
      b. All others shall be submitted for pre-approval prior to bid date.

2.8 LAVATORIES, SINKS

A. Lavatories,: Accessible, counter top, vitreous-china fixture.
   1. Products:
      a. American Standard, Inc.
      b. Kohler Co.
      c. Toto
      d. CRANE

2.9 SINKS
A. Sinks: Commercial, counter-mounting, stainless-steel fixture.
   1. Products:
      a. Elkay Manufacturing Co.
      b. Just Manufacturing Co.

2.10 SERVICE SINKS
A. Service/Mop Sinks: Floor-mounting, enameled, sink with front apron, raised back, and coated, wire rim guard.
   1. Products:
      a. Commercial Enameling Co.
      b. Kohler Co.
      c. Fiat

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION
A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.
D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
E. Install wall-hanging fixtures with tubular waste piping attached to supports.
F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
G. Install counter-mounting fixtures in and attached to casework.
H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.
I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.
J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
M. Install toilet seats on water closets.
N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.
R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.
S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect water supplies from water distribution piping to fixtures.
C. Connect drain piping from fixtures to drainage piping.
D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
F. Ground equipment.
    1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.
B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
B. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.
C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
    1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
    2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.
B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 47 13 - DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Drinking fountains.
   2. Self-contained water coolers.
   3. Fixture supports.

1.3 DEFINITIONS

A. Accessible Drinking Fountain and Water Cooler: Fixture that can be approached and used by people with disabilities.
B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
C. Fitting: Device that controls flow of water into or out of fixture.
D. Fixture: Drinking fountain or water cooler, unless one is specifically indicated.
E. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of fixture indicated.
B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
C. Maintenance Data: For fixtures to include in maintenance manuals specified in Division.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" about fixtures for people with disabilities.
C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
E. TAS: Texas Accessibility Standards.

1.6 COORDINATION

A. Coordinate roughing-in and final fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified below.
   1. Elkay.
   2. Halsey Taylor.
   3. Haws Corporation.

2.2 DRINKING FOUNTAINS

A. Drinking Fountains,: Accessible, Style W, wall-hanging fixture made of stainless steel.
   1. Receptor Shape: Rectangular.
   2. Back Panel: Stainless-steel wall plate behind drinking fountain.
   3. Bubblers: Two, with automatic stream regulator, located on deck.
   4. Control: Push button.

5. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
6. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME Standards.
7. Support: Type I, water-cooler carrier. Refer to "Fixture Supports" Article.

2.3 SELF-CONTAINED WATER COOLERS

A. Water Coolers: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-hanging fixture.
1. Cabinet: Bilevel with two attached cabinets, enameled steel with stainless-steel top.
2. Bubbler: One, with automatic stream regulator, located on each cabinet deck.
3. Control: Push button.
4. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve and filter.
5. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME Standards.
6. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
a. Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
b. Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
7. Support: Type II, water-cooler carrier. Refer to "Fixture Supports" Article.

2.4 FIXTURE SUPPORTS

A. Off-Floor, Plumbing Fixture Supports: ASME A112.6.1M, water-cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
1. Available Manufacturers:
2. Manufacturers:
a. Josam Co.
b. Smith, Jay R. Mfg. Co.
c. Tyler Pipe; Wade Div.
d. Zurn Specifications Drainage Operation.
3. Type I: Hanger-type carrier with two vertical uprights.
4. Type II: Bilevel, hanger-type carrier with three vertical uprights.
5. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
B. Examine walls and floors for suitable conditions where fixtures are to be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.
B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.
B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.
C. Install fixtures level and plumb.
D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Refer to Division Section "Valves" for general-duty valves.
E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division Section "Basic Mechanical Materials and Methods" for escutcheons.
G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division for sealant and installation requirements.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect water supplies from water distribution piping to fixtures.
C. Connect drain piping from fixtures to drainage piping.
D. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

SECTION 23 00 00 - HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Mechanical Contract Documents were prepared for the Project by:

Trinity MEP Engineering, LLC
3533 Moreland Dr. Ste. A
Weslaco, Texas 78596
Phone Number: (956) 973-0500
Contact Person: Leonardo Munoz, P.E.

C. General Scope of Work:

1. Install AC equipment and ductwork as shown on the contract documents. Refer to drawings for schedule of equipment that will be installed. After installing equipment, connect power to unit.
2. HVAC: Provide all materials and labor associated with a complete operational installation of new HVAC systems including, but not limited to:

- DX Split System A/C Units
- Exhaust fans
- Sheet metal, Ductwork
- Diffusers and Grilles
- Duct accessories, including grilles, and louvers
- Air Test and Balance

1.3 COORDINATION

A. All mechanical work shall be done under sub-contract to a General Contractor. Mechanical Contractor shall coordinate all work through General Contractor, even in areas where only mechanical work is to take place.

B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.

C. Work shall take place with minimal disruption to Owner’s operations in areas surrounding the new building.

D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

E. Fully coordinate with electrical contractor for providing power to mechanical equipment.

F. Mechanical Contractor is responsible for all control wiring including thermostat(s). This includes all conduit, wire, and accessories both low voltage and source voltage for the controls' system. Mechanical Contractor will provide all the necessary actuators, relays, software, hardware, and all necessary accessories required for a fully functional controls' system.

1.4 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.5 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
   1. Owner Occupancy: Allow for Owner occupancy and use by the public.
   2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
   1. Temporary fencing around construction areas.
   2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
   3. Temporary fencing around equipment while site work is in progress.

1.6 SUBMITTALS

1. To extradite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire mechanical or plumbing in a bound enclosure. This will eliminate delays in the submittal process.

END OF SECTION

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete base construction requirements.
   3. Escutcheons.
   4. Dielectric fittings.
   5. Flexible connectors.
   6. Mechanical sleeve seals.
   7. Equipment nameplate data requirements.
   8. No shrink grout for equipment installations.
   9. Field-fabricated metal and wood equipment supports.
   10. Installation requirements common to equipment specification sections.
   11. Cutting and patching.
   12. Touchup painting and finishing.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
F. The following are industry abbreviations for plastic materials:
G. PVC: Polyvinyl chloride plastic.
H. The following are industry abbreviations for rubber materials:

   1. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.
B. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
   1. Planned piping layout, including valve and specialty locations and valve-stem movement.
   2. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
   3. Sizes and location of required concrete pads and bases.
   4. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

5. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes, ductwork, equipment, and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in architectural section.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.8 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.

C. The date of acceptance by the Engineer, for beneficial use by the Owner, shall be the beginning date of the warranty period.

1.9 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of each item of mechanical equipment shown on the Drawings is based on the dimensions of a particular manufacturer as indicated. While other manufacturers may be acceptable, it shall be the responsibility of the Contractor to determine whether or not the equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared when required by the engineer to indicate a suitable arrangement.

B. Install equipment in a manner to permit access to all surfaces. Install valves, motors, drives, lubricating devices, filters, and other accessory items in a position to allow removal for service without requiring the disassembly of another part.

C. Provide access panels acceptable to the Engineer for equipment that is concealed above ceiling space.

D. Large equipment assemblies or components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. Provisions shall be implemented by the Contractor to insure that the equipment will not be damaged in any way during the associated construction procedures.

1.10 START-UP OF EQUIPMENT AND SYSTEMS

A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.

B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

1.11 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Engineer to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include piping diagrams, valve identification charts, control and interlocking wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

D. Provide the Owner with three (3) complete sets of all maintenance manuals, pamphlets, brochures or instructions. This material shall be catalogued, indexed and bound into books.

1.12 ACCEPTABLE MANUFACTURERS

A. A. Provide equipment and materials from listed manufacturers listed within this specification. Deviations from this specification will not be acceptable. When one manufacturer is listed, alternate materials and equipment may be provided "equal to" the listed. When more than one manufacturer is listed, equipment and material must be provided by one of the listed manufacturers.

PART 2 - PRODUCTS

2.1 STANDARD PRODUCTS

A. Each item of equipment furnished under this Division of the Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same kind or class of equipment are required, these shall be the products of a single manufacturer; however, the component parts of the equipment need not be the products of one manufacturer.

B. Materials and equipment shall be of the base quality normally used in good commercial practice and shall be the products of reputable domestic manufacturers unless otherwise specified. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

2.2 QUALITY AND CLASSIFICATION OF MATERIALS

A. Materials and equipment shall be new and of the quality specified and shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new materials or equipment identical with those damaged.

B. Wherever a UL standard has been established for a particular type of material or equipment, each such material or equipment provided on this project shall meet the requirements of the UL standard in every way and shall be UL listed and labeled.

2.3 LOCAL PARTS AND SERVICE

A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 50 miles of the project site."

2.4 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials used for insulation, acoustical linings, adhesives, jackets and coatings, and combinations of these materials, shall each have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less, as determined by an independent testing laboratory in accordance with NFPA-255.

2.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Dielectric Unions:
      a. Watts Industries, Inc.; Water Products Div.
      b. Zurn Industries, Inc.; Wilkins Div.
   2. Mechanical Sleeve Seals:
      a. Calpico, Inc.
      b. Metraflex Co.
      c. Thunderline/Link-Seal.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.
   4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
   1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
   2. OD: Completely cover opening.
   3. Cast Brass: One piece, with set screw.
      a. Finish: Rough brass.
      b. Finish: Polished chrome-plate.
   4. Cast-Iron Floor Plate: One-piece casting.

2.8 GROUT

A. No shrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psig, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
F. Install piping free of sags and bends.
G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
K. Install fittings for changes in direction and branch connections.
L. Install couplings according to manufacturer's written instructions.
M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
    1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
    2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
    3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
    4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
    5. Piping in Utility Areas: Cast brass or stamped steel, with setscrew or spring clips.
N. Sleeves are not required for core drilled holes.
O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    1. Cut sleeves to length for mounting flush with both surfaces.
        a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    2. Build sleeves into new walls and slabs as work progresses.
    3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials: Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
        b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
    4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
    5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe or pipe insulation and sleeve for installing mechanical sleeve seals.
    1. Install steel pipe for sleeves smaller than 6 inches in diameter.
    2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
    3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
    1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials.
T. Verify final equipment locations for roughing-in.
U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
    1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. PVC No pressure Piping: ASTM D 2855.
   c. PVC to ABS No pressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.
9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT AND MATERIAL INSTALLATION - COMMON REQUIREMENTS

A. Install equipment and material to provide maximum possible headroom, if mounting heights are not indicated.
B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
E. Install equipment and ductwork giving right of way to piping installed at required slope.
F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 PAINTING AND FINISHING

A. Refer to paint materials, surface preparation, and application of paint.
B. Do not paint piping specialties with factory-applied finish.
C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement or as specified.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

A. Install nonmetallic, no shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placing of grout.
E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases to provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 29 - HANGER & SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
.3 Section 03 30 00 - Cast-in-Place Concrete.
.4 Section 05 12 23 - Structural Steel for Buildings.
.5 Section 05 50 00 - Metal Fabrications.

1.3 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Materials Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.
.3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

.1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the National Building Code

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
.2 Shop drawings: submit drawings stamped and signed for approval by Owner’s Representative.
.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.
.2 Connections to equipment and structure.
.3 Structural assemblies.

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner's Representative will make available 1 copy of systems supplier's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: Suspension from lower flange of I-Beam.

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 9 mm UL listed, 13 mm FM approved.

.2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: MSS SP-89.

.2 Steel brackets: MSS SP-89.
.3 Sway braces for seismic restraint systems: to MSS SP-89.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel galvanized.
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation saddles for hot pipework.
.4 Oversize pipe hangers and supports for insulated pipes.

.8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.
.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.
.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
.3 Bolts: to ASTM A307.
.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).
.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
.3 Provide upper and lower factory set travel stops.
.4 Provide load adjustment scale for field adjustments.
.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrication.

2.10 HOUSE-KEEPING PADS

.1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger all around than equipment, and with chamfered edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

2.11 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.

.2 Bolt-tightening torques to be to industry standards.

.3 Steel pipes: Install below coupling or shear lugs welded to pipe.

.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,

.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.

.2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

.6 Within 300 mm of each elbow.
.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION
.1 Install hanger so that rod is vertical under operating conditions.
.2 Adjust hangers to equalize load.
.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members, comprised of angel iron or c-channel.

3.5 HORIZONTAL MOVEMENT
.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT
.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.
.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

SECTION 23 05 30 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.
B. Sleeves and seals.
C. Flashing and sealing equipment and pipe stacks.

1.2 SUBMITTALS

D. Submit shop drawings and product data under provisions of specification.
E. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.
B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.
C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.
E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roll.
G. Vertical Support: Steel riser clamp.
H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.
   For pipes 2-1/2" and smaller – Type PP10 with roller
   For pipes 3" through 8" – Type PS
   For multiple pipes – Type PSE - Custom
K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers: Plastic coated; Unistrut or equal.
L. For installation of protective shields refer to specification section 15140-3.03.
M. Shields for Vertical Copper Pipe Risers: Sheet lead.
N. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief "Pipe Titan", Holdrite or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.
B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.
C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.
D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

2.6 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.
B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.
C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.
D. Sleeves for Round Ductwork: Form with galvanized steel.
E. Sleeves for Rectangular Ductwork: Form with galvanized steel.
F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.
G. Caulk: Paintable 25-year acrylic sealant.
H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.7 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
B. Design hangers without disengagement of supported pipe.
C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.8 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.
B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

E. Support horizontal piping as follows:

PIPE SIZE	MAX.	HANGER

	HANGER SPACING	DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7’-0”	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

F. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
G. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.
H. D. Use hangers with 1-1/2 inch minimum vertical adjustment.
I. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
J. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
K. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
L. Support riser piping independently of connected horizontal piping.
M. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.
N. Portable pipe hanger systems shall be installed per manufacturers’ instructions.
O. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.3 Insulated Piping: Comply with the following installation requirements.

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

NPS	LENGTH	THICKNESS
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

D. Piping 2” and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

E. Insert material shall be at least as long as the protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION

SECTION 23 05 63 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:
   1. Equipment nameplates.
   2. Equipment markers.
   3. Access panel and door markers.
   4. Pipe markers.
   5. Duct markers.
   6. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
   1. Terminology: Match schedules as closely as possible.
   2. Data:
      a. Name and plan number.
      b. Equipment service.
      c. Design capacity.
      d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
   3. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
   4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
   4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme [approved by Architect] <Insert other>. Provide 5/32-inch (4-mm) hole for fastener.

1. Material: 3/32-inch- (2.4-mm-) thick laminated plastic with 2 black surfaces and white inner layer.
2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Divisions. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
2. Heat exchangers, coils, evaporators, and similar equipment.
3. Fans, blowers, primary balancing dampers, and mixing boxes.
4. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fire department hose valves and hose stations.
   c. Meters, gages, thermometers, and similar units.
   d. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   e. Heat exchangers, coils, evaporators, and similar equipment.
   f. Fans, blowers, primary balancing dampers, and mixing boxes.
   g. Packaged HVAC central-station and zone-type units.
   h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
   1. Identify mechanical equipment with equipment markers in the following color codes:
      a. Green: For cooling equipment and components.
      b. Yellow: For heating equipment and components.
      c. Orange: For combination cooling and heating equipment and components.
   2. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
   4. Include signs for the following general categories of equipment:
      a. Main control and operating valves, including safety devices.
      b. Pumps, compressors, chillers, condensers, and similar motor-driven units.
      c. Heat exchangers, coils, evaporators, and similar equipment.
      d. Fans, blowers, primary balancing dampers, and mixing boxes.
      e. Packaged HVAC central-station and zone-type units.
      f. Tanks and pressure vessels.
      g. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
   1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.
   2. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches (38 mm) wide, lapped at least 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:
   1. Green: For cold-air supply ducts.
   2. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
   3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
   4. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:
   a. Cold Water: 1-1/2 inches (38 mm), round.
   b. Hot Water: 1-1/2 inches (38 mm), round.
   c. Fire Protection: 2 inches (50 mm), round.

C. Valve-Tag Color:
   a. Cold Water: Green.
   b. Hot Water: Yellow.
   c. Fire Protection: Red.

2. Letter Color:
   a. Cold Water: White.
   b. Hot Water: White.
   c. Fire Protection: White.

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING & BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
   1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Adjusting total HVAC systems to provide indicated quantities.
   3. Measuring electrical performance of HVAC equipment.
   4. Setting quantitative performance of HVAC equipment.
   5. Verifying that automatic control devices are functioning properly.
   6. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:
   1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
   2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

M. AABC: Associated Air Balance Council.

N. CTI: Cooling Tower Institute.

O. NEBB: National Environmental Balancing Bureau.

P. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

C. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.4 QUALITY ASSURANCE

A. Agent Qualifications for larger projects: Engage a testing, adjusting, and balancing agent certified by AABC.
B. Agent Qualifications for smaller projects: Engage a testing, adjusting, and balancing agent certified by NEBB.
C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
   1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
   2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
E. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
F. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
G. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
H. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
   2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
B. Examine approved submittal data of HVAC systems and equipment.
C. Examine project record documents described in specifications.
D. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause

reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
G. Examine system and equipment test reports.
H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
L. Examine equipment for installation and for properly operating safety interlocks and controls.
M. Examine automatic temperature system components to verify the following:
    1. Dampers, valves, and other controlled devices operate by the intended controller.
    2. Dampers and valves are in the position indicated by the controller.
    3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
    4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
    5. Sensors are located to sense only the intended conditions.
    6. Sequence of operation for control modes is according to the Contract Documents.
    7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
    8. Interlocked systems are operating.
    9. Changeover from heating to cooling mode occurs according to design values.
N. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Complete system readiness checks and prepare system readiness reports. Verify the following:
    1. Permanent electrical power wiring is complete.
    2. Automatic temperature-control systems are operational.
    3. Equipment and duct access doors are securely closed.
    4. Balance, fire dampers are open.
    5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
    6. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.
B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare schematic diagrams of systems' "as-built" duct layouts.
C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
F. Verify that motor starters are equipped with properly sized thermal protection.
G. Check dampers for proper position to achieve desired airflow path.
H. Check for airflow blockages.
I. Check condensate drains for proper connections and functioning.
J. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.
B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   2. Measure static pressure across each air-handling unit component.
      a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
   3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
   4. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
   1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
      a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
D. Measure terminal outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
   1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer, model, and serial numbers.
   2. Motor horsepower rating.

3. Motor rpm.
4. Efficiency rating if high-efficiency motor.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 CONDENSING UNITS

A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.

3.8 HEAT-TRANSFER COILS

A. Electric-Heating Coils: Measure the following data for each coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperatures at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kW at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.9 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
B. Measure outside-air, wet- and dry-bulb temperatures.

3.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.
B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
C. Record controller settings and note variances between set points and actual measurements.
D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
E. Verify free travel and proper operation of control devices such as damper and valve operators.
F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
G. Confirm interaction of electrically operated switch transducers.
H. Confirm interaction of interlock and lockout systems.
I. Verify main control supply-air pressure and observe compressor and dryer operations.
J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
1. Supply and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.12 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
1. Include a list of the instruments used for procedures, along with proof of calibration.
C. Final Report Contents: In addition to the certified field report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of testing, adjusting, and balancing Agent.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of testing, adjusting, and balancing Agent who certifies the report.
   10. Summary of contents, including the following:
      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   11. Nomenclature sheets for each item of equipment.
   12. Data for terminal units, including manufacturer, type size, and fittings.
   13. Notes to explain why certain final data in the body of reports vary from design values.
   14. Test conditions for fans and pump performance forms, including the following:
      a. Settings for outside-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings, including settings and percentage of maximum pitch diameter.
      f. Settings for supply-air, static-pressure controller.
      g. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
   1. Quantities of outside, supply, return, and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.
   6. Balancing stations.

F. Roof Top Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Unit arrangement and class.
      g. Discharge arrangement.
      h. Sheave make, size in inches (mm), and bore.
      i. Number of belts, make, and size.
      j. Number of filters, type, and size.
   2. Motor Data: Include the following:
      a. Make and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
   3. Test Data: Include design and actual values for the following:

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Preheat coil static-pressure differential in inches wg (Pa).
f. Cooling coil static-pressure differential in inches wg (Pa).
g. Heating coil static-pressure differential in inches wg (Pa).
h. Outside airflow in cfm (L/s).
i. Return airflow in cfm (L/s).
j. Outside-air damper position.
k. Return-air damper position.
l. Discharge air temperature

G. Electric-Coil Test Reports: For electric duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data: Include the following:
a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btuh (kW).
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Discharge air temperature
2. Test Data: Include design and actual values for the following:
a. Heat output in Btuh (kW).
b. Airflow rate in cfm (L/s).
c. Air velocity in fpm (m/s).
d. Entering-air temperature in deg F (deg C).
e. Leaving-air temperature in deg F (deg C).
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For exhaust fans, include the following:
1. Fan Data: Include the following:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
2. Motor Data: Include the following:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Number of belts, make, and size.
3. Test Data: Include design and actual values for the following:
a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

I. Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, include the following:
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Unit make and model number.
      d. Manufacturer's compressor serial numbers.
      e. Compressor make.
      f. Compressor model and serial numbers.
      g. Refrigerant weight in lb (kg).
   2. Test Data: Include design and actual values for the following:
      a. Entering-air, dry-bulb temperature in deg F (deg C).
      b. Leaving-air, dry-bulb temperature in deg F (deg C).
      c. Control settings.
      d. Unloader set points.
      e. Low-pressure-cutout set point in psig (kPa).
      f. High-pressure-cutout set point in psig (kPa).
      g. Suction pressure in psig (kPa).
      h. Suction temperature in deg F (deg C).
      i. Condenser refrigerant pressure in psig (kPa).
      j. Condenser refrigerant temperature in deg F (deg C).
      k. Oil pressure in psig (kPa).
      l. Oil temperature in deg F (deg C).
      m. Voltage at each connection.
      n. Amperage for each phase.
      o. The kW input.
      p. Number of fans.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.2 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

B. Deliver and store all insulation with protective material until installation. Any material left exposed to moisture and/or particulates shall be removed and replaced.

C. Any installed insulation left temporarily incomplete shall be covered with protective material until final connections can be installed.

1.5 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.6 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mineral-Fiber Insulation:
      a. CertainTeed Manson.
      b. Knauf FiberGlass GmbH.
      c. Owens-Corning Fiberglas Corp.
      d. Schuller International,Inc.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film

2.3 Field Applied Jacket

A. Foil and paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
   1. Tape Width: 4 inches (100 mm).

B. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
   1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Apply multiple layers of insulation with longitudinal and end seams staggered.
E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
F. Keep insulation materials dry during application and finishing.
G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
H. Apply insulation with the least number of joints practical.
I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
L. Apply insulation with integral jackets as follows:
    1. Pull jacket tight and smooth.
    2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
    3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
    1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
    2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
    1. Seal penetrations with vapor-retarder mastic.
    2. Apply insulation for exterior applications tightly joined to interior insulation ends.
    3. Seal insulation to roof flashing with vapor-retarder mastic.
P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
    1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
    1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
    2. Install anchor pins and speed washers on sides and bottom of horizontal ducts and all sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.

3. Impale insulation over anchors and attach speed washers.
4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
7. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round duct elbows with individually mitered gores cut to fit the elbow.
8. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
9. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
C. Insulate the following plenums and duct systems:
1. Indoor concealed supply-, return-, and outside-air ductwork.
2. Indoor exposed supply-, return-, and outside-air ductwork.
3. Indoor concealed range-hood exhaust ductwork.
4. Indoor concealed dishwasher ductwork.
D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors.
4. Vibration-control devices.
5. Testing agency labels and stamps.
6. Nameplates and data plates.
7. Access panels and doors in air-distribution systems.

3.6 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round and rectangular, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
2. Thickness: 3 inches (R-8 or greater)
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.
B. Service: Round and rectangular, return-air ducts, outside air duct, concealed or exposed.
1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and Paper
5. Vapor Retarder Required: Yes.
C. Service: Round and rectangular, supply and return-air ducts, exposed and in mechanical rooms.
1. Material: 2" liner insulation
2. Thickness: 2 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No
D. Service: Round and rectangular, exhaust air ducts, concealed & exposed and in mechanical rooms.

1. Material: 1" Interior liner
2. Thickness: 1 inches
3. Number of Layers: One.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:

1.2 REFERENCES

A. Association Publications:
   1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
      a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
   2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
      a. VISCMA 101-12, 'Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
      b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.

B. Definitions:
   1. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
   2. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

C. Reference Standards:
   1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ANSI/ASHRAE Standard 15-2010, 'Safety Standard for Refrigeration Systems'.
      b. ANSI/ASHRAE Standard 34-2010, 'Designation and Classification of Refrigerants'.
   2. American National Standards Institute / American Welding Society:
      a. ANSI/AWS A5.8M/A5.8-2011, 'Specification for Filler Metals for Brazing and Braze Welding'.
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. '2011 ASHRAE Handbook - HVAC Applications'.
         1) Chapter 48, 'Noise and Vibration Control'.
   4. ASTM International:
      a. ASTM A36/A36M-08, 'Standard Specification for Carbon Structural Steel'.
      b. ASTM B280-08, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'.
   5. National Fire Protection Association / American National Standards Institute:
      a. NFPA 90A-2012, 'Installation of Air Conditioning and Ventilating Systems'.
   6. Underwriters Laboratories:
      a. UL 2182, 'Refrigerants' (2nd Edition).

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Show each individual equipment and piping support.

B. Informational Submittals:
   1. Qualification Statements: Technician certificate for use of HFC and HCFC refrigerants.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Refrigerants:
      a. Underwriters Laboratories / Underwriters Laboratories of Canada:

1) Comply with requirements of UL 2182.

B. Qualifications. Section 01 4301 applies, but is not limited to the following:

1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:

1. Manufacturer Contact List:
   a. Airtec,
   b. Cush-A-Clamp by ZSI Manufacturing,
   c. Elkhart Products Corp,.
   d. Emerson Climate Technologies,
   e. Handy & Harman Products
   f. Harris Products Group,
   g. Henry Valve Co,
   h. Hilti Inc,
   i. Hydra-Zorb Co,
   j. JB Industries,
   k. Mueller Steam Specialty,
   l. Nibco Inc,
   m. Packless Industries, Parker Corp,
   n. Sporlan Valve Co.
   o. Sherwood Valves,.
   p. Thomas & Betts,
   q. Unistrut, Div of Atkore International, Inc.
   r. Universal Metal Hose.
   s. Vibration Mountings & Controls,
   t. Virginia KMP Corp,

B. Materials:

1. Refrigerant Piping:
   a. Meet requirements of ASTM B280, hard drawn straight lengths. Soft copper tubing not permitted.
   b. Do not use pre-charged refrigerant lines.
2. Refrigerant Fittings:
   a. Wrought copper with long radius elbows.
   b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Mueller Streamline.
      2) Nibco Inc.
      3) Elkhart.
3. Suction Line Traps:
   a. Manufactured standard one-piece traps.
   b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Mueller Streamline.
      2) Nibco Inc.
      3) Elkhart.
4. Tee Access:
   a. Brass:
      1) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         a) JB Industries: Part #A3 Series with Factory Cap and Valve Core.
5. Connection Material:
   a. Brazing Rods in accordance with ANSI/AWS A5.8M/A5.8:
      1) Copper to Copper Connections:
         a) Classification BCuP-4 Copper Phosphorus (6 percent silver).

b) Classification BCuP-5 Copper Phosphorus (15 percent silver).
2) Copper to Brass or Copper to Steel Connections: Classification BAg-5 Silver (45 percent silver).
3) Do not use rods containing Cadmium.

b. Flux:
1) Type Two Acceptable Products:
a) Stay-Silv White Brazing Flux by Harris Products Group.
b) High quality silver solder flux by Handy & Harmon.
c) Equal as approved by Architect before use. See Section 01 6200.

6. Valves:
a. Expansion Valves:
1) For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
2) Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
3) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
a) Emerson Climate Technologies.
b) Henry.
c) Mueller.
d) Parker.
e) Sporlan.
b. Manual Refrigerant Shut-Off Valves:
1) Ball valves designed for refrigeration service and full line size.
2) Valve shall have cap seals.
3) Valves with hand wheels are not acceptable.
4) Provide service valve on each liquid and suction line at compressor.
5) If service valves come as integral part of condensing unit, additional service valves shall not be required.
6) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
a) Henry.
b) Mueller.
c) Sherwood.
d) Virginia.

7. Filter-Drier:
a. On lines 3/4 inch (19 mm) outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
b. On lines smaller than 3/4 inch (19 mm) outside diameter, filter-drier shall be sealed type with brazed end connections.
c. Size shall be full line size.
d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
1) Emerson Climate Technologies.
2) Mueller.
3) Parker.
4) Sporlan.
5) Virginia.

8. Sight Glass:
a. Combination moisture and liquid indicator with protection cap.
b. Sight glass shall be full line size.
c. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
1) HMI by Emerson Climate Technologies.

9. Flexible Connectors:
a. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.

b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
1) Vibration Absorber Model VAF by Packless Industries.
2) Vibration Absorbers by Virginia KMP Corp.
3) Anaconda 'Vibration Eliminators' by Universal Metal Hose.
4) Style 'BF' Spring-flex freon connectors by Vibration Mountings.

10. Refrigerant Piping Supports:
a. Base, Angles, And Uprights: Steel meeting requirements of ASTM A36.
b. Securing Channels:
1) At Free-Standing Pipe Support:
a) Class One Quality Standard: P-1000 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
2) At Wall Support:
a) Class One Quality Standard: P-3300 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
3) At Suspended Support:
a) Class One Quality Standard: P-1001 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
4) Angle Fittings:
a) Class One Quality Standard: P-2626 90 degree angle by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.
c. Pipe Clamps:
1) Type Two Acceptable Manufacturers:
a) Hydra-Zorb.
b) ZSI Cush-A-Clamp.
c) Hilti Cush-A-Clamp.
d) Equal as approved by Architect before installation. See Section 01 6200.
d. Protective Cover: 18 ga (1.2 mm) steel, hot-dipped galvanized.

11. Locking Refrigerant Cap:
a. Provide and install on charging valves:
1) Class One Quality Standard: 'No Vent' locking refrigerant cap.
2) Acceptable Manufacturers: Airtec.
3) Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refrigerant Lines:
1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
2. Slope suction lines down toward compressor one inch/10 feet (25 mm in 3 meters). Locate traps at vertical rises against flow in suction lines.

B. Connections:
1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties:
1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.

2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.

D. Refrigerant Supports:
1. Support Spacing:
a. Piping 1-1/4 inch (32 mm) And Larger: 8 feet (2.450 m) on center maximum.
b. Piping 1-1/8 inch (28.5 mm) And Smaller: 6 feet (1.80 m) on center maximum.
c. Support each elbow.
2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

3.2 FIELD QUALITY CONTROL

A. Field Tests:
1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. Non-Conforming Work:
1. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION

SECTION 23 26 00 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Coordinate installation of condensate drain piping with Section 22 0501 as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:

1. ASTM International:
   a. ASTM B88-09, 'Standard Specification for Seamless Copper Water Tube'.
   b. ASTM D1785-12, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120'.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Materials:

1. Condensate Drains:
   a. Exterior And Interior Lines: Type M copper meeting requirements of ASTM B88.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains:

1. Support piping and protect from damage.

END OF SECTION

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

B. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg

1.3 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect.

1.5 SUBMITTALS

A. Product Data: For duct liner and sealing materials.

B. Shop Drawings: Show details of the following:

1. Duct layout indicating pressure classifications and sizes on plans.
2. Fittings.
3. Penetrations through fire-rated and other partitions.
4. Coordination with other trades and including but not limited to: structural members, electrical lights and conduits, plumbing lines, & fire sprinkler lines.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
2. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

D. Duct Construction Standards: Provide a copy of the duct construction standards to be used for each pressure classification in this project. Duct Construction Standards must comply with the latest edition of SMACNA “HVAC Duct Construction Standards – Metal and Flexible.”

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

D. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.
C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation
D. Deliver and store all ductwork with protective material until installation. Any material left exposed to moisture and/or particulates shall be removed and replaced.
E. Any installed ductwork or piping system left temporarily incomplete shall be covered with protective material until final connections can be installed.
F. All ductwork and/or liner insulation to be wrapped with protective material until installation. Any ductwork or insulation left exposed to the environment or contaminating particulate matter shall be replaced at the contractor’s expense.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.
C. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.
D. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
   1. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
   2. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.3 HANGERS AND SUPPORTS

A. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
   1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
   2. Straps and Rod Sizes: Comply with latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
C. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
   1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
   3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.4 RECTANGULAR DUCT FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
   1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.

2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Fabricate range hood exhaust ducts with 0.0598-inch- thick, galvanized sheet for concealed ducts and 0.0500-inch-thick stainless steel for exposed ducts. Weld and flange seams and joints. Comply with NFPA 96.

C. Fabricate dishwasher hood exhaust ducts with 0.0500-inch- thick stainless steel. Weld and flange seams and joints.

D. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:

1. Supply Ducts between AHU and Air Terminal Units: 3-inch wg.
2. Supply Ducts after air terminal units and on constant volume supply equipment: 1-inch wg (250 Pa), positive pressure
3. Return Ducts: 1-inch wg ,negative pressure.
4. Exhaust Ducts: 1-inch wg negative pressure.

E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

2.5 ROUND FABRICATION

A. Round Ducts: Fabricate spiral seam supply and return ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Snap Lock Longitudinal seam ductwork will not be allowed. Adjustable elbows will not be allowed.

B. Spiral seam round or oval duct may be substituted for rectangular duct at the contractors option. Spiral seam ductwork sizing must result in the same or less pressure drop than the rectangular duct indicated on the plans.

2.6 DUCT STORAGE

A. All duct must have end capped with plastic covers on both ends from end of fabrication to duct installation. If this is not provided at the field, vacuum ducts before final acceptance to remove dust and debris.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct installation requirements are specified in other Division Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.

B. Construct and install each duct system for the specific duct pressure classification indicated.

C. Install round ducts in lengths not less than 10 feet (3 m), unless interrupted by fittings.

D. Install ducts with fewest possible joints.

E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.

F. Install couplings tight to duct wall surface with a minimum of projections into duct.

G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.

K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division Section "Duct Accessories." Firestopping materials and installation methods are specified in other Divisions

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." All duct to be sealed to SMACNA seal class A which

requires sealing all transverse joints, longitudinal seams and duct wall penetrations regardless of pressure classification.

B. Seal externally insulated ducts before insulation installation.

C. All ducts shall be inspected after sealing is complete and prior to insulation installation. Provide the engineer with a minimum 7 days notice prior to beginning duct insulation.

3.3 RANGE HOOD EXHAUST DUCT INSTALLATIONS

A. Install ducts to allow for thermal expansion of ductwork through 2000 deg F temperature range.

B. Install ducts without dips or traps that may collect residues, unless traps have continuous or automatic residue removal.

C. Install access openings at each change in direction and at 15-foot intervals; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.

D. Do not penetrate fire-rated assemblies.

3.4 DISHWASHER EXHAUST DUCT INSTALLATIONS

A. Install dishwasher exhaust ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 HANGING AND SUPPORTING

A. Install rigid round and rectangular metal duct with support systems indicated in the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Support vertical ducts at a maximum interval of 16 feet and at each floor.

D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.6 CONNECTIONS

A. Connect equipment with flexible connectors according to Section "Duct Accessories."

B. For branch, outlet and inlet, and terminal unit connections, comply with the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.7 DUCT APPLICATION

A. Service: Round and rectangular, supply/return/outside -air ducts, concealed.

B. Sheet-metal with wrap insulation

C. Service: Round and rectangular, supply/return/outside -air ducts, exposed and in mechanical rooms.

1. Sheet-metal double wall with lined insulation in-between.
2. Inner sheet-metal duct shall be perforated in areas with acoustical requirements, ref. plans.

3.8 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

B. 25% of the duct installed after the air handling units and (prior to the air terminal units, when applicable) shall be tested in the presence of the Architect, at static pressures equal to maximum design pressure of system or section being tested. The sections of duct to be tested shall be chosen by the architect or engineer after installation of the duct. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

C. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.

E. Remake leaking joints and retest until leakage is less than maximum allowable.

3.9 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect the system.

END OF SECTION

SECTION 23 33 00 - HVAC DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Backdraft dampers.
   2. Manual-volume dampers.
   3. Fire dampers.
   4. Turning vanes.
   5. Duct-mounted access doors and panels.
   6. Flexible ducts.
   7. Flexible connectors.
   8. Duct accessory hardware.

1.2 SUBMITTALS

A. Product Data: For the following:
   1. Backdraft dampers.
   2. Manual-volume dampers.
   3. Fire dampers.
   4. Duct-mounted access doors and panels.
   5. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
   1. Special fittings and manual- and automatic-volume-damper installations.
   2. Fire-damper installations, including sleeves and duct-mounted access doors and panels.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:
   1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installations.

B. Frame: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel, with welded corners and mounting flange.

C. Blades: 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.

D. Blade Seals: Vinyl.

E. Blade Axles: Galvanized steel.
F. Tie Bars and Brackets: Galvanized steel.
G. Return Spring: Adjustable tension.

2.3 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
   1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
   3. Blade Axles: Galvanized steel.
   4. Tie Bars and Brackets: Galvanized steel.
C. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. General: Labeled to UL 555.
B. Fire Rating: One and one-half hours.
C. Fire Rating: One and one-half hours.
D. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
E. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
   1. Minimum Thickness: 0.052 inch (1.3 mm) or 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
   2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
F. Mounting Orientation: Vertical or horizontal as indicated.
G. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized steel blade connectors.
H. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
I. Fusible Link: Replaceable, 165 deg F (74 deg C) rated as indicated.

2.5 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
B. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.6 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
E. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.7 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

C. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

D. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch- (111-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.

E. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
   1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
   2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.

F. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
   1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
   2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.

2.8 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.

B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.
   1. Reinforcement: Steel-wire helix encapsulated in inner liner.
   2. Outer Jacket: Polyethylene film.
   3. Inner Liner: Polyethylene film.

C. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

2.9 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch (6-mm), zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
   1. Install fusible links in fire dampers.

E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
   1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
   2. Install access panels on side of duct where adequate clearance is available.

F. Label access doors according to Division "Mechanical Identification."

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.
B. Adjust fire dampers for proper action.
C. Final positioning of manual-volume dampers is specified in Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 23 33 46 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:

1. National Fire Protection Association / American National Standards Institute:
   a. NFPA 90A: ‘Standard for the Installation of Air-Conditioning and Ventilating Systems' (2012 Edition).
2. Underwriters Laboratories:
   a. UL 181, ‘Factory-Made Ducts and Air Connectors' (10th Edition).
   b. UL 181B, ‘Closure Systems for Use With Flexible Air Ducts and Air Connectors' (3rd Edition).

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:

1. Manufacturer Contact List:
   a. Anco Products Inc,
   b. Thermaflex by Flexible Technologies
   c. Flexmaster USA Inc, Houston, TX

B. Materials:

1. Ducts:
   a. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict airflow after bending.
   b. Insulation:
      1) Nominal 1-1/2 inches (38 mm), 3/4 lb per cu ft (12 kg per cu m) density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.
   c. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
   d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) ANCO-FLEX 4625 by Anco Products.
      2) M-KC by Thermaflex by Flexible Technologies.
      3) Type 4m Insulated by Flexmaster.
2. Cinch Bands: Nylon, 3/8 inch removable and reusable type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct in fully extended condition free of sags and kinks, using 60 inch maximum lengths.

B. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with specified cinch bands.

END OF SECTION

SECTION 23 33 46 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:

1. National Fire Protection Association / American National Standards Institute:
   a. NFPA 90A: ‘Standard for the Installation of Air-Conditioning and Ventilating Systems' (2012 Edition).
2. Underwriters Laboratories:
   a. UL 181, ‘Factory-Made Ducts and Air Connectors' (10th Edition).
   b. UL 181B, ‘Closure Systems for Use With Flexible Air Ducts and Air Connectors' (3rd Edition).

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:

1. Manufacturer Contact List:
   a. Anco Products Inc,
   b. Thermaflex by Flexible Technologies
   c. Flexmaster USA Inc, Houston, TX

B. Materials:

1. Ducts:
   a. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict airflow after bending.
   b. Insulation:
      1) Nominal 1-1/2 inches (38 mm), 3/4 lb per cu ft (12 kg per cu m) density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.
   c. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
   d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) ANCO-FLEX 4625 by Anco Products.
      2) M-KC by Thermaflex by Flexible Technologies.
      3) Type 4m Insulated by Flexmaster.
2. Cinch Bands: Nylon, 3/8 inch removable and reusable type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct in fully extended condition free of sags and kinks, using 60 inch maximum lengths.

B. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with specified cinch bands.

END OF SECTION

SECTION 23 34 16 - CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes centrifugal fans and vent sets.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.

B. Operating Limits: Classify according to AMCA standards.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each unit scheduled and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For centrifugal fans to include in maintenance manuals specified in specifications.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

A. Coordinate size and location of structural support members and/or shaft locations.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in these documents.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cook, Loren Company.
2. Greenheck.

2.2 HOUSINGS

A. Roof Mounted Centrifugal Exhaust Fan.

1. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid

aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

2.3 WHEELS

A. Roof Mounted Centrifugal Exhaust Fan

1. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

2.4 SHAFTS

A. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

B. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.

C. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

2.5 BEARINGS

A. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.

1. Ball-Bearing Rating Life: ABMA 9, L_{50} of 200,000 hours.
2. Roller-Bearing Rating Life: ABMA 11, L_{50} of 200,000 hours.

2.6 BELT DRIVES

A. Description: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor: 1.5.

B. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

C. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

D. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

E. Motor Mount: Adjustable for belt tensioning.

2.7 ACCESSORIES

A. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.

B. Companion Flanges: Galvanized steel, for duct connections.

C. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.

D. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.

E. Spark-Resistant Construction: AMCA 99 (where required).

F. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.

G. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.8 MOTORS

A. Refer to Section "Motors" for general requirements for factory-installed motors.

B. Motor Construction: NEMA MG 1, general purpose, continuous duty, high efficiency, Design B.

C. Enclosure Type: [Open dripproof] [Totally enclosed, fan cooled].

2.9 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.
B. Install units with clearances for service and maintenance.
C. Label fans according to requirements specified in Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
B. Install ducts adjacent to fans to allow service and maintenance.
C. Ground equipment.
D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Verify lubrication for bearings and other moving parts.
B. Starting Procedures:
   1. Energize motor and adjust fan to indicated rpm.
   2. Measure and record motor voltage and amperage.
C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
E. Shut unit down and reconnect automatic temperature-control operators.
F. Refer to Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
G. Replace fan and motor pulleys as required to achieve design airflow.
H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.
B. Adjust belt tension.
C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   2. Review data in maintenance manuals. Refer to specifications Section "Closeout Procedures."
   3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 23 37 13 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.3 SUBMITTALS

A. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Diffusers, registers, and grilles are scheduled on Drawings.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Titus.
2. Price

2.2 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. Coordinate device locations with ceiling grid, sprinklers, and lights. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

SECTION 23 74 10
PACKAGED ROOFTOP UNITS (TRANE)

PART1- GENERAL

1.1 SECTION INCLUDES

Package roof top unit.
Heat exchanger.
Refrigeration components.
Unit operating controls.
Roof curb.
Electrical power connections.
Operation and maintenance service.

1.2 SUBMITTALS

Submit unit performance data including: capacity, nominal and operating performance.
Submit Mechanical Specifications for unit and accessories describing construction, components and options.
Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.
Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.3 DELIVERY, STORAGE and HANDLING

Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
Protect units from physical damage. Leave factory-shipping covers in place until installation.

1.4 WARRANTY

Provide parts warranty (excluding refrigerant) for one year from start-up or 18 months from shipment, whichever occurs first.
Provide five-year extended warranty for compressors.

1.5 REGULATORY REQUIREMENTS

Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioner.

1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

1.6 EXTRA MATERIALS

Provide one set of filters.
Furnish a complete set of fan motor drive belts.

PART2- PRODUCTS

2.1 SUMMARY

The contractor shall furnish and install package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
APPROVED MANUFACTURERS

1. Trane:
2. Carrie
3. Lennox

2.2 GENERAL UNIT DESCRIPTION

A. Unit(s) furnished and installed shall be packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standard <<ARI_STANDARDS>>. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.

Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
Units shall be convertible airflow design as manufactured.
Wiring internal to the unit shall be colored and numbered for identification.

2.3 UNIT CASING

A. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge.

Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
Cabinet construction shall allow for all service/ maintenance from one side of the unit.
Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.
Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.
Units base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
Insulation: Provide 1/2 inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.
The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

2.4 AIR FILTERS

A. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. One-inch thick glass fiber disposable media filters shall be provided with the provisions within the unit for 2 inch thick filters to be field- provided and installed.

2.5 FANS AND MOTORS

A. Provide units 6 tons and above with direct drive plenum fan design. Fan is backward incline design.
Outdoor and Indoor Fan shall be permanently lubricated and have internal thermal overload protection.
Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.6 ELECTRIC HEATING SECTION

A. Provide heavy duty nickel chromium heating elements internally wired. Heater shall have pilot duty or automatic reset line voltage limit controls and any circuit carrying more than 48 amps shall have fuse protection in compliance with N.E.C.
Heater shall be internal to unit cabinet.
Heater shall be UL and CSA listed and approved and provide single point power connection.

2.7 EVAPORATOR COIL

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.
Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

2.8 CONDENSER SECTION

A. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

2.9 REFRIGERATION SYSTEM

A. Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.
Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
Provide each unit with 2 refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

2.10 OUTDOOR AIR SECTION

A. Provide economizer with barometric relief and reference enthalpy control.
Provide adjustable minimum position control located in the economizer section of the unit.
Provide spring return motor for outside air damper closure during unit shutdown or power interruption.
OPERATING CONTROLS
Provide microprocessor unit-mounted DDC control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling, and ventilating decisions through resident software logic.
Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.
Economizer Preferred Cooling (if supplied with economizer) - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

2.11 STAGING CONTROLS

A. Provide NEC Class II, electronic, adjustable zone control to maintain zone temperature setting.

Provide programmable electronic microcomputer based zone control.

1. Zone control shall incorporate:
   a. Automatic changeover from heating to cooling.
   b. Set-up for at least 2 - sets of separate heating and cooling temperatures per day.
   c. Instant override of setpoint for continuous or timed period from one hour to 31 days.
   d. Switch selection features including Fahrenheit display, 12 or 24-hour clock, keyboard disable, remote sensor, fan on-auto.
   e. Smart Fan Operation: Allows the unit fan operation to default to the Auto Mode during unoccupied periods, regardless of the Fan switch position.
   f. Economizer Minimum Position Override: Allows the unit controller to override and close the minimum position setting on the economizer damper during unoccupied time periods.
2. Zone sensor display shall be capable of:
   a. Time of day.
   b. Actual room temperature.
   c. Programmed temperature.
   d. Programmed time.
   e. Duration of timed override.
   f. Day of week.
   g. System mode indication: heating, cooling, low battery, and fan on.

Provide remote temperature sensor capability.

Provide mixed air sensor in supply air to close outside air damper.

2.12 UNIT CONTROLS

A. Provide with manufacturers designed thermostat capable of controlling all of the units operations.

2.13 ROOF CURB

A. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

Curb shall be designed to withstand winds of 135 MPH. Curb design shall be designed and sealed by a professional engineer.

PART3- EXECUTION

3.1 EXAMINATION

Contractor shall verify that roof is ready to receive work and opening dimensions are as submitted by manufacturer.

Contractor shall verify that proper power supply is available.

3.2 INSTALLATION

A. Contractor shall install in accordance with manufacturer's instructions.

Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

END OF SECTION

SECTION 26 00 00 - ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Specification Sections and other Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
B. General Scope of Work:
   1. Providing new panels, feeders, conduits, disconnect, fire alarm, rough-in for telephone and data system, and new light fixtures.

1.4 COORDINATION

A. All electrical work shall be done under sub-contract to a General Contractor. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.

B. Work shall take place with minimal disruption to Owner’s operations in areas surrounding the new building.

C. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

D. Fully coordinate with mechanical contractor for providing power to mechanical equipment.

1.5 UTILITIES

1. Coordinate with power company and provide conduit, and trenching from transformer to power source. Coordinate with water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

   1. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

   1. Temporary fencing around construction areas.
   2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
   3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

1. To extradite the submittal process more efficiently, do not piece-meal the submittals. Submit entire electrical in a bound enclosure. This will eliminate delays in the submittal process. Unbound submittals shall be returned without review. Submit 10 copies minimum.

END OF SECTION

SECTION 26 01 20 OPERATION AND MAINTENANCE OF LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART1- GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions, Specification Sections and all relevant documents shall form a part of this Section of the Specifications, and shall be incorporated in this Section and each Section 260000 hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the work under this Section. Certain specific paragraphs of said references may be referred to hereinafter in this Section. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve him of responsibility. The omission of details of other portions of the work from this Section shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the work related to the construction in progress or to the adjacent building shall be determined by examination at the site.

1.2 SCOPE OF WORK

A. The requirements contained in this Section apply to all work performed under these Specifications.

B. The work covered by this Section of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.

C. Refer to other Sections of the Specifications for related work.

1.3 DEFINITION OF "CONTRACTOR"

A. Where the word "Contractor" is used under any Section of this Section of the Specifications, it shall mean the Contractor engaged to execute the work included under that Section, even though this Contractor may be technically described as a Subcontractor, or an authorized representative.

B. If the Contractor, engaged to execute a portion of the work, employs a Subcontractor to perform some of that work, he shall be completely responsible for the proper execution of this Subcontractor’s work, in full conformity with the Contract Documents.

1.4 RESPONSIBILITY OF THE CONTRACTOR

A. The Contractor shall be responsible for all work of every description in connection with this Section of the Specifications. The Contractor shall specifically and distinctly assume, and does zeso assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the work, and undertake the responsibility to defend the Owner against all claims on account of any such damage or injury.

B. The Contractor will be held responsible for the satisfactory execution and completion of the work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, the Contractor shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the work.

1.5 TERMINOLOGY

A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and similar phrases

occur, it is the intent that the materials, equipment and devices described be furnished, installed and connected under this Section, complete for operation, unless specifically noted to the contrary.

B. It is also the intent, unless specifically noted to the contrary, that all materials, equipment and devices described and specified under this Section of the Specifications be similarly furnished, installed and connected under this Section, whether or not a phrase as described in the preceding paragraph has been actually included.

C. Whenever the words “Owner’s Representative” occurs, it is intended to refer to the Architect, Engineer and/or specific Owner’s Representative responsible for or capable of providing the necessary direction pertaining to the referenced issue.

1.6 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.

C. The Contractor shall obtain and pay for all permit and connection fees as required for the complete installation of the specified systems, equipment, devices and materials.

D. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

E. The work shall be in accordance with, but shall not be limited to, the requirements of:
   1 National Fire Protection Association
   2 National Electrical Code
   3 National Safety Code
   4 State of Texas Safety Code
   5 Local City Building Codes
   6 State of Texas Building Codes

F. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications govern.

1.7 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

B. Materials, equipment and devices furnished under this Section of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.

C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.

D. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. The Contractor shall verify that all materials, equipment and devices proposed for use on this project are within the constraints of the allocated space.

1.8 QUALITY ASSURANCE

A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.

B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.9 REFERENCE STANDARDS

A. Materials, equipment, devices and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.

B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the work shall be corrected of noncompliance deficiencies with the Contractor bearing all costs.

C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

AABM	-	American Association of Battery Manufacturers
ADA	-	American’s with Disabilities Act
AIA	-	American Institute of Architects
ANSI	-	American National Standards Institute
ASTM	-	American Society for Testing and Materials
CBM	-	Certified Ballast Manufacturers Association
ETL	-	Electrical Testing Laboratories
FM	-	Factory Mutual
ICEA	-	Insulated Cable Engineers Associated
IEEE	-	Institute of Electrical and Electronic Engineers
IES	-	Illuminating Engineering Society
IRI	-	Industrial Risk Insurance
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NECA	-	National Electrical Contractors Association
NEMA	-	National Electrical Manufacturers Association
NESC	-	National Electrical Safety Code
NETA	-	National Electrical Testing Association
NFPA	-	National Fire Protection Association
UL	-	Underwriters Laboratories

1.10 DRAWINGS AND SPECIFICATIONS

A. The interrelation of the Drawings (including the schedules) and the Specifications are as follows:

1 The Drawings establish quantities, locations, dimensions and details of materials, equipment and

devices. The schedules on the Drawings indicate the capacities, characteristics and components.

2 The Specifications provide written requirements for the quality, standard and nature of the materials, equipment, devices and construction systems.

B. The Drawings and Specifications shall be considered as being compatible; therefore, the work called for by one and not by the other shall be furnished and installed as though called for by both. Resolution of conflicts between Drawings and Specifications shall be as follows:

1 If the Drawings and Specifications disagree in themselves, or with each other, the Contractor's pricing shall be based on furnishing and installing the most expensive combination of quality and quantity of work indicated for a complete operable system. Contractor is responsible to notifying the Architect and Engineer. In the event of this type of disagreement, the resolution shall be determined by the Owner's Representative. The contractor shall assume for an operable system at the most expensive combination as per the latest National Electrical Code. The contractor shall review all drawings and specifications prior to bid date.

2 The Contractor shall be responsible for bringing any conflicts in the Drawings and the Specifications to the attention of the Owner's Representative immediately, prior to bid date.

3 In general, if there is conflict between the Drawings and Specifications, the Drawings shall govern the Specifications.

4 Where the Specifications do not fully agree with schedules on the Drawings, the schedules shall govern. Actual numerical dimensions indicated on the Drawings govern scale measurements and large scale details govern small scale drawings.

5 Materials, equipment and devices called for on the Drawings and not indicated herein, shall be completely provided and installed as though it were fully described herein.

6 Materials, equipment and devices called for herein shall be completely provided and installed, whether or not it is fully detailed, scheduled or indicated on the Drawings.

C. The Contractor shall examine the Drawings and Specifications of the other portions of the work for fixtures and finishes in connection with this work. The Contractor shall carefully examine the Drawings to determine the general construction conditions, and shall familiarize himself with all limitations caused by such conditions.

D. When discrepancies exist between scale and dimension, or between the Drawings of the various portions of the work, they shall be called to the attention of the Owner's Representative for further instruction, whose instructions shall be final and binding and work promptly resumed without any additional cost to the Owner.

E. Review the construction details of the building(s) as illustrated on the Drawings of the other portions of the work, i.e., architectural, structural, civil, landscape, etc., and be guided thereby. Route conduits and set all boxes as required by the pace of the general construction.

F. The Drawings diagrammatically show the sizes and locations of the various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the work. In cooperation with other Contractors, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner's Representative, without additional cost to the Owner.

G. The Drawings and Specifications are intended to describe and illustrate systems which will not interfere with the structure of the building(s), fit into the available spaces, and insure complete and satisfactory operating installations. Prepare installation drawings as required for all critical areas illustrating the installation of the work in this Section as related to the work of all other Sections and correct all interferences with the other portions of the work or with the building structures before the work proceeds.

H. The Drawings do not indicate the existing electrical installations other than to identify modifications or extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work under this Section.

1.11 SUBMITTALS

A. Submit product data and shop drawings in accordance with the Specifications.

B. Process product data and shop drawings to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.

C. Submittals shall be provided for review and approval on all systems, equipment, devices and materials proposed for use on this project. Submittals shall include, but not be limited to, the following:
   1 Lighting and Appliance Panelboards
   2 Disconnect Switches
   3 Circuit Breakers and Fuses
   4 Materials: conduit, conductors, connectors, supports, etc.
   5 Lighting Fixtures, Lamps and Control Systems/Devices
   6 Wiring Devices
   7 Transformers
   8 Distribution Panelboards
   9 Motor Control Center
   10 As indicated on each submittal section

D. The product data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

E. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.

F. Assemble submittals on related items procured from a single manufacturer in bound brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.

G. Prepare shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Owner's Representative. Shop drawings shall be prepared at a scale of not less than 1/4 inch equals 1 foot.

H. The Contractor shall sign the submittal as an indication of compliance with the Contract Documents. If there are any deviations from the Contract Documents, he shall so indicate on the submittal. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

1.12 SUBSTITUTIONS

A. Where a single manufacturer is mentioned by trade name or manufacturer's name, unless specifically noted otherwise, it is the only manufacturer that will be accepted.

B. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.

C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum seven (7) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or “not applicable”. In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.
   1 By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full

compliance with the item specified and will provide exactly the same with no deviations.

2 By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.

3 By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.

4 By noting the term “not applicable” or “N/A”, it shall be understood that the specified item is not applicable to the project.

D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal 1/4 inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.

E. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.

F. The Owner's Representative reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

G. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.13 INSTALLATION DRAWINGS

A. Prepare installation drawings for coordinating the work of this Section with the work of other Sections, to illustrate its concealment in finished spaces, to avoid obstructions, and to demonstrate the adaptability of any item of material, equipment or device in the space upon which the Contract Documents are based.

B. Use these drawings in the field for the actual installation of this work. Provide three (3) copies, not for approval, to the Owner's Representative for his information, review and record.

1.14 WORKMANSHIP AND INSTALLATION

A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the Owner's Representative and shall secure his approval before the work is started.

B. The work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

C. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.

1.15 INSPECTION OF SITE

A. The accompanying drawings do not indicate existing installations other than to identify modifications of and extensions thereto. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work to be performed. Failure to comply with this shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Section.

B. Review construction details of the adjacent building presently under construction during the site inspection and include all work required to modify the existing installations and install new materials, comprising a part of the installation. Review all construction details of the new building as illustrated on the drawings and be guided thereby.

1.16 WARRANTY

A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Owner's Representative for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the proper registration of these warranties so that the Owner can make all proper claims should future need develop.

B. The Contractor shall furnish to the Owner's Representative for transmittal to the Owner, the name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

1.17 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments and complete punch list items before final acceptance by the Owner.

1.18 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.19 SCHEDULE AND SEQUENCE OF WORK

A. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence this work so as to insure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

1.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the regulatory authorities. Remedy any deficiencies to the satisfaction of the inspecting official.

B. Upon final completion of the work, obtain certificates of acceptance from the regulatory authorities.

Deliver the certificates to the Owner's Representative for transmission to the Owner.

1.21 EQUIPMENT INSTALLATION

A. Install equipment and devices in a manner to permit access to all surfaces or components, requiring such access, without the need to disassemble other unrelated parts of the work.

B. Equipment specified to be factory assembled and tested prior to shipment shall not be disassembled at the job site and reassembled at its final location. Apparatus not so specified may be disassembled and reassembled in the proper location.

C. Furnish all scaffolding, rigging and hoisting required for the installation of all the work.

1.22 CONCRETE HOUSEKEEPING PADS

A. Concrete housekeeping pads shall be provided for all floor mounted equipment, unless noted or required otherwise.

B. All pads shall be not less than 3-1/2" high and extend a maximum 3" beyond the actual equipment size. Coordinate the proper size of the pad with the equipment furnished. Pads shall be poured in forms built of new dressed lumber with corners chamfered using sheet metal or triangular wood strips nailed to the form. Use 6 x 6 No. 3 mesh for reinforcing. Install heavy duty adjustable anchor bolts, set in the form and positioned using templates, prior to pouring concrete. After the equipment is set on the pad, the equipment shall be aligned, leveled and fully grouted to the pad and all void spaces shall be filled with a non-shrinking grout.

C. Perform all concrete work specified to be provided under this Section in strict accordance with the applicable provisions of Section, CONCRETE.

1.23 SLEEVES

A. Each conduit, regardless of material, which passes through a concrete slab, masonry wall, or roof or portion of the building structure shall be free from the structure and shall pass through a sleeve.

B. All sleeves shall be constructed from electrical-metallic tubing or equivalent weight galvanized steel tubing and shall be flush on both sides of the surface penetrated, unless noted otherwise. All sleeves penetrating the roof areas shall extend a minimum 10 inches above the roof with approved weatherproof counterflashing attached to the conduit above the roof. All sleeves penetrating floors shall extend a minimum of 6 inches above the finished floors. The sleeves shall be sized to allow free passage of the conduit to be inserted.

C. Sleeves passing through walls or floors on or below grade or in moist areas shall be constructed of galvanized rigid steel and shall be designed with a suitable flange in the center to form a waterproof passage. After the conduit has been installed in the sleeves, the void space around the conduit shall be caulked and filled with an asphalt-base compound to insure a waterproof penetration. Jute twine caulking shall not be used due to susceptibility to termite infestation.

1.24 ESCUTCHEONS

A. In each finished space, provided a chromium plated, sectional escutcheon on each conduit, or hanger rod penetrating a wall, floor or ceiling.

B. Size escutcheons and collars to fit snugly around conduit and rods.

C. Where required, provide escutcheons with set screws so that they fit snugly against the finished surface.

1.25 ACCESS PANELS

A. Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings.

B. Access panels shall be UL listed and labeled as required to suit the fire rating of the surface in which installed, with mounting straps, concealed hinges, screwdriver locks, 180 degree open door design, 16 gauge steel construction and door and frame finished in prime coat finish. Panels shall be 12-inch by 12-inch minimum size, but shall be larger as the access requirement of the concealed electrical equipment item or device increases.

1.26 SEALING OF PENETRATIONS

A. All penetrations in horizontal or vertical fire-rated construction shall be sealed using approved fire-rated sealing materials equivalent to the following:
   1 Foam: Dow Corning 3-6548 RTV silicone foam, liquid component Part 4 (black) and liquid component Part B (off-white).
   2 Sealant: Dow Corning 96-081 RTV silicone adhesive sealant.
   3 Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by applicator.

B. Preparation: Remove combustible materials and loose impediments from penetration opening and involved surfaces. Remove free liquid and oil from penetration surfaces.

C. Installation: In accordance with manufacturer's instructions, install damming materials and sealant to cover and seal penetration openings; inject foam mixtures into openings.

D. In addition to the Dow Corning products, equal products by Spec Seal Firestop Products, 3M Fire Barrier or CS240 Firestop are acceptable.

1.27 PROTECTION OF APPARATUS

A. At all times take every precaution to properly protect apparatus from damage due to dust, dirt, water, etc. or from damage due to physical forces. Include the erection of temporary shelters as required, to adequately protect any apparatus stored at the site, the cribbing of any apparatus directly above the construction, and the covering of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the Owner's Representative will be sufficient cause for the rejection of the pieces of apparatus in question.

B. Responsibility for the protection of apparatus extend also to existing apparatus involved in this Section of the work, whether such apparatus is designated to be used temporarily and later removed, or is to be reused as a part of the permanent installation. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.

C. The Contractor shall protect this work and the work of all other Contractors from damage by his work or workmen and shall make good any damage thus caused. He shall also be responsible for the proper protection of his equipment, machinery, materials and accessories delivered and installed on the job.

1.28 INSTALLATION OF CONTROL AND OPERATING DEVICES

A. The highest operable part of controls (light switches, dimmer switches, emergency power off devices, etc.), receptacles (electrical and communications) and other operable devices shall be 48" above finish floor. The lowest operable part shall be no less than 15" above finished floor. For purposes of uniformity, unless noted otherwise, the top of a device shall be maximum 48" AFF and the bottom of a device shall be minimum 15" AFF. Refer to the electrical symbols list on the Drawings for specific requirements.

B. Visual alarm appliances shall be placed 80" above finished floor (the highest floor level within a space) or 6" below the ceiling, whichever is lower.

1.29 INSTALLATION AND CONNECTION OF OTHER SECTION'S EQUIPMENT

A. Verify the electrical requirements of all equipment furnished under other Sections, separate contracts, or by the Owner. Install conduit, power wiring, control wiring, devices, etc. as required for complete operation of all equipment.

1.30 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES

A. The location of power, data and telephone outlets, wall switches and other related devices may be relocated at the Owner's option, at no additional cost to the Owner, to a point within10 feet of their present location provided the Contractor is notified prior to installation.

1.31 COOPERATION AND CLEAN-UP

A. It shall be the responsibility of the Contractor to cooperate fully to keep the job site in a clean and safe

condition. Upon the Contractor shall immediately remove all of his tools, equipment, surplus materials and debris.

B. After he installation is complete and before the equipment is energized, clean the interior and exterior of all equipment thouroughly. Clean equipment, removing all debris, rubbish and foreign materials. Each component shall be cleaned and all dust and other foreign material. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with lemon-oil rag after all other cleaning is complete. Any portion of the work requiring touch-up finishing shall be so finished to equal the specified finish on the product.

1.32 RECORD DRAWINGS AND DOCUMENTATION FOR OWNER

A. The Contractor shall obtain at his own expense a complete set of blueline prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The Contractor shall record up to date information at least once a week and retain the set of prints on site for periodic review by the Architect/Engineer. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. If the Contractor prepared large scale installation drawings of electrical rooms, conduit routing, busduct, routing, etc., these drawings or reproducible sepias therefrom shall be revised as required to accurately illustrate the actual installation. All conduit buried in concrete slabs, walls and below grade shall be located by dimension; both horizontally and by vertical elevation, unless a surface mounted device in each space indicates the exact location.

B. Upon anticipated completion of the job, obtain one complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer all project related notations and deliver these record drawings to the Architect/Engineer at job completion before final payment and delivery to the Owner. This information shall be delivered prior to final acceptance.

C. The Contractor shall accumulate in duplicate during the job progress, the following data prepared in indexed 3-ring looseleaf, hard-back binders sized for 8-1/2 inch by 11 inch sheets. No binder shall exceed 3-1/2 inches thick. This data shall be turned over to the Owner's Representative for review and subsequent delivery to the Owner prior to final acceptance.

1 Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.
2 Approved lighting fixture brochures, wiring diagrams and control diagrams.
3 Copies of approved submittals and shop drawings.
4 Operating instructions and recommended maintenance procedures for major apparatus.
5 Copies of all other data and/or drawings required during construction.
6 Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
7 Tag charts and diagrams hereinbefore specified.

1.33 FINAL OBSERVATION

A. The purpose of the final observation is to determine whether the Contractor has completed the construction in accordance with the Contract Documents and that in the Owner Representative's opinion the installation is satisfactory for final acceptance by the Owner.

B. It shall be the responsibility of the Contractor to assure that the installation is ready for final acceptance prior to calling upon the Owner's Representative to make a final observation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Raceways.
   2. Building wire and connectors.
   3. Supporting devices for electrical components.
   4. Electrical identification.
   5. Electricity-metering components.
   6. Concrete equipment bases.
   7. Electrical demolition.
   8. Cutting and patching for electrical construction.
   9. Touchup painting.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.
B. FMC: Flexible metal conduit.
C. IMC: Intermediate metal conduit.
D. LFMC: Liquidtight flexible metal conduit.
E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For electricity-metering equipment.
B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
   1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
C. Coordinate electrical service connections to components furnished by utility companies.
   1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
   2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Architectural documents.
E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

D. Slotted-Steel Channel Supports: Comply with Division Section "Metal Fabrications" for slotted channel framing.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
3. Color: Black letters on orange background.
4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

B. Meter Sockets: Comply with requirements of electrical power utility company.

C. Modular Meter Centers: Factory-coordinated assembly of a main meter center circuit-breaker unit with wireways, tenant meter socket modules, and tenant branch circuit breakers arranged in adjacent vertical sections, complete with interconnecting buses.

1. Housing: NEMA 250, Type 3R enclosure.

D. Concrete Forms and Reinforcement Materials: As specified in Division Section "Cast-in-Place Concrete."

E. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division Section "Cast-in-Place Concrete."

2.4 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Use temporary raceway caps to prevent foreign matter from entering.

D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Install conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

H. Install telephone and signal system raceways, 2-inch trade size (DN53) and smaller, in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch (1830-mm) flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.
   a. Field Welding: Comply with AWS D1.1.
7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8-m) maximum intervals in congested areas.
3. Colors: As follows:

a. Fire Alarm System: Red.
b. Security System: Blue and yellow.
c. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.
4. Neutral: White.
5. Ground: Green.

H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
1. Phase A: Brown.
2. Phase B: Orange.
3. Phase C: Yellow.
4. Neutral: White with a colored stripe or gray.
5. Ground: Green.

I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch-(9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.7 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division Section "Firestopping."

3.8 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.10 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.

4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.11 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division Section "Painting."
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTOR AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wires and Cables:
      a. American Insulated Wire Corp.; Leviton Manufacturing Co.
      b. BICC Brand-Rex Company.
      c. Carol Cable Co., Inc.
      d. Senator Wire & Cable Company.
      e. Southwire Company.
   2. Connectors for Wires and Cables:
      a. AMP Incorporated.
      b. General Signal; O-Z/Gedney Unit.
      c. Monogram Co.; AFC.
      d. Square D Co.; Anderson.
      e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

B. Rubber Insulation Material: Comply with NEMA WC 3.

C. Thermoplastic Insulation Material: Comply with NEMA WC 5.

D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.

E. Conductor Material: Copper.

F. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.
G. Plenum rated cable for all cables above the ceiling.

2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type RHW or THWN, in raceway.
B. Feeders: Type 75C insulation THHN/THWN, in raceway.
C. Fire-Pump Feeder: Type MI, 3-conductor.
D. Branch Circuits: Type THHN/THWN, in raceway.
E. Fire Alarm Circuits: Type THHN/THWN, in raceway.
F. Class 1 Control Circuits: Type THHN/THWN, in raceway.
G. Class 2 Control Circuits: Type THHN/THWN, in raceway.
H. Equipment or any device rated 100 amperes or less, conductor shall be rated 60C as per National Electrical Code.
I. Equipment or any device rated over 100 amperes, conductor shall be rated 75C as per National Electrical Code.

3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
B. Remove existing wires from raceway before pulling in new wires and cables.
C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
F. Support cables according to Section "Basic Electrical Materials and Methods."
G. Seal around cables penetrating fire-rated elements according to Section "Firestopping."
H. Identify wires and cables according to Section "Basic Electrical Materials and Methods."
I. Identify wires and cables according to Section "Electrical Identification."

3.4 CONNECTIONS

A. Conductor Splices: Keep to minimum.
B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
C. Use splice and tap connectors compatible with conductor material.
D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.
E. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening

values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
   1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding and bonding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
2. Section "Underground Ducts and Utility Structures" for ground test wells.

1.3 SUBMITTALS

A. Revise this Article to suit Project and office practice. Frequently, no product submittal is required for this Section.

B. Product Data: For each type of product indicated.

C. Retain paragraph above if Product Data are required for each product specified. Retain paragraph below if Product Data are required only for selected products.

D. Product Data: For the following:

1. Ground rods.
2. Chemical rods.
3. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency. Delete if Contractor is allowed to perform ground-resistance testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.
2. Grounding Conductors, Cables, Connectors, and Rods:
   a. Apache Grounding/Erico Inc.
   b. Boggs, Inc.
   c. Chance/Hubbell.
   d. Copperweld Corp.
   e. Dossert Corp.
   f. Erico Inc.; Electrical Products Group.
   g. Framatome Connectors/Burndy Electrical.
   h. Galvan Industries, Inc.
   i. Hastings Fiber Glass Products, Inc.
   j. Ideal Industries, Inc.
   k. ILSCO.
   l. Kearney/Cooper Power Systems.
   m. Korns: C. C. Korns Co.; Division of Robroy Industries.
   n. Lightning Master Corp.
   o. Lyncole XIT Grounding.
   p. O-Z/Gedney Co.; a business of the EGS Electrical Group.
   q. Raco, Inc.; Division of Hubbell.
   r. Robbins Lightning, Inc.
   s. Salisbury: W. H. Salisbury & Co.
   t. Superior Grounding Systems, Inc.
   u. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section "Conductors and Cables."
B. If only copper conductors are permitted in Division 16 Section "Conductors and Cables," delete paragraph below.
C. Material: copper.
D. Equipment Grounding Conductors: Insulated with green-colored insulation.
E. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
F. Grounding Electrode Conductors: Stranded cable.
G. Underground Conductors: stranded, unless otherwise indicated.
H. Sizes and types below are typical. Adjust to suit Project conditions and requirements.
I. Copper Bonding Conductors: As follows:
   1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
   2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
   3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
   4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
J. Delete paragraph and subparagraphs below if use of aluminum conductors is not permitted.
K. Ground Conductor and Conductor Protector for Wood Poles: As follows:
   1. No. 4 AWG minimum, soft-drawn copper conductor.
   2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Copper-clad steel is most common. See Evaluations for discussion on where other materials might be more appropriate.

B. Ground Rods: Copper-clad steel.

1. Select paragraph above or paragraph and subparagraph below. Sectional types are used when rods longer than 10 feet (3 m) are installed.
2. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

D. Test Wells: Provide handholes as specified in Section "Underground Ducts and Utility Structures."

PART 3 - EXECUTION

3.1 APPLICATION

A. Delete paragraph below if only copper conductors are specified in Division 16 Section "Conductors and Cables."

B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

C. In raceways, use insulated equipment grounding conductors.

D. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

E. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

F. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

G. Delete paragraph and subparagraphs below if grounding bus is not required, or edit to suit Project.

H. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

I. Edit below to suit Project.

J. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. NEC permits two basic types of equipment grounding conductors: metallic raceway or cable sheath as the conductor, or a separate equipment grounding conductor. The installation of an equipment grounding conductor provides an additional degree of safe operation when compared to relying on raceway as the conductor. Revise paragraphs and subparagraphs in this Article to suit Project.

B. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

C. Install equipment grounding conductors in all feeders and circuits.

D. Select paragraph above or paragraph and subparagraphs below.

E. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.

F. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

G. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

H. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

I. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

J. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

K. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

L. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

M. Coordinate paragraph and subparagraphs below with Drawings and Specification Sections for systems referenced. Edit to suit Project.

N. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
   2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

O. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.3 INSTALLATION

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
   1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
   2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 CONNECTIONS

A. Coordinate paragraph and subparagraphs below with Drawings.
B. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
C. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

F. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
G. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
H. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
I. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Retain one of three paragraphs below.
B. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
a. NFPA 70 has minimum value of 25 ohms. See Evaluations for discussion on appropriate grounding resistance values. Values listed below are typical; adjust to suit Project conditions.
b. Equipment Rated 500 kVA and Less: 10 ohms.
c. Equipment Rated 500 to 1000 kVA: 5 ohms.
d. Equipment Rated More Than 1000 kVA: 3 ohms.
e. Substations and Pad-Mounted Switching Equipment: 5 ohms.
f. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.6 GRADING AND PLANTING

A. Delete below if inappropriate or if surface restoration work is covered on Drawings or in Division 2 Sections. Coordinate with Drawings.
B. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

B. Comply with this sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of supporting devices, including related systems and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unistrut Corp.

B. B-Line Systems, Inc.

C. Midland Ross-Kindorf

2.2 MATERIALS

A. Suspension Hangers

1. Suspension hangers for individual conduit runs shall be zinc plated formed steel type.

B. Vertical Supports

1. Malleable iron one hole pipe straps shall be used for vertical runs

C. Clamps

1. Beam clamps shall be used for bar joists and beams.

D. Anti-Vibration Hangers

1. Anti-vibration hangers shall be combination type having a double deflection neoprene element in series with a steel coil spring; double deflection of 0.30"; steel coil spring shall be selected from a 1" static deflection series with a minimum additional travel to solid of ½"; spring diameters shall be large enough to permit 15 degree angular misalignment of the rod connecting the hanger to the ceiling support without rubbing the hanger box.

2.3 LIGHT FIXTURE HANGERS

A. Refer to Section 26 51 00

B. Corrosive Areas: PVC; at factory apply a minimum of 10-mil-thick PVC coating, bonded to metal, inside and outside.Z

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hangers

1. Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of raceway and contents and shall be arranged to prevent vibration transmission to the building and allow for raceway movement.
2. Hangers shall be supported by means of uncoated solid steel rods which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments

permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

B. NOMINAL CONDUIT SIZE ROD DIAMETER

1/2" through 2 1/4"

2-1/2" through 3 3/8" 4" and 5 1/2"

1. Hanger spacing shall be as required for proper and adequate support raceway, but in no case shall be less than one hanger per 8'-0" of raceway length except that conduit less than 1" diameter shall be supported at least every 6'-0".
2. Where numerous conduits are run parallel to one another, they may be supported from a trapeze type hanger arrangement with strut bottom.
3. Anti-vibration type hangers shall be provided for equipment as required to minimize vibration and/or as directed by the Architect/Engineer.

Supports

4. Support of hangers shall be by means of sufficient quantities of individual after set steel expansion shields, or beam clamps attached to structural steel.
5. Stiff-legs shall be furnished and installed in cases where support from overhead structure is not possible.
6. Ceiling mounted lighting fixtures shall be supported from the building structure at two opposite corners. The Contractor shall provide fixture hangers to properly interface with the ceiling system.
7. Furnish and install complete any additional structural support steel, brackets, fasteners, etc., as required to adequately support all raceway and equipment.
8. Support of hangers from concrete slabs shall be by means of sufficient quantity of "U" brackets attached with after set expansion shields and bolts.
9. Support of hangers from concrete tees shall be by means of sufficient quantity of angle iron brackets attached with after set expansion shields and bolts.

END OF SECTION

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
   1. Edit lists below to suit Project.
   2. Raceways include the following:
      a. RMC.
      b. IMC.
      c. PVC externally coated, rigid steel conduits.
      d. PVC externally coated, IMC.
      e. EMT.
      f. FMC.
      g. LFMC.
      h. LFNC.
      i. RNC.
      j. ENT.
      k. Wireways.
      l. Surface raceways.
   3. Boxes, enclosures, and cabinets include the following:
      a. Device boxes.
      b. Floor boxes.
      c. Outlet boxes.
      d. Pull and junction boxes.
      e. Cabinets and hinged-cover enclosures.

B. Related Sections include the following:
   1. List below only products and equipment for this Project that the reader might expect to find in this Section but are specified elsewhere. Verify that Section titles listed below are correct for this Project's Specifications because Section titles may have changed since this Section was updated.
   2. Section "Basic Electrical Materials and Methods" for raceways and box supports.
   3. Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.
B. ENT: Electrical nonmetallic tubing.
C. FMC: Flexible metal conduit.
D. IMC: Intermediate metal conduit.
E. LFMC: Liquidtight flexible metal conduit.
F. LFNC: Liquidtight flexible nonmetallic conduit.
G. RMC: Rigid metal conduit.
H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Delete below except for custom enclosures.

C. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metal Conduit and Tubing:
      a. Alflex Corp.
      b. Anamet, Inc.; Anaconda Metal Hose.
      c. Anixter Brothers, Inc.
      d. Carol Cable Co., Inc.
      e. Cole-Flex Corp.
      f. Electri-Flex Co.
      g. Flexcon, Inc.; Coleman Cable Systems, Inc.
      h. Grinnell Co.; Allied Tube and Conduit Div.
      i. Monogram Co.; AFC.
      j. Spiraduct, Inc.
      k. Triangle PWC, Inc.
      l. Wheatland Tube Co.
   2. Nonmetallic Conduit and Tubing:
      a. Anamet, Inc.; Anaconda Metal Hose.
      b. Arnco Corp.
      c. Breeze-Illinois, Inc.
      d. Cantex Industries; Harsco Corp.
      e. Certainteed Corp.; Pipe & Plastics Group.
      f. Cole-Flex Corp.
      g. Condux International; Electrical Products.
      h. Electri-Flex Co.
      i. George-Ingraham Corp.
      j. Hubbell, Inc.; Raco, Inc.
      k. Lamson & Sessions; Carlon Electrical Products.
      l. R&G Sloan Manufacturing Co., Inc.
      m. Spiraduct, Inc.
      n. Thomas & Betts Corp.
   3. Conduit Bodies and Fittings:
      a. American Electric; Construction Materials Group.
      b. Crouse-Hinds; Div. of Cooper Industries.
      c. Emerson Electric Co.; Appleton Electric Co.
      d. Hubbell, Inc.; Killark Electric Manufacturing Co.
      e. Lamson & Sessions; Carlon Electrical Products.
      f. O-Z/Gedney; Unit of General Signal.

g. Scott Fetzer Co.; Adalet-PLM.
h. Spring City Electrical Manufacturing Co.

4. Metal Wireways:
a. Hoffman Engineering Co.
b. Keystone/Rees, Inc.
c. Square D Co.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.
B. Rigid Aluminum Conduit: ANSI C80.5.
C. IMC: ANSI C80.6.
D. EMT and Fittings: ANSI C80.3.
1. Fittings: Set-screw type.
E. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
C. LFNC: UL 1660.

2.4 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.
B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
D. Select 1 of 4 paragraphs below.
E. Wireway Covers: Screw – cover type flanged-and-gasketed type.
F. Finish: Manufacturer's standard enamel finish.

2.5 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.
B. Edit paragraph below. Aluminum is also available and suitable for use with steel raceways.
C. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.6 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.
B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.7 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Use a comprehensive wiring method schedule on Drawings or use this Article to specify where various raceway types are to be installed. Edit examples below, adding or deleting materials and methods to suit Project. Coordinate with Division 16 Section "Wires and Cables." Do not duplicate information on Drawings, in NFPA 70, or in other Division 16 Sections. List exceptions to stated requirements. Check code to avoid specifying uses not permitted.

B. Outdoors: Use the following wiring methods:
   1. Exposed: Rigid steel.
   2. Concealed: Rigid steel.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R .

C. Indoors: Use the following wiring methods:
   1. Exposed: EMT.
   2. Concealed: EMT.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
   6. Damp or Wet Locations: Rigid steel conduit.
   7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      a. Select 1 of 2 subparagraphs below and add other specific box and enclosure requirements to suit Project.
      b. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Select paragraph above or below.

C. Minimum Raceway Size: 3/4-inch trade size (DN21).

D. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Install raceways level and square and at proper elevations. Provide adequate headroom.

G. Complete raceway installation before starting conductor installation.

H. Support raceways as specified in Section "Basic Electrical Materials and Methods."

I. Use temporary closures to prevent foreign matter from entering raceways.

J. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

K. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

L. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

M. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

N. Raceways Embedded in Slabs (Must be indicated on drawings to be embedded. Please notify Engineer if required but not shown): Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

O. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

P. Join raceways with fittings designed and approved for the purpose and make joints tight.
1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

Q. Tighten set screws of threadless fittings with suitable tools.

R. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

T. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

U. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

V. Delete paragraph below if not applicable.

W. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

Y. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

Z. Delete paragraph below if no high-frequency installation.

AA. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in a nonmetallic sleeve.

BB. Do not install aluminum conduits embedded in or in contact with concrete.

CC. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

DD. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.
1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

EE. Set floor boxes level and adjust to finished floor surface.

FF. Select paragraph above for metal floor boxes and below for nonmetallic floor boxes.

GG. Set floor boxes level and trim after installation to fit flush to finished floor surface.

HH. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

II. NO PVC CONDUIT ALLOWED ABOVE THE CEILING OR IN THE A/C RETURN PLENUM. PROVIDE RIGID CONDUIT. Verify all MEP documents.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION **26 05 53** - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

B. Comply with ELECTRICAL Sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

C. A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of electrical identification, including related accessories.

D. B.Provide electrical identification for the following:

1. **Panelboards, motor starters, contactors, disconnect switches, circuit breakers and other electrical equipment with nameplate identifying the item of equipment and the equipment serving the same.**
2. **Raceways, junction boxes and pull boxes.**
3. **Label each panelboard index indicating the room #s to the related circuit. Also add the index sheet in a laminated white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.**
4. **Wiring devices.**
5. **Wiring.**
6. **Three phase motor rotation.**

1.3 SUBMITTALS

E. A.Submit product data in accordance with Section for products specified under PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brady
B. Panduit
C. Thomas & Betts
D. Seton

2.2 IDENTIFICATION

E. A. Nameplates

1. **Nameplates shall be black engraved surface on white core for normal power circuits and red engraved surface on white core for emergency power circuits.**
2. **Provide for each distribution panelboard, branch circuit panelboard, transformer and any other similar equipment furnished under this section identification as to its given name, voltage and origination of service. Examples are as follows:**

‘LR1’ ‘LR2’
120/240V 120/240V
FED FROM ‘MDP’ FED FROM ‘MDP’

3. **Provide for each motor starter enclosure, circuit breaker enclosure, disconnect switch and any other similar equipment furnished under this section, identification as to the specific load that it serves and the origination of service. Examples are as follows:**

‘AHU-1' ‘CU-1'
FED FROM ‘MDP' FED FROM ‘MDP’

4. **Provide for each feeder protective device in each distribution panelboard and any other similar equipment furnished under this section, identification as to the specific load that it serves.**
5. **Nameplates shall be laminated, white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.**

F. B. Junction Boxes and Pull Boxes

1. **1. Identification shall be with a black permanent marking pen on the top of 4" x 4" junction box covers or on the back of an outlet box cover plate identifying the branch circuits and systems within the conduit. Pull boxes shall be provided with a nameplate stating voltage and system served.**

G. C. Wiring Device Wall Plates

1. **1. On the back side of wiring device wall plates identify with a black permanent marking pen the panelboard and branch circuit number the device is served from.**

H. D. Wire Markers

1. **1. Wire markers for identification of wiring shall be self-adhesive type having letters and numerals indicating serving equipment and feeder or branch circuit number.**

I. Rotation Tags

1. **Rotation tags shall be brass or aluminum securely attached to equipment.**

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces to receive labels or nameplates shall be carefully prepared in accordance with the manufacturer's instructions and recommendations.

3.2 NAMEPLATES

J. A.Nameplates shall be properly attached to identify panelboards, feeder circuit breakers, disconnect switches, pull boxes and other similar equipment furnished under this section.

3.3 WIRE MARKERS

K. A.Wire markers shall be applied to each conductor or cable within panelboards, motor starter enclosures, circuit breaker enclosures, disconnect switches, cabinets, junction boxes, pull boxes, and other similar equipment identifying the serving equipment and feeder or branch circuit from which the conductors originate.

END OF SECTION

SECTION 260573.13 SHORT CIRCUIT STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, short-circuit study to determine the minimum required short-circuit ratings for all electrical equipment.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional or qualified engineer in charge of performing the study and documenting recommendations.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.3 ACTION SUBMITTALS

A. Product Data:

1. Submit information on computer software program to be used for studies.
2. Submit the following after the approval of system submittals. Submittals shall be in digital form.

a. Short-circuit study input data, including completed computer program input data sheets.

b. Short-circuit study and equipment duty evaluation report; signed and dated by a professional or qualified engineer.

1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If completion of studies will cause delay in equipment manufacturing, obtain approval from Owner for preliminary submittal of sufficient accuracy to ensure that selection of devices and associated characteristics is satisfactory. All assumptions made in a preliminary submittal shall be clearly identified.

2) Revised one-line diagram, reflecting any discrepancies noted or updates required based on data collected for the study.

3) Study report shall include documentation of all equipment data used in the short-circuit and equipment duty analysis.

4) Study shall include a detailed listing of any electrical equipment found to be underrated for the calculated fault duty.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:
1. For Power Systems Analysis Software.
2. For Power System Analysis Specialist.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Final Short-Circuit Study Report:
   a. Final one-line diagram.
   b. Final Equipment Duty Report.
   c. Short-circuit study data files.
   d. Power system data.
   e. Software data file in electronic format compatible with the software version used in the study.
   f. Software library data used for the study.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed electrical power system analysis software.

B. Software algorithms and methodology shall comply with requirements of applicable standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform ANSI and IEC based short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.

D. Power Systems Analysis Specialist Qualifications: Professional Engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this Professional Engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide EasyPower, LLC software with ANSI ShortCircuit, IEC ShortCircuit, Scenario Manager, SmartDuty and SmartBreaker or comparable product by one of the following:

1. CGI CYME.
2. Power Analytics, Corporation.

B. Comply with IEEE 399 and IEEE 551.

1. Analytical features of power systems analysis software program shall have capability as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Detailed list of all electrical equipment found to be underrated for the available short-circuit current.

C. Recommendations for resolving any issues found with underrated equipment.

D. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

E. One-line diagram of modeled power system, indicating the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer size and impedance.
4. Motor and generator designations and ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.

6. Any revisions to electrical equipment required by the study.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment short-circuit ratings exceed available short-circuit current based on the applicable standards.
2. Tabulations of circuit breaker, fuse, and other protective device short-circuit ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

G. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Utility or incoming power short-circuit data.
3. Manufacturer, model, and short-circuit rating of protective devices.
4. Conductors.
5. Transformer data.

H. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and single line to ground fault calculations, indicating the following for each overcurrent device location:
   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Multiplying factor.
2. High-Voltage Momentary Short-Circuit Report: Three-phase and single line to ground fault calculations, indicating the following for each equipment location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:
      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 2.6.
3. High-Voltage Interrupting Short-Circuit Report: Three-phase and single line to ground fault calculations, indicating the following for each equipment location:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
4. Equipment Duty Report: For each protective device, indicate short-circuit ratings and calculated equipment duty for both ½ cycle and interrupting ratings as applicable. Calculated duty must automatically take into account any necessary derating factor due to the system X/R ratio and based on the actual maximum fault current through each device rather than the total bus fault current. All calculations to be based on the specific applicable test standards for each device such that no further interpretation of the results is necessary.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Owner's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or their representative. Data must include, but not be limited to, the following:

1. Product Data for Project's overcurrent protective devices. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at each service from the serving utility.
3. For transformers, include kVA ratings, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
4. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
5. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
6. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
7. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
8. Motor horsepower and NEMA MG 1 code letter designation.
9. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents in accordance with IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin the scope of the short-circuit current and equipment duty analysis at the service, extending down to system overcurrent protective devices as follows:

1. Down to and including all three-phase panelboards at voltages 208 V ac or higher.

F. For systems with multiple sources or multiple operating conditions, evaluate short-circuit and equipment duty for multiple scenarios as necessary to determine the maximum short-circuit current at each location.

G. Analysis software must factor in ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply this to the short-circuit and equipment duty calculations as recommended by applicable standards. Also account for the fault-current dc decrement to address asymmetrical current ratings of applicable electrical equipment and components.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

I. Equipment duty report must clearly indicate any protective device that is being applied outside its short-circuit rating.

J. For any equipment found to be underrated, the report shall include recommendations for resolving this deficiency.

END OF SECTION

SECTION 26 05 73.19 ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard boundary distance and the incident energy to which personnel could be exposed during work on or near energized electrical equipment.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.3 ACTION SUBMITTALS

A. Product Data: Submit information regarding computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:

1. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.

2. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

3. Exported data from computer-based, one-line diagram detailing the system data used for the arc-flash calculations, provided in .csv or Microsoft Excel format.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.

2. For Power System Analysis Specialist.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.5 CLOSEOUT SUBMITTALS

A. Arc-Flash Hazard Analysis:

1. Provide final arc-flash hazard analysis report in hard copy and digital format.

2. Provide digital file containing electrical system model in a format consistent with power system analysis software used to perform study.
3. Provide library files for power system analysis software used to perform study.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis.

E. Power Systems Analysis Specialist Qualifications: Professional or qualified engineer in charge of performing the arc-flash study, analyzing the arc-flash results, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional or qualified engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide software developed and sold by EasyPower software with ANSI ShortCircuit, ArcFlash, PowerProtector, Scenario Manager, SmartDuty and SmartBreaker or comparable product by one of the following:

1. CGI CYME.
2. Power Analytics, Corporation.

B. Software must provide results consistent with the requirements of the latest versions of IEEE 1584 and NFPA 70E.

C. Software capable of creation and storage of unlimited number of operating scenarios. All scenarios stored in the same project model file. System changes made to the base case automatically propagated to each operating scenario.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, indicating the following:

1. Protective device designations, locations, and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.
6. Utility sources.

D. Study Input Data: As described in "Power System Data" Article.

E. Equipment Duty Report: As specified in Section 260573.13 "Short-Circuit Studies."

F. Data on all protective devices; manufacturers, types, sizes and adjustable settings that were used for the arc-flash calculations.

G. List of protective devices found to be inoperable or with signs of impending failure. These devices must be clearly listed and excluded from use in determination of the arc time.

H. Equipment Duty Study: Report to verify that all protective devices have adequate short-circuit ratings to interrupt the calculated maximum short-circuit current.

I. Arc-Flash Study Calculations and Output Reports:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.

J. Arc-Flash Study input data, scenario descriptions, and arc-flash calculations including a definition of terms and guide for interpretation of the arc-flash hazard report. Study input data must be provided in electronic form as .csv or Excel files.

2.3 ARC-FLASH WARNING LABELS

A. Provide a weatherproof, self-adhesive equipment label for each location requiring arc-flash hazard identification.

1. Minimum Size: 6 inches wide by 4 inches high.
2. Sample label submitted for review prior to printing of actual labels.

B. Content: Orange header with the wording, "WARNING, ARC-FLASH HAZARD, Arc-Flash and Shock Risk Assessment, Appropriate PPE Required." and the following information taken directly from the arc-flash hazard analysis:

1. Equipment ID.
2. Nominal voltage.
3. Protection boundaries.
    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.
4. Available incident energy.
5. Working distance.
6. Engineering report number, revision number, and issue date.

C. Completely machine printed, no field-applied markings.

D. Compliance: NFPA 70E.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project electrical equipment submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study. The report shall clearly state any assumptions that were necessary to complete the analysis.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with the latest versions of NFPA 70E for the arc-flash hazard analysis study.

B. Study all operating scenarios to determine the maximum incident energy at each location.

C. Submit proposed arc-flash analysis scenarios for review prior to performing arc-flash calculations. Arc-flash hazard analysis report shall indicate which scenario created the maximum arc-flash energy for each location. All arc-flash calculations must be performed in accordance with the procedures and recommendations contained in the latest version of IEEE 1584. Calculate the arc-flash hazard boundary and incident energy at all locations in electrical distribution system where personnel could service or examine equipment while energized.

D. Include all three-phase medium- and low-voltage equipment locations.

E. Calculate the limited and restricted approach boundaries for each location.

F. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources or fault current that changes with time during the fault. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented based on the recommendations in IEEE 399 and ANSI C37 where applicable.

G. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

H. Base arc-flash calculations on the time-current curve or operating time of the fastest upstream device using the predicted arcing current through that device. For medium-voltage circuit breakers, the breaker interrupting time must be automatically added to the relay operating time. Based on the recommendations in IEEE 1584 and sound engineering judgment, a maximum arc time of two seconds can be applied for situations where the protective device operating time is found to exceed two seconds.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings. Call any discrepancies or missing information to Owner's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer. Data shall include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance or available short-circuit current at each service.
3. Short-circuit current at each system bus (three phase and line to ground).
4. Voltage level at each bus.

5. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio if available, tap settings, and phase shift.
6. For reactors, provide manufacturer and model designation, voltage rating and impedance.
7. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, short-circuit rating, continuous current rating, and settings for all adjustable settings.
8. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
9. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
10. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
11. Motor horsepower.
12. Low-voltage conductor sizes, lengths, number, conductor material, and conduit material.
13. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material.

3.4 LABELING

A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Low voltage transformers.
6. Panelboard.
7. Safety switch.
8. Fused disconnect switch.
9. Enclosed circuit breaker.
10. Adjustable frequency drive.
11. Control panel.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the interpretation of arc-flash warning labels.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROLS SYSTEM

PART 1 - GENERAL

1.1 Summary

.1 Section includes a lighting control system comprised of the following components:

.1 System Software Interfaces

.1 Management Interface

.2 Visualization Interface

.3 Smartphone Programming Interface for Wired Devices

.4 Smartphone Programming Interface for Wireless Devices

.2 System Backbone and Integration Equipment

.1 System Controller

.3 Wired Networked Devices

.1 Wall Stations

.2 Graphic Wall Stations

.3 Digital Key Switches

.4 Auxiliary Input/Output Devices

.5 Occupancy and Photocell Sensors

.6 Wall Switch Sensors

.7 Embedded Sensors

.8 Power Packs and Secondary Packs

.9 Networked Luminaires

.10 Relay and Dimming Panel

.11 Bluetooth® Low Energy Programming Device

.12 Communication Bridge

.4

.2 The lighting control system shall meet all the characteristics and performance requirements specified herein.

.3 The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 Related Documents

.1 Section 26 27 26 Wiring Devices

.2 Section 26 09 23 Lighting Control Devices

.3 Section 26 51 13 Interior Lighting Fixtures

1.3 Submittals

.1 Submittal shall be provided including the following items.

.1 Bill of Materials necessary to install the networked lighting control system.

.2 Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.

.3 Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

.4 Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.

.5 Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).

.6 Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).

.7 Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

.8 Hardware and Software Operation Manuals.

1.4 Approvals

.1 Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

.2 Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.

.3 Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.

.4 For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.5 Quality Assurance

.1 Product Qualifications

.1 System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.

.2 System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.

.3 System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.

.4 All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.

.5 All components and the manufacturing facility where product is manufactured must be RoHS compliant.

.2 Installation and Startup Qualifications

.1 System startup shall be performed by qualified personnel approved or certified by the manufacturer.

.3 Service and Support Requirements

.1 Phone Support: Toll free technical support shall be available.

.2 Remote Support: The bidder shall offer a remote support capability.

.3 Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.

.4 Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.6 Project Conditions

.1 Only install indoor equipment after the following site conditions are maintained:

.1 Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)

.2 Relative Humidity: less than 90% non-condensing

.2 Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.

.3 Only properly rated equipment and enclosures, installed per the manufacturer’s instructions, may be subjected to dust and moisture following installation.

1.7 Warranty

.1 The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.

.2 The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.8 Maintenance & Sustainability

.1 The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 - EQUIPMENT

2.1 Manufacturers

.1 Acceptable Manufacturers shall match and be compatible with existing system by Acuity

.1 Acuity Brands Lighting, Inc.

.2 Basis of Design System: **Acuity Controls nLight**

2.2 System Compliance

.1 System components shall comply with UL 916 and UL 924 standards where applicable.

.2 System components shall comply with CFR Title 47, Part 15 standards where applicable.

.3 System components shall comply with ISED Canada RSS-247 standards where applicable.

.4 All equipment shall be installed and connected in compliance with NFPA 70.

2.3 System Performance Requirements

.1 System Architecture

.1 System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.

.2 Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

.3 System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see *Control Zone Characteristics* sections for each type of network connection, wired or wireless).

.4 Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

.5 Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”

.1 Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.

.6 Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.

.7 Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.

.8 The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.

.9 All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

.2 Wired Networked Control Zone Characteristics

.1 Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.

.2 Devices in an area shall be connected via a “daisy-chain” topology; requiring all individual networked devices to be connected back to a central component in a “hub-and-spoke” topology shall not be permitted, so as to reduce the total amount of network cable required for each control zone.

.3 System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.

.4 Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

.5 Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.

.6 All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

.7 Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:

.1 Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.

.2 UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.

.8 Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.

.9 Wired networked Wall stations shall provide the follow Scene Control Capabilities:

.1 Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.

.2 Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

.3 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” preset scene and profile scene control.

.3 Wireless Networked Control Zone Characteristics

.1 No wired connections between networked devices shall be required for the purposes of system communications.

.2 Multiple wireless networking protocols shall be supported:

.1 A standards based, distributed star topology type of protocol for 900 MHz communication, so as to support lighting control applications and IoT applications.

.2 A Bluetooth standard protocol for 2.4 GHz communication that supports direct connection to a smartphone and tablet device, so as to support device configuration, control applications, and IoT without requiring the use of a system backbone.

.3 Wireless network shall be self-healing, such that the loss of backbone or local communication between devices does not result in the loss of control of the lights in the space.

.4 Wireless network communication shall support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wall station signal.

.5 To support the system architecture requirement for distributed intelligence, wireless network communication shall support communication of control signals from sensors and wall stations to networked luminaires and wireless load control devices, without requiring any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge or gateway.

.6 All wireless communication between lighting control components shall support the following five tiers of security measures.

.1 Data Encryption

.2 Firmware Protection

.3 Tamper-Proof Hardware

.4 Authenticated User Access

.5 Mutual Device Authentication

.7 Accounting for typical environmental conditions and building construction materials encountered within commercial indoor lighting environments, wireless networked devices shall be capable of communicating to at least 150’ spacing between devices with embedded wireless transceivers under typical site conditions.

.8 Wireless networked devices shall have a line-of-sight communication range of at least 1000’ under ideal environmental conditions.

.4 System Integration Capabilities

.1 The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:

.1 The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.

.2 The system shall support reading of individual device status information. The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.

.3 The system shall support activation of pre-defined system Global Profiles (see *Supported Sequence of Operations for further definition of Global Profile capabilities)*.

.2 The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See *Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)*

.3 The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.

.5 Supported Sequence of Operations

.1 Control Zones

.1 Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.

.2 Wall station Capabilities

.1 Wall stations shall be provided to support the following capabilities:

.1 On/Off of a local control zone.

.2 Continuous dimming control of light level of a local control zone.

.2 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support “multi-way” switching and/or dimming control.

.3 Occupancy Sensing Capabilities

.1 Occupancy sensors shall be configurable to control a local zone.

.2 Multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.

.3 System shall support the following types of occupancy sensing sequence of operations:

.1 On/Off Occupancy Sensing

.2 Partial-On Occupancy Sensing

.3 Partial-Off Occupancy Sensing

.4 Vacancy Sensing (Manual-On / Automatic-Off)

.4 On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:

.1 Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.

.2 Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.

.3 To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.

.4 Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities.*

.5 The use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

.5 Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:

.1 The use of a wall station is required turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.

.2 Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.

.3 To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.

.4 To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of vacancy, the system shall support an “automatic grace period” immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.

.5 Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under *Photocell Sensing Capabilities.*

.6 At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

.6 To accommodate diverse types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.

.4 Photocell Sensing Capabilities (Automatic Daylight Sensing)

.1 Photocell sensing devices shall be configurable to control a local zone.

.2 The system shall support the following type of photocell-based control:

.1 Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

.5 Schedule Capabilities

.1 System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.

.2 System shall support blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule. Wall stations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.

.6 Global Profile Capabilities

.1 The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.

.2 Global profiles may be scheduled with the following capabilities:

.1 Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.

.2 Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

.3 Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.

.4 Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

.5 Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.

.3 System Global Profiles shall have the following additional capabilities:

.1 Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.

.2 Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.

.3 Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

.4 A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.

.7 System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response.

2.4 System Software Interfaces

.1 Management Interface

.1 System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.

.2 Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.

.3 Management interface shall require all users to login with a User Name and Password, and shall support creation of at least 100 unique user accounts.

.4 Management interface shall support at least three permission levels for users: read-only, read & change settings, and full administrative system access.

.5 Management interface shall be capable of restricting access for user accounts to specific devices within the system.

.6 All system devices shall be capable of being given user-defined names.

.7 The following device identification information shall be displayed in the Management interface: model number, model description, serial number or network ID, manufacturing date code, custom label(s), and parent network device.

.8 Management interface shall be able to read the live status of a networked luminaire or intelligent control device and shall be capable of displaying luminaire on/off status, dim level, power measurement, device temperature, PIR occupancy sensor status, microphonic occupancy sensor status, remaining occupancy time delay, photocell reading, and active Profiles.

.9 Management interface shall be able to read the current active settings of a networked luminaire or intelligent control device and shall be capable of displaying dimming trim levels, occupancy sensor and photocell enable/disable, occupancy sensor time delay and light level settings, occupancy sensor response (normal or vacancy), and photocell setpoints and transition time delays.

.10 Management interface shall be able to change the current active settings and default settings for an individual networked luminaire or intelligent control device.

.11 Management interface shall be capable of applying settings changes for a zone of devices or a group of selected devices using a single “save” action that does not require the user to save settings changes for each individual device.

.12 A printable network inventory report shall be available via the management interface.

.13 A printable report detailing all system profiles shall be available via the management interface.

.14 All sensitive information stored by the software shall be encrypted.

.15 All system software updates must be available for automatic download and installation via the internet.

.2 Visualization and Programming Interfaces

.1 System shall provide an optional web-based visualization interface that displays graphical floorplan.

.2 Graphical floorplan shall offer the following types of system visualization:

.1 Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined. This shall include, but not be limited to, the following:

.1 Controls embedded light fixtures

.2 Controls devices not embedded in light fixtures

.3 Daylight Sensors

.4 Occupancy Sensors

.5 Wall Switches and Dimmers

.6 Scene Controllers

.7 Networked Relays

.8 Wired Bridges

.9 System Controllers

.10 Wired Relay Panels

.11 Group outlines

.2 Group Only Option - A master graphic of the entire building, by floor, showing only control groups outlined.

.3 Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor’s master graphic.

.4 A mouse click on any control device shall display the following information (as applicable):

.1 The device catalog number.

.2 The device name and custom label.

.3 Device diagnostic information.

.4 Information about the device status or current configuration is available with an additional mouse click.

.3 Smartphone Programming Interface for Wired Devices

.1 Application interface shall be provided for both Apple iOS® and Android operating systems that allows configuration of lighting control settings.

.2 The application shall support the configuration and control of wired networked control devices via a Bluetooth® Low Energy (BLE) Programming Device.

.1 Application shall support a security pin-code to access the zone of lighting control devices.

.2 The application shall provide indication of signal strength where multiple Bluetooth Low Energy Programming Devices are available for configuration.

.3 The application shall indicate the number of wired networked control devices connected to the local daisy-chain zone.

.4 The application shall provide on/off/dimming control of all control groups.

.5 The application shall provide the ability to identify all individual luminaires and control devices.

.3 Programming capabilities through the application shall include, but not be limited to, the following:

.1 Switch/occupancy/photosensor zone configuration

.2 Manual/automatic on modes

.3 Turn-on dim level

.4 Occupancy sensor time delays

.5 Dual technology occupancy sensors sensitivity

.6 Photosensor calibration adjustment and auto-setpoint

.7 Multiple photosensor zone offset

.8 Trim level settings

.9 Preset scene creation and copy for scene capable devices.

.10 Application of custom device labels to the Bluetooth Low Energy Programming Devices and individual connected lighting control devices.

.4 Smartphone Programming Interface for Wireless Devices

.1 Application interface shall be provided for both Apple iOS® and Android operating systems that allows configuration of lighting control settings.

.2 The application shall support the configuration of wireless networked control devices

.1 Application shall limit access with a user name and password

.2 Access to the program information will be governed by a permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.

.3 The application shall provide indication of signal strength where multiple Bluetooth Low Energy Programming Devices are available for configuration.

.3 Programming capabilities through the application shall include, but not be limited to, the following:

.1 Switch/occupancy/photosensor group configuration

.2 Manual/automatic on modes

.3 Turn-on dim level

.4 Occupancy sensor time delays

.5 Dual technology occupancy sensors sensitivity

.6 Photosensor calibration adjustment and auto-setpoint

.7 Multiple photosensor zone offset

.8 Trim level settings

2.5 System Backbone and System Integration Equipment

.1 System Controller

.1 System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.

.2 System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.

.3 System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.

.4 System Controller shall perform the following functions:

.1 Time-based control of downstream wired and wireless network devices.

.2 Linking into an Ethernet network.

.3 Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.

.4 Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.

.5 System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.

.6 Device shall have option for a graphical touch screen to support configuration and diagnostics.

.7 Device shall have three RJ-45 networked lighting control ports for connection to any of the following:

.1 The graphical touch screen

.2 Wired communication bridges

.3 Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)

.8 Device shall automatically detect all networked devices connected to it.

.9 Device shall have an internal time clock used for astronomical and standard schedules.

.10 Device shall have 2 switched RJ-45 10/100 BaseT Ethernet ports for local area network (LAN) connection.

.1 Ethernet connection shall support daisy chain wiring to other lighting control system LAN devices.

.2 Ethernet connection shall support IPv4 and shall be capable of using a dedicated static or DHCP assigned IP address.

.11 Device shall have 2 x USB 2.0 Expansion ports for 802.11 Wi-Fi Adapter enabling wireless connectivity including:

.1 Hot Spot

.2 Access Point

.3 Client

.12 Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).

.1 Multiple System Controllers may be networked together via LAN connection to scale the system up to 20,000 networked devices.

.13 System Controller shall support BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.

.1 BACnet MS/TP shall support 9600 to 115200 baud rate.

.2 System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.

.14 System controller shall contain a “FIPS 140-2 Level 1 Inside” cryptographic module.

.15 System controller shall support RESTful API control of BACnet objects, user management, date and time, and file management.

.16 System controller shall be available within a NEMA 1 enclosure with Class 1 and Class 2 separation

.1 Enclosure shall support power input power of 120-277VAC, or optional 347

2.6 Wired Networked Devices

.1 Wired Networked Wall Switches, Dimmers, Scene Controllers

.1 Devices shall recess into single-gang switch box and fit a standard GFI opening.

.2 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.3 All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.4 Devices with mechanical push-buttons shall provide tactile and LED user feedback.

.5 Devices with mechanical push-buttons shall be made available with custom button labeling.

.6 Wall switches & dimmers shall support the following device options:

.1 Number of control zones: 1, 2 or 4

.2 Control Types Supported:

.1 On/Off

.2 On/Off/Dimming

.3 On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types

.3 Colors: Ivory, White, Light Almond, Gray, Black, Red

.7 Scene controllers shall support the following device options:

.1 Number of scenes: 1, 2 or 4

.2 Control Types Supported:

.1 On/Off

.2 On/Off/Dimming

.3 Preset Level Scene Type

.4 On/Off/Dimming/Preset Level for Correlated Color Temperature

.5 Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

.6 Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

.3 Colors: Ivory, White, Light Almond, Gray, Black, Red

.2 Wired Networked Graphic Wall Stations

.1 Device shall surface mount to single-gang switch box.

.2 Device shall have a 3.5", capacitive full color touch screen.

.3 Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.

.4 Device shall have a micro-USB style connector for local computer connectivity.

.5

.6 Communication shall be over standard low voltage network cabling with RJ-45 connectors.

.7 Device shall enable user supplied screen saver image to be uploaded within one of the following formats: jpg, png, gif, bmp, tif.

.8 Device shall enable configuration of all switches, dimmers, control zones, and lighting preset scenes via password protected setup screens.

.9 Graphic wall stations shall support the following device options:

.1 Number of control zones: Up to 16

.2 Number of scenes: Up to 16

.3 Profile type scene duration: User configurable from 5 minutes to 12 hours

.4 Colors: White, Black

.3 Wired Networked Digital Key Switches

.1 Devices shall recess into single-gang switch box and fit a standard GFI opening.

.2 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.3 All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.4 Devices shall have LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.

.5 Digital key switches shall support the following device options:

.1 Control Types Supported:

.1 On/Off

.2 On/Off/Dimming

.3 Preset Level Scene Type

.4 Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

.5 Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.

.2 Colors: Ivory, White, Light Almond, Stainless Steel

.4 Wired Networked Auxiliary Input / Output (I/O) Devices

.1 Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.

.2 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.3 Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:

.1 Contact closure or Pull High input

.1 Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.

.2 0-10V analog input

.1 Input shall be programmable to function as a daylight sensor.

.3 RS-232/RS-485 digital input

.1 Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.

.4 0-10V dimming control output, capable of sinking up to 20mA of current

.1 Output shall be programmable to support all standard sequence of operations supported by system.

.5 Digital control output via EldoLED LEDcode communication

.1 Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

.5 Wired Networked Occupancy and Photosensors

.1 Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.

.2 Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.

.3 For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.

.4 Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

.5 All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

.6 System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.

.7 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.8 All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.9 Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.

.10 Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).

.11 Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.

.12 Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.

.13 Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

.14 Photosensor and dimming sensor’s set-point and dead band shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.

.15 Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

.16 A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an “offset” from the primary zone.

.6 Wired Networked Wall Switch Sensors

.1 Devices shall recess into single-gang switch box and fit a standard GFI opening.

.2 Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

.3 All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

.4 Devices with mechanical push-buttons shall provide tactile user feedback.

.5 Wall switches sensors shall support the following device options:

.1 User Input Control Types Supported: On/Off or On/Off/Dimming

.2 Occupancy Sensing Technology: PIR only or Dual Tech acoustic

.3 Daylight Sensing Option: Inhibit Photosensor

.4 Colors: Ivory, White, Light Almond, Gray, Black, Red

.7 Wired Networked Embedded Sensors

.1 Network system shall have embedded sensors consisting of occupancy sensors and/or dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.

.2 Occupancy sensor detection pattern shall be suitable for 7.5’ to 20’ mounting heights.

.3 Embedded sensors shall support the following device options:

.1 Occupancy Sensing technology: PIR only or Dual Tech acoustic

.2 Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor

.8 Wired Networked Power Packs and Secondary Packs

.1 Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.

.2 Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.

.3 Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.

.4 Power Supplies shall provide system power only, but are not required to switch line voltage circuit.

.5 Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).

.6 Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.

.7 Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.

.8 Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.

.9 When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

.10 Power/Secondary Packs shall be available with the following options:

.1 Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.

.2 Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.

.3 Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.

.4 Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.

.5 Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).

.6 Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.

.7 Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.

.8 Secondary Pack capable of louver/damper motor control for skylights.

.9 Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.

.10 Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).

.11 Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

.9 Wired Networked Luminaires

.1 Networked luminaire shall have a mechanically integrated control device.

.2 Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter).

.3 Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers).

.4 Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG and CCT capable versions).

.5 System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports “sleep mode.”

.6 System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by automatically varying the dimming control signal to account for lumen depreciation.

.1 System shall indicate (via a blink warning) when the LED luminaire is no longer able to compensate for lumen depreciation.

.7 System shall be able to provide control of network luminaire intensity, in addition to correlated color temperature of specific LED luminaires.

.8 System shall be able to provide control of network luminaire intensity, in addition to dynamic features, such as grayscale and color accent of specific LED luminaires.

.10 Wired Networked Relay and Dimming Panel

.1 Relay and dimming panel shall be available with 4, 8, 12, 16, 24, 32, 40 or 48 individual relays per panel, with an equal number of individual 0-10V dimming outputs.

.2 Optional Field Configurable Relays (FCR) used shall have the following required properties:

.1 Configurable in the field to operate with single-, double-, or triple-pole relay groupings.

.2 Configurable in the field to operate with normally closed or normally open behavior.

.3 Provides visual status of current state and manual override control of each relay.

.4 Listed for the following minimum ratings:

.1 40A @ 120-480VAC Ballast

.2 16A @ 120-277VAC Electronic

.3 20A @ 120-277VAC Tungsten

.4 20A @ 48VDC Resistive

.5 2HP @ 120VAC

.6 3HP @ 240-277VAC

.7 65kA SCCR @ 480VAC

.3 0-10 dimming outputs shall support a minimum of 100mA sink current per output.

.4 Relay and dimming outputs shall be individually programmable to support all standard sequence of operations as defined in this specification.

.5 Panel shall be UL924 listed for control of emergency lighting circuits.

.6 Panel shall power itself from an integrated 120-277 VAC or optional 347VAC supply.

.7 Panel shall provide a configurable low-voltage sensor input with the following properties:

.1 Configurable to support any of the following input types:

.1 Indoor Photocell

.2 Outdoor Photocell

.3 Occupancy Sensor

.4 Contact Closure

.2 Low voltage sensor input shall provide +24VDC power for the sensor so that additional auxiliary power supplies are not required.

.3 Sensor input supports all standard sequence of operations as defined in this specification.

.8 Panel shall provide a contact closure input for each group of 8-relays that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel. This input is intended to provide an interface to alarm systems, fire panels, or BMS system to override the panel.

.9 Panel shall supply current limited low voltage power to other networked devices connected via low voltage network cable.

.10 Panel shall be available with NEMA 1 rated enclosure with the following mounting and cover options:

.1 Surface-mounted for all panel sizes

.2 Flush-mounted for up to 16 relay panel sizes

.3 Screw-fastened for up to 16 relay panel sizes

.4 Hinged cover with keyed lock for all panel sizes

.11 Surface-mounted screw cover options for 8 and 16 relay panel sizes shall be plenum rated

.12 Panel shall be rated from 0-50C for 8 and 16 enclosure sizes, and 0-45C for 32 and 48 enclosure sizes.

.11 Wired Networked Bluetooth® Low Energy Programming Device

.1 Device shall be plenum rated and be inline wired, screw mountable.

.2 Communication and low voltage power shall be delivered to device via standard low voltage network cabling with RJ-45 connectors.

.3 Bluetooth Low Energy connection shall allow connection from smartphone application for programming device settings within the local daisy-chain zone (*see list of available settings in section 2.4-System Software Interfaces, Sub-section E).*

.1 Device shall provide visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.

.12 Wired Networked Communication Bridge

.1 Device shall surface mount to a standard 4” x 4” square junction box.

.2 Device shall have 8 RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.

.3 Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.

.4 Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply, or powered via low voltage network connections from powered lighting control devices (e.g. power packs).

.5 Wired Bridge shall be capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

2.7

PART 3 - EXECUTION

3.1 Installation Requirements

.1 Installation Procedures and Verification

.1 The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.

.2 The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.

.3 The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:

.1 Wire Map (continuity, pin termination, shorts and open connections, etc.)

.2 Length

.3 Insertion Loss

.2 Coordination with Owner's IT Network Infrastructure

.1 The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.

.1 The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.

.2 The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

.3 Documentation and Deliverables

.1 The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.

.2 The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:

.1 As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.

.2 As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.

.1 CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
Titleblock
Text- Inclusive of room names and numbers, fixture tags and drawings notes
Fixture wiring and homeruns
Control devices
Hatching or poché of light fixtures or architectural elements

.2 CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 System Startup

.1 Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.

.1 For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.

.2 System start-up and programming shall include:

.1 Verifying operational communication to all system devices.

.2 Programming the network devices into functional control zones to meet the required sequence of operation.

.3 Programming and verifying all sequence of operations.

.3 Initial start-up and programming is to occur on-site.

3.3 Project Turnover

.1 System Documentation

.1 Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.

.2 Installing contractor to grant access to the owner for the programming database, if requested.

.2 Owner Training

.1 Provisions for onsite training for owner and designated attendees to be included in submittal package.

.2 Provide 12-hours of training for programing and troubleshooting the system

End of Section

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
   1. Edit panelboards below to suit Project.
   2. Lighting and appliance branch-circuit panelboards.
   3. Distribution panelboards.

B. Related Sections include the following:
   1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
   2. Retain subparagraph below if Project includes fusible panelboards.
   3. Section "Fuses."

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.
B. EMI: Electromagnetic interference.
C. GFCI: Ground-fault circuit interrupter.
D. RFI: Radio-frequency interference.
E. RMS: Root mean square.
F. SPDT: Single pole, double throw.
G. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
B. Shop Drawings: For each panelboard and related equipment.
   1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Enclosure types and details for types other than NEMA 250, Type 1.
      b. Bus configuration, current, and voltage ratings.
      c. Short-circuit current rating of panelboards and overcurrent protective devices.
      d. Delete subparagraph below if series rating of overcurrent protective devices is not used.
      e. UL listing for series rating of installed devices.
      f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
C. Delete paragraph below if independent testing agency is not used.
D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
E. Field Test Reports: Submit written test reports and include the following:
   1. Test procedures used.

2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in other sections. In addition to requirements specified in Section "Contract Closeout," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 COORDINATION

A. Edit below to delete or add types of equipment that affect panelboard installation.

B. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to work-space clearance requirements.

1.7 EXTRA MATERIALS

A. Extra materials may not be allowed for publicly funded projects. Revise quantity below to suit Project.

B. Keys: [SIX] 6 spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lists below are examples only. Retain or insert only those manufacturers whose products correspond with other requirements and whose availability and suitability for the application have been verified.
2. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
a. Eaton
b. Square D Co.
c. General Electric
d. SIEMENS

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
1. Delete items below if not applicable. Add other Project-specific requirements.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Enclosures in hazardous locations must be carefully selected to meet the division and group listing of the environment.
5. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Retain paragraph above or below.

D. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

E. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

F. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

G. Bus: Hard-drawn copper, 98 percent conductivity.
H. Main and Neutral Lugs: Copper mechanical type suitable for use with conductor material.
I. Ten paragraphs below are special features. Add other required features and coordinate with Drawings.
J. Equipment Ground Bus: Copper and adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
K. Delete paragraph below except for panelboards incorporating one or more main service disconnect switches. Edit to suit Project.
L. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
M. Delete paragraph below if future provisions are not required.
N. Isolated Equipment Ground Bus: Copper and adequate for branch-circuit equipment ground conductors; insulated from box.
O. Extra-Capacity Neutral Bus: Copper neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
P. Split Bus: Vertical buses divided into individual vertical sections.
Q. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
R. Gutter Barrier: Arrange to isolate individual panel sections.
S. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
T. Feed-through Lugs: Copper mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Select one of two paragraphs below for series-rated system or system that has panelboards and circuit breakers rated for full value of short-circuit current available at location of equipment. Edit to suit Project and coordinate with Drawings.
B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Plug-in or bolt on circuit breakers, replaceable without disturbing adjacent units.
B. Coordinate below with Drawings.
C. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISTRIBUTION PANELBOARDS

A. Edit three paragraphs and associated subparagraphs below to suit Project. Coordinate with Drawings.
B. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
C. Main Overcurrent Protective Devices: Circuit breaker.
D. Branch overcurrent protective devices shall be one of the following:
   1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.
   2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Edit three paragraphs and associated subparagraphs below to suit Project. Coordinate with schedules and Drawings.
B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.

c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
5. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.
B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
D. Revise paragraph below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.
E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
F. Install filler plates in unused spaces.
G. Revise below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.
H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Select Division 16 Section "Basic Electrical Materials and Methods" for projects with simple requirements and Division 16 Section "Electrical Identification" for projects with complex requirements.
B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Basic Electrical Materials and Methods] [Electrical Identification."
C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Coordinate paragraphs below with Drawings.
B. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
   3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited for Project.
B. GFI: Ground-fault circuit interrupter.
C. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each product specified.
B. Shop Drawings: Legends for receptacles and switch plates.
C. Include sample review below if products may have critical features needing hands-on appraisal.
D. Samples: For devices and device plates for color selection and evaluation of technical features.
E. Maintenance Data: For materials and products to include in maintenance manuals specified in other sections.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
B. Comply with NEMA WD 1.
C. Comply with NFPA 70.

1.6 COORDINATION

A. Delete paragraph below unless receptacles for Owner-Furnished equipment with plugs have unknown configurations.
B. Receptacles for Owner-Furnished Equipment: Match plug configurations.
C. Coordinate with pool contractor for special receptacles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wiring Devices:
      a. Bryant Electric, Inc.
      b. Eagle Electric Manufacturing Co., Inc.
      c. GE Company; GE Wiring Devices.
      d. Hubbell, Inc.; Wiring Devices Div.
      e. Killark Electric Manufacturing Co.
      f. Leviton Manufacturing Co., Inc.
      g. Pass & Seymour/Legrand; Wiring Devices Div.
      h. Pyle-National, Inc.; an Amphenol Co.

2.2 RECEPTACLES

A. Select one of three paragraphs below to specify grade of receptacles. See Editing Instruction No. 3 in the Evaluations for wiring device grades.
B. Straight-Blade and Locking Receptacles: Heavy-Duty grade. The device shall be 20-ampere, 125-volts, Nema configuration 5-20R, back and side wired.
C. Special Receptacles for NEMA configuration refer to Manufacturer specs.
D. Termination-type GFCI unit may be substituted for feed-through type where no protection of downstream receptacles is required.
E. GFI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Device shall have an indicator light.

F. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap. Device shall be white finish with the orange symbol.
   2. Devices: Listed and labeled as solated-ground receptacles.
   3. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

2.3 SWITCHES
A. General
   1. Switches shall be toggle rocker type as indicated herein.. The body of the switch shall be made of an arc-resistant thermoset material. All toggle switch handles shall be constructed of a thermoplastic material. All rocker switch handles shall be constructed of a thermoset material. All wall switches shall be of the quiet AC type.
   2. Switches shall be SPST, DPST, 3-way or 4-way as indicated on the Drawings.
   3. Switch color shall be white unless noted otherwise. Coordinate with Architect.

B. Specification Grade

   1. Specification Grade switches shall be toggle type. The contact arms shall be made of one-piece copper alloy material. The switch shall include a green ground screw attached to the mounting strap. The switch shall be 20-ampere, 120/277-volts AC, horsepower rated, back and side-wired.

C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.
   1. Modify subparagraph below to suit preference.
   2. Control: Continuously adjustable slide, toggle, or rotary knob. Single-pole or three-way switch to suit connections.
   3. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide with “on/off” switch; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads. Dimmer to be sized per circuit load.

2.4 WALL PLATES(All wall plates)
A. For all single and combination types match corresponding wiring devices.
   4. Plate-Securing Screws: Metal with head color to match plate finish.
   5. Select one of five subparagraphs below. Coordinate with Division 9 Section "Painting."
   6. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.
   7. Select one of three subparagraphs below or delete all.
   8. Material for Unfinished Spaces: stainless steel.

2.5 FLOOR SERVICE FITTINGS
A. Items in this Article are available for telephone and data cable service as well as power. Edit to suit Project.
B. Select one of three paragraphs below.
C. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
D. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install devices and assemblies plumb and secure.
B. Install wall plates when painting is complete.
C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.
D. Do not share neutral conductor on load side of dimmers.
E. Coordinate two paragraphs below with Drawings.
F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
G. Protect devices and assemblies during painting.
H. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.
I.

3.2 IDENTIFICATION
A. Comply with Section "Electrical Identification."
B. Select paragraph above or below.
C. Comply with Section "Basic Electrical Materials and Methods."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

A. Select paragraph above or below. Coordinate with Division 16 Section "Grounding."
B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
D. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
B. Dparagraph below if GFCIs are not in Part 2.
C. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
D. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Fuses.

1.3 SUBMITTALS

A. Use this Article to convey basic design intent. Delete if Drawings show sufficient detail to clarify intent.
B. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.
C. Product Data for each fuse type specified.
D. Select above or below. Data listed in paragraph below are appropriate where selective coordination is necessary.
E. Field test reports indicating and interpreting test results.
F. Maintenance data for tripping devices to include in the operation and maintenance manual specified in other sections.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source and by a single manufacturer.
B. Comply with NFPA 70 for components and installation.
C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
   2. Subparagraph below is required by some Federal agencies.
   3. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 EXTRA MATERIALS

A. Extra materials may not be allowed for publicly funded projects.
B. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
1. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuses that may be incorporated into the Work include, but are not limited to, the following:
B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."
C. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:
   1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.
   2. Cooper Industries, Inc.; Bussmann Div.
   3. Eagle Electric Mfg. Co., Inc.
   4. Ferraz Corp.
   5. General Electric Co.; Wiring Devices Div.
   6. Gould Shawmut.

7. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

2.3 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door with key-coded cam lock and pull.

1. Size: Adequate for orderly storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: Stencil legend "SPARE FUSES" in 1-1/2-inch (40-mm) letters on door.
4. Fuse Pullers: For each size fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Select and edit paragraphs below. Add paragraphs as Project requires to specify fuse applications rather than show them on Drawings.

B. Motor Branch Circuits: Class RK1, time delay.

C. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

B. Install spare fuse cabinet where indicated.

3.4 IDENTIFICATION

A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

1.2 SCOPE OF WORK

B. A.Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of disconnect switches, including all related systems and accessories.

1.3 SUBMITTALS

C. A.Submit product data and shop drawings in accordance with other Sections for products specified under PART 2 - PRODUCTS.

D. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.

E. Provide designations for each disconnect. RE: to section 16075.

1.4 REFERENCE STANDARDS

F. A. Switches shall be manufactured in accordance with the following standards:

1. UL 98 - Enclosed and Dead Front Switches
2. NEMA KS1 - Enclosed Switches
3. NEMA 250 - Enclosures for Electrical Equipment

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Eaton
B. Square D Co.
C. General Electric

2.2 GENERAL

A .Switches shall be heavy duty type.

SWITCH INTERIOR

A. Switches shall have switch blades which are visible when the switch is OFF and the cover is open.
Lugs shall be copper and front removable and UL listed for 60°C or 75°C conductors 30-100 ampere, 75°C conductors 200 ampere and up.
Current carrying parts shall be plated to resist corrosion.
Switches shall have removable arc suppressor to facilitate easy access to line side lugs.
Switches shall have provisions for a field installable electrical interlock.

2.4 SWITCH MECHANISM

A.Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

B. The operating handle shall be an integral part of the box, not the cover.

C.Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.

D.The handle position shall travel at least 90° between OFF and ON positions to clearly distinguish and indicate handle position.

E.Switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

2.5 SWITCH ENCLOSURES

A.Switch covers shall be attached with welded pin-type hinges (Type 1) or top-hinged, attached with removable screws and securable in the open position (Type 3R).

B.The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel (Type 1) or gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvannealed steel (Type 3R).

C. The enclosure shall have ON and OFF markings stamped into the cover.

D.The operating handle shall be provided with a dual colored, red/black position indication.

E.Switches shall have provisions to accept up to three 3/8" hasp padlocks to lock the operating handle in the OFF position.

Tangential knockouts shall be provided to facilitate ease of conduit entry (Type 1).

Type 3R enclosure shall contain no knockouts. Supply watertight hubs.

Type 4x shall be stainless steel enclosure with no knockouts. Supply watertight hubs.

2.6 SWITCH RATINGS

A.Switches shall be horsepower rated.

B.The UL listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses 30-600 ampere employing appropriate fuse rejection schemes.

PART 3- EXECUTION

3.1 INSTALLATION

D. Install disconnect switches where indicated shown or not shown.

E. Install fuses in fusible disconnect switches.

END OF SECTION

SECTION 26 43 13 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions, apply to work covered by this Section.

B. Comply with Electrical Sections, as applicable. Refer to other Sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of a high-energy power conditioning surge protection device(s) at branch circuit panelboards where indicated on the Drawings. The device shall incorporate transient voltage surge suppression (TVSS) and high-frequency electrical line noise filtering. The device shall provide effective high energy transient voltage suppression, surge current diversion, high-frequency attenuation, and line stabilization in ANSI/IEEE C62.41-2002 environments connected downstream from the facility's main overcurrent protective device. The device shall be connected in parallel with the facility's wiring system.

B. The device shall be installed as an integral part or external of the panelboard, switchboard.

1.3 SUBMITTALS

A. Submit product data and shop drawings for products specified under PART 2 - PRODUCTS.

B. Manufacturers' Product Data: Submit material specifications and installation data for products specified under PART 2 - PRODUCTS.

C.

D. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract documents.

1 Include electrical characteristics and ratings for the specified equipment.

2 Include wiring diagrams indicating the internal connections of the specified equipment within its enclosure.

3 Drawings shall be provided indicating device dimensions, weights, mounting provisions, connection details and wiring diagrams.

4 Documentation of the specified device UL 1449 3rd Edition voltage protection rating (VPR) and per mode surge current rating shall be included. All submittals without this documentation will be rejected.

5 The manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 Guidelines.

E. Record Drawings

1 A complete set of manufacturers' product data and shop drawings indicating all post bid revisions and field changes.

1.4 QUALITY ASSURANCE

A. Industry Reference Standards and Publications: The device shall be designed, manufactured, tested and installed in compliance with the latest editions of:

1 American National Standards Institute (ANSI) and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-2002 and C62.45-2002)

2 Federal Information Processing Standards Publication 94 (FIPS PUB 94)

3 National Electrical Manufacturers Association (NEMA LS-1)

4 National Fire Protection Association (NFPA 70, National Electrical Code (NEC), 75 and 78)

5 Underwriters Laboratories UL 1449 Standard for Transient Voltage Surge Suppressors Surge Protection Devices and UL 1283 Standard for Electromagnetic Interference Filters.

B. The device shall be UL listed under UL 1449 and UL 1283 complimentary listed.

C. The device shall be warranted against defects in material and/or workmanship and any failure or end-of-life event including lighting for a minimum of TEN (10) years from the date of shipment.

D.

E. The device shall be thoroughly factory-tested before shipment. Testing of the device shall include but not be limited to quality control checks, maximum continuous operating voltage (MCOV) check, and clamping voltage verification tests. The MCOV check shall consist of a minimum of one (1) hour burn-in at the applicable MCOV.

F.

1.5 SYSTEM DESCRIPTION

A. Environmental Requirements

1 Storage Temperature: Storage temperature range shall be -40º to +85º C (-40º to +185º F).

2 Operating Temperature: Operating temperature range shall be -40º to +60º C (-40º to 140º F).

3 Relative Humidity: Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.

4 Operating Altitude: The device shall be capable of operation in an altitude of 0 - 12,000 feet above sea level.

5 Audible Noise: The device shall not generate any audible noise.

6 Magnetic Fields: No appreciable magnetic fields shall be generated. The device shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

7 Electrical Requirements

8 Device Operating Voltage: The nominal operating voltage and configuration shall be that of the switchgear, distribution panel, sub or branch panelboard. Maximum Continuous Operating Voltage (MCOV): The allowable maximum continuous operating voltage of all suppression components utilized in the unit shall not be less than 115% of the nominal operating voltage.

9 Operating Frequency: The operating frequency range of the device shall be 47 to 63 Hertz.

10 Protection Modes: The devices primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground.

11 Surge Current Capacity and Voltage Protection Rating: Unless specifically noted on the drawings and/or the schedules, the surge current capacity, and the voltage protection rating of the SPD shall be not less than listed on the following table.

The above text gives you the option to request a specific surge current rating on the riser or panel schedules

5. Construction: SPD's with a surge current rating of greater than 155,000 amps per mode shall be field serviceable modular devices. SPD's with a surge current rating of less than 155,000 amps may be non-modular.

Location	Per Mode Surge Current Rating	120/208vac 3 phase VPR	277/480vac 3 phase VPR
Switchgear	200,000 amps	900v	1200v
Distribution Panel	150,000 amps	900v	1200v
Sub or Branch Panel	100,000 amps	900v	1200v

1.6 DOCUMENTATION

A. Equipment Manual. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the system.

PART 2 - PRODUCTS

3.1 MANUFACTURER

1 Square D

2 Cutler-Hammer

3 Current Technology

4 THOR SYSTEMS

3.2 TRANSIENT VOLTAGE SURGE SUPPRESSION COMPONENTS

A. The device shall include a solid-state suppression system which includes arrays of fused non-linear voltage dependent metal oxide varistors (MOV's) with similar operating characteristics. The suppression system shall not utilize gas tubes, spark gaps, silicon avalance diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components which may degrade performance or reliability of the

3.3 HIGH-FREQUENCY FILTER

A. The device shall include a UL 1283 high frequency extended range tracking filter. The filter shall reduce fast rise-time, high-frequency, error-producing transients and electrical line noise eliminating disturbances which may lead to system upset. The filter shall provide minimum insertion loss of 45 dB at 100 kHz attenuation frequency utilizing the MIL-STD-E220A 50 ohm insertion loss methodology.

3.4 INTERNAL CONNECTIONS

a. All internal wiring associated with the suppression/filter device and subject to surge currents shall utilize low-impedance copper bus bar and/or #4 AWG copper conductor or larger. All internal connections associated with the suppression/filter device and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance.

3.5 FIELD CONNECTIONS

A. The device shall include mechanical lugs for each phase, neutral and ground, or permanently connected conductors as applicable. The lugs shall accommodate up to #4 AWG copper conductor.

3.6 ENCLOSURE

A. The device shall be provided in a surface mounted NEMA 1 type hinged enclosure, with a NEMA rating that matches or exceeds that of the switchgear, distribution panel, sub or branch panelboard that is being protected. of minimum 14 gauge steel, painted inside and out. Enclosure width shall not be greater than 24 inches.

3.7 MONITORING

a. The device shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status of each phase of the unit.
b. Dry Contacts
c. Audible alarm with silence switch
d. For Service Entrance or Switchgear SPD's: LED visual status indicators, Audible alarm with silence switch, Dry Contacts plus Surge Event Counter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation and testing of the system shall be in full accordance with the manufacturer's installation, operation and maintenance instructions, and all national and local codes.

B. The device shall be installed as close as practical to the facility's wiring system in accordance with NEC Article 285, IEEE 1100-2005 section 8.4.2.5, plus applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be from a minimum 40A branch circuit breaker in the switchgear, distribution panel or panelboard with #4 AWG copper conductors not any longer than necessary, avoiding unnecessary bends. Advise the engineer if the installed In no case shall conductors will be longer than 3 feet in length. Verify circuit breaker size with manufacturer.

3.2 TESTING

A. The system shall be field tested in the presence of the Owner. At the same time operational procedures shall be reviewed with the Owner.

B. If external test equipment is required, two (2) testers shall be furnished to the owner and two (2) training sessions shall be furnished. The first training session shall be with 90 days of occupancy and the second training session shall be not less eight months, but not more than 12 months after the first training session. Training and test equipment shall be furnished at no additional cost to the owner.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, emergency lighting units, and accessories.

B. Related Sections include the following:

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.
2. Select one of two subparagraphs below. With second subparagraph, photometric tests by manufacturer's laboratory are acceptable.
3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
4. Emergency lighting unit battery and charger.
5. LED lights
6. Retain two subparagraphs below for projects with air-handling fixtures.
7. Types of lamps.

B. Delete paragraph and subparagraph below unless custom fixtures are indicated.

C. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

D. Consider retaining paragraph below for projects with congested ceiling space and where Drawings do not include comprehensive reflected ceiling plans.

E. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

F. Retain paragraph and subparagraphs below if fixture Samples are required for verification purposes. Edit if sample requirements are indicated in other than interior lighting fixture schedule. As an alternative, list of fixture types for sample submission can be added below.

G. Delete paragraph below if not required.

H. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.

I. Delete paragraph below except for projects with extensive tests of emergency lighting equipment.

J. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

K. Maintenance Data: For lighting fixtures to include in maintenance manuals in the close out documents.

1.4 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. Delete paragraph below if FM compliance is not required. Coordinate with Drawings.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Retain this Article if Coordination Drawings are not required.

B. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Interior Lighting Fixture Schedule at the end of Part 3.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule in the plans. Submit Manufacturers as is in the Lighting Fixture Schedule or Equal. Submit Equal Manufacturers 10 days prior to bidding day for approval. For Equal Manufacturers submit lighting calculation for each equal fixture submitted for approval.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

2.3 LED FIXTURES

A. Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.

B. Include the following features unless otherwise indicated:

1. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

2. Each luminaire shall be rated for a minimum operational life of 50,000 hours utilizing a minimum ambient temperature of (25°C).

3. Light Emitting Diodes tested under LM-80 Standards for a minimum of 12,000 hours.
4. Color Rendering Index (CRI) of 82 at a minimum.
5. Color temperature [3500] <Insert value> K, unless otherwise indicated.
6. Rated lumen maintenance at 70% lumen output for 50,000 hours, unless otherwise indicated.
7. Fixture efficacy of 60 Lumens/Watt, minimum.
8. 5 year luminaire warranty, minimum.
9. Photometry must comply with IESNA LM-79.
10. The individual LEDs shall be constructed such that a catastrophic loss of the failure of one LED will not result in the loss of the entire luminaire.
11. Luminaire shall be constructed such that LED modules may be replaced or repaired without the replacement of the whole fixture.

C. Technical Requirements

1. Luminaire shall have a minimum efficacy of 60 lumens per watt. The luminaire shall not consume power in the off state.
2. Operation Voltage: The luminaire shall operate from a 50 HZ to 60 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
3. Power Factor: The luminaire shall have a power factor of 0.9 or greater.
4. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 15 percent.
5. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

D. Thermal Management

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
2. The LED manufacturer’s maximum thermal pad temperature for the expected life shall not be exceeded.
3. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
4. The luminaire shall have a minimum heat sink surface such that LED manufacturer’s maximum junction temperature is not exceeded at maximum rated ambient temperature.

2.4 LED EXIT SIGNS

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
B. Housing and door shall be die-cast aluminum.
C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
D. Finish shall be satin or fine-grain brushed aluminum.
E. There shall be no radioactive material used in the fixtures.
F. Fixtures:
1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltage: Multi-voltage (120 – 277V).

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
1. Battery: Sealed, maintenance-free, lead-acid type with minimum 5-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.6 LAMPS

A. ALL LED – NO LAMPS

2.7 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
B. NFPA 70 requires minimum support for fixtures. Retain paragraphs below for more specific support requirements and for requirements exceeding code minimums. Units in seismic zones must have additional supports and restraining devices beyond those specified here. See Editing Instruction No. 3 in the Evaluations.
C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Do not use grid for support.
   1. Install a minimum of two ceiling support system wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
   2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
   3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
D. Suspended Fixture Support: As follows:
   1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3.2 CONNECTIONS

A. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
B. Advance Notice: Give dates and times for field tests.
C. Provide instruments to make and record test results.
D. Tests: As follows:
   1. Verify normal operation of each fixture after installation.
   2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
   3. Verify normal transfer to battery source and retransfer to normal.
   4. Report results in writing.
E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
F. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior lighting units with luminaries and lamps.

B. Related Sections include the following:

1. Section "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.

1.3 DEFINITIONS

A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.

B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

1.4 SUBMITTALS

A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Materials and dimensions of luminaries.
2. Delete "independent" in subparagraph below if certified tests by manufacturer are adequate.
3. Select one of two subparagraphs below. With second subparagraph, photometric tests by manufacturer's laboratory are acceptable.
4. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
5. Certified results of laboratory tests for fixtures and lamps for photometric performance.
6. High-intensity-discharge luminaire ballasts.

B. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.

C. Delete paragraph below except for projects with extensive tests of installations.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For lighting units to include in maintenance manuals specified in other sections.

1.5 QUALITY ASSURANCE

A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by acceptable to authorities having jurisdiction

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 WARRANTY

A. General Warranty: LED fixture warranty is a five year limited warranty. Pole standard warranty is one year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Exterior Lighting Unit Schedule at the end of Part 3.

B. Retain above for nonproprietary or below for semiproprietary Specification, and name products in schedules or details.

C. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule in the plans. Submit Manufacturers as is in the Lighting Fixture Schedule or

Equal. Submit Equal Manufacturers 10 days prior to bidding day for approval. For Equal Manufacturers submit lighting calculation for each equal fixture submitted for approval.

2.2 LUMINAIRES

A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
B. Metal Parts: Free from burrs, sharp corners, and edges.
C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
F. Exposed Hardware Material: Stainless steel.
G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
J. Photoelectric Relays: As follows:
   1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
   2. Relay Mounting: In luminaire housing.
K. High-Intensity-Discharge Ballasts: Comply with ANSI C82.4. Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
   1. Single-Lamp Ballasts: Minimum starting temperature of minus 40 deg C.
   2. Open-circuit operation will not reduce average life.
   3. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
   4. Noise: Uniformly quiet operation, with a noise rating of B or better.
L. Lamps: Comply with the standard of the ANSI C78 series that is applicable to each type of lamp. Provide luminaires with indicated lamps of designated type, characteristics, and wattage. Where a lamp is not indicated for a luminaire, provide medium wattage lamp recommended by manufacturer for luminaire.
M. LED sources shall meet the following requirements:
   1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).
   2. Correlated Color Temperature (CCT): 4000K
   3. Color Rendering Index (CRI): ≥ 85.
   4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating

LED DRIVERS

A. LED drivers shall meet the following requirements:
   1. Drivers shall have a minimum efficiency of 85%.
   2. Starting Temperature: -40 degrees C (-40 degrees F).

3. Input Voltage: 120 to 480 (±10%) volt.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.//

PART 3 - EXECUTION

3.1 CONNECTIONS

A. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Ground metal poles/support structures according to Section "Grounding and Bonding."
   1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect luminaires to grounding system with No. 6 AWG conductor.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged units.
B. Advance Notice: Give dates and times for field tests.
C. Provide instruments to make and record test results.
D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:

3.3 CLEANING AND ADJUSTING

A. Clean units after installation. Use methods and materials recommended by manufacturer.

END OF SECTION

SECTION 27 05 33 - CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions apply to work covered by this Section.

B. Comply with Sections 26 00 00, as applicable. Refer to other Sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of a telephone and data communications empty conduit system, including all related systems and accessories.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with the Architectural sections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Conduit, conduit sleeves, outlet boxes, cover plates and pullwire as indicated.

B. Fireproofing material for telephone and data communication conduit and conduit sleeves through fire rated walls and floors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install telephone and data communication raceways as indicated.

B. Install individual raceways from telephone and data communications outlets to above accessible ceiling. In areas without a ceiling, raceways shall be routed to the nearest ceiling space. In building without a ceiling, raceways shall be extended back to the main telephone/ data communication board or to a location indicated on the Drawings.

1 Minimum size conduit: one inch, REFER TO PLANS FOR SIZES.

2 Raceway installation shall be in accordance with Section 26 05 33.

3 Coordinate raceway installations in millwork and other fabricated architectural items with the other portions of the Work.

4 Provide pullwire in each raceway tagged on each end.

5 Raceways shall be terminated with an insulating bushing or a suitable connector with an insulated throat.

C. Provide telephone and data communications outlet boxes.

6 Provide a one-gang outlet unless noted otherwise.

7 Install outlet box and device ring at each location.

8 Install telephone and data communications outlets at same height specified for convenience outlets unless noted otherwise. Group telephone and data communications outlets with related receptacle outlets unless noted otherwise.

9 Install a blank cover plate on all unused communications outlet boxes.

END OF SECTION

SECTION 27 10 00 - STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Summary of Work:
   a. Provide a complete and tested cable distribution system for data interconnections. The data distribution system shall include fully terminated unshielded twisted pair cables, raceways, conduit, UTP termination devices, data communications outlets, patch panels, patch cables, and another incidental and miscellaneous premises wiring system hardware as required for a complete and usable system. The installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications.
   b. Contractor shall provide new Fiber Optic armored plenum cable from MDF to each IDF.

1.2 QUALITY ASSURANCE

A. Acceptable manufacturers:
   a. The equipment/products described herein, and furnished per these specifications shall be the product of one manufacturer. **No substitutions allowed.** All references to model numbers and other detailed descriptive data are intended to establish standards of design performance, and quality, as required.

B. Installer Qualifications:
   a. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The proposer shall be firm normally employed in the low voltage and data cabling industry and shall provide a reference list of five (5) large-scale projections and contact names confirming successful category 6 premises wiring system installations.
   b. All Data Cable systems installation shall be performed by a (BICSI) Certified-Registered Telecommunications Technician or under the direct supervision of a (BICSI) Certified-Registered Communications Distribution Designer (RCDD).
   c. All data Cable Systems installation shall be performed by a factory/manufacturer certified installer, no exceptions.

C. Pre-Construction Meeting:
   a. The successful Contractor shall attend mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work,

D. Acceptance:
   a. The owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Warranty:

a. The selected system installer shall be a certified installing Contractor of product and hold current certification. Contractor shall be shall provide and end-to-end performance warranty of not less than five (5) years on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by tested bi-directly (end to end) using Level 2 tester, per TSB-67, and that all test results conform to the most current TIA/EIA-526-14 Standard, method B.
b. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
c. The warranty will stipulate that all products used in this installation met the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA/EIA-568-A or EN 50173. Quality and workmanship evaluation shall be solely by the owner/designer and designated representatives.

1.3 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   a. Latest Local and Codes and Amendments
   b. 2011 National Electrical Code

B. Other References:
   a. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
   b. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
   c. TIA/EIA-606 The administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   d. TIA/EIA-607 Commercial building Grounding and Bonding requirements for telecommunications.
   e. EIA/TIA4 455-A Standard Test Procedure for fiber optic fibers, Cables, transducers, sensors, connecting and terminating devices and other fiber optic components.
   f. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling systems
   g. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
   h. ISO/IEC 11801 Generic Cabling Standard
   i. EN 50173 Generic Cabling Standards for Customer Premises
   j. ANSI/EIA/TIA 526-14Optical power loss measurements of Installed Multimode Fiber Cable Plan

C. Governing Codes and Conflicts:
   a. If the requirements of these specifications or the project Drawings exceed those of governing codes and regulations, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes and regulations

1.4 ABBREVIATIONS

a. The following abbreviations are used in this document:

CMP	Ceiling Mounted Projector
TWS	Teacher Workstation
PS	Presentation Station
UTP	Unshielded Twisted Pair
STP	Shielded Twisted Pair

1.6 SUBMITTALS

A. Project Initiation:
   a. Within fourteen (14) days of Notice to Proceed, the projection system installed shall furnish the following in a single consolidated submittal:
      i. Permits: the Contractor shall obtain all required permits and proved copies to the Owner/Architect/Engineer.
      ii. Product literature: Complete manufacture's product literature for all projectors, mounting plates, projector bracket, speakers, amplifiers, Cable, cross-connect blocks, Cable supports, Cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
      iii. Construction Schedule: a time-scaled construction schedule, using the installation of the Cable distribution system.
      iv. Testing: Proposed Contractor Enhanced Category 6 UTP Cable test result forms, fiber optic Cable test result forms and a list of instrumentation to be used for system testing.

B. Shop Drawings:
   a. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed.
      i. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (registered Communications Distribution Designer). The RCDD certification must be current.
      ii. Conformance: For items which are being provided exactly as specified, provide a letter stating the item description and model number, and that it is being provided as specified. For items which are not as specified, provide standard manufacture's cut sheets or other descriptive information and a written description detailing the reason for the substitution.

C. Project Completion:
   a. As a condition for project acceptance, the Contractor shall submit the following for review and approval:
      i. Samples: Complete manufacture's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the project.

ii. Inspection and test reports: During the course of the project, the Contactor shall maintain an adequate inspection system to unsure that the materials supplied and the work performed conform to Contact requirements. The Contractor shall provide written documentation that indicated that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation which indicated that all Cable termination testing was completed and that all irregularities were corrected prior to job completion.

iii. Operating and Maintenance instructions: Operating and maintenance instruction for all devices within the system. This instruction shall reflect any changes made during the course of construction, and shall be provided to the Owner for their use in a three-ring binder labeled with the project name and description (4 Copies).

iv. As Built Drawing: As built drawings will include Cable pathways, outlet locations with correct labeling and MDF location. The as-built drawings will be prepared using AutoCAD version 14 or later. Provide the owner with one Mylar plot of each drawing and two blue line prints of each drawing. Provide the Owner with electronic versions of the as-built on CD Rom/ hard drive.

PART 2- PRODUCTS

2.1 GENERAL

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials eating all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect/Engineer to review.

C. Testing: all installed cabling shall be tested 100% good after installation by the Contractor.

D. Ratings: all products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including inner duct) shall bear the Underwriters Laboratories label. All communications Cable shall bear flammability testing ratings as follows:
   a. CM Communications Cable
   b. CMP Plenum Rated Communications Cable
   c. CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all Cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged Cable or any other components failing to meet specifications shall not be used in the installation's

F. Cable Lubricants" Lubricants specifically designed for installing communications Cable may be used to reduce pulling tension as necessary when pulling Cable into conduit.
   a. Approved Products
      i. Twisted-pair Cable: Dyna-Blue
         American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be released with an Underwriter Laboratories (UL) approved sealant.
   a. Approved Products
      i. 3M or
      ii. Pre-approved equal

2.2 NEW DATA WALL MOUNT ENCLOSURE ENHANCED FIBER AND CATERGORY 6 TERMINATION HARDWARE

A. Equipment: Provide the following equipment.

IDF ROOM #101

Product	Description	Quantity
Wall mount Racks Specifications Qty	**Model**	**Description**
1	SRW12USDP	Smart rack 12U UPS-depth, ventilated, Hinged back
2	N252024 or Equivalent	24-port 2U rack mount CAT6 patch panel,2 PoE, compatible with rack
1	VCM-DS-84-12B or Equivalent	Vertical cable management, black door
1	or Equivalent	Horizontal cable management,
2	SUM48RMXLBP2U or Equivalent	APC Smart-UPS XL Modular 48V Extended Run Battery Pack

Note:

Vendor must provide a turnkey solution (Hardware, Installation, and Configuration) and adhere to all standards as defined in the General Specifications and Specific Requirements and Services on the main RFP.

B. Distribution Rack Grounding
   a. All racks shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building at building electrical service entrance.
      i. Approved products- Ground Terminal Block
      Chatsworth Products, Inc.- (CPI) #08009-001
      ii. Approved Products- Wall mount Bus Bar (one pre MDF/IDF location)
      Chatsworth Products, Inc (CPI) #10622-010

C. Category 6 equipment:

Category 6 Cable –
Each data wiring device shall consist of CommScope Category 6 Plenum cables from designated data closet to each area; number of cables described in accompanying documentation.

- 3 meters service loop to be provided at each termination including MDF/IDF's.

Unshielded Twisted Pair (UTP) Category 6 cable:

1. All Category 6 cable will be tested with certified level tester that can provide a hard copy. Level 6 cables will be tested for according to industry standards.
2. Vendor will provide hard copy of test results for all ports.
3. Cable will be Category 6 4-pair plenum.
4. Installation should follow the UTP Category 6 standards for distance
5. All termination jacks, connectors, and patch cords will follow Category 6 UTP standards or higher.
6. All wall faceplates and cables will be labeled in a scheme where switch ports can be identified.
7. Cable must be labeled on both end with gap between label and cable end of 6 inches.
8. Installation must meet or exceed all ANSI/TIA/EIA-568-B.2-1 for Category 6 cabling.
9. Each equipment rack or wiring closet shall have adequate horizontal and vertical wire management hardware to ensure an organized and aesthetic installation to the District's satisfaction.
10. All jacks and patch panels shall be configured to the 568B-wiring scheme.

All wire mold systems and surface mounted boxes must be secured with anchors. Gluing to the wall as the sole means of securing these items is unacceptable. No less than one anchor must be installed for every three feet of wire mold. All copper (UTP) runs in rooms shall be concealed in walls via conduit system.

Category 6 Patch Panels
Adequate patch panel ports are to be supplied in data closet to accommodate the number of cable drops in this. All patch panels shall meet or exceed EIA/TIA Category 6 standards. Terminate and provide Category 6 Rj-45 jacks and wire management system. Label all patch panels with printed labels circuit ID. All jacks and patch panels shall be configured to the 568B-wiring scheme.

All Patch Panels must be of modular design.
Panels are to be 24 or 48 Ports only. 96 Port Panels will not be accepted.

- Uniprise® Category 6 Angled Patch Panel, 24 port (UNP610-ANG-24P)
- Uniprise® Category 6 Angled Patch Panel, 48 port (UNP610-ANG-48P)

Category 6 Accessories
Category 6 Inserts

- Uniprise UNJ600 Category 6 U/UTP Information Outlet, blue (Data) (UNJ600-BL)
- Uniprise UNJ600 Category 6 U/UTP Information Outlet, red Systimax Uniprise (Phones) (UNJ600-RD).

Standard Faceplate 4 ports –

- L Type Flush Mounted Faceplate, four port ivory (M14L-246)

Patch cables data closet

• Use appropriate lengths to obtain a dressed appearance.

F. Raceway/Wire Molding

1. All patch cords, cable, jacks, patch panels and any other device used in the cabling system must be labeled.

2. Cable drops included in this proposal will be used to support voice in rooms. Vendor must separate voice drops to different patch panel's base on the layout provided on this appendix. Typically every room will have at least one voice drop. Verify with owner.

3. Cable drops included in this proposal will be used to support signal for all IP cameras. Vendor must separate cameras in patch panel. Verify with owner.

4. Cable drops included in this proposal will be used to signal for wireless devices in spaces. Vendor must separate drops in patch panel and label cable. Verify with owner.

G. Cable tray:

2.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be high quality Category 6 RJ45 modular jacks with circuit board construction and IDC style or 110 style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for category 6 connecting hardware.

PART 3- EXECUTION

3.1 GENERAL

A. Fire wall penetrations: the Contractor shall avoid penetration of fire-rated walls and floors whenever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
B. Allowable Cable Bend Radius and Pull tension: In general, communications Cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the Cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.
C. Cable Lubricants: After installation, exposed Cable and other surfaces must be cleaned free of lubricant residue.
D. Pull strings: Provide pull strings in all new conduits, including all conduits with Cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video Cables can be pulled together with pull strings
E. Conduit Fill: Conduit fill shall not exceed 40%
F. Damage:
    a. The Contractor shall replace or rework Cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and Cable sheath removed too far (over 1-1/2 inches).
    b. The Contractor shall replace any damaged ceiling tiles that broken during installation.
G. Clean up:
    a. All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Labels:
    a. The Contractor will label all outlets using permanent/legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least on-eight inch (1/8”) in height, block. All labels shall correspond to as-builts and to final test reports.
    b. The following nomenclature should be used when labeling data/voice jacks:
    c. Vendor shall coordinate with owner to label cables.
B. Floor Plan

a. A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

C. Cables: All Cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie Cables, and fiber optic Cables.

3.3 EQUIPMENT RACK CONFIGURATION

A. Equipment Racks: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each Rack shall be securely mounted on the floor and braced to the wall with Cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical Cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.

B. Wire management Components: Horizontal Cable management panels shall be installed directly above and below each patch panel, also 2 per each 48 port patch panel should be left at site to accommodate the switch gear when they are installed. Vertical Cable management panels shall be installed in each side of the rack. In instances where more than one rack is installed in a single location, vertical Cable management shall be installed between the racks and on either side.

C. Cable Placement: Cable installation in the wiring closet must conform to the project drawings, all cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress Cables to allow other Cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All Cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum Cable bending raii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

E. Installation: all incoming Cables shall be routed on the Cable tray and neatly dressed down to the patch panels.

F. Hardware: provide rack and jack panel hardware as required for all data station wiring.

3.4 STATION WIRING INSTALLATION

A. General:
   a. Cabling between wiring closet and data device locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
   b. All Cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the Cable. There shall never be more than one and one half inches of unsheathed enhanced category 6 UTP Cable at either the wiring closer or

B. Exposed Cable:
   a. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station Cable will only be run where indicated on the Drawings.

b. Unless otherwise approved all cabling shall be concealed. All cabling ran in exposed ceiling areas shall be routed in conduit adequately sized and shall maintain fill ration per NEC and BICSI standards.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:

a. All cabling placed in ceiling areas must be in conduit, Cable tray or J-Hookes. Cable supports shall be permanently anchored to building structure or substrates. Provide attachments hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the Cables to be supported. Do not route Cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section.

b. Attaching Cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 Cables (Chatsworth hooks with appropriate brackets). All runs of sixteen (16) or more Cables provide Cable rings on 36 inch maximum centers to hang Cable. Communications Cable shall be rerouted so as to provide a minimum of 18 inches spacing shall not be attached to ceiling. Grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple Cables to be bundled together every 6 feet.

3.4 CABLE TESTING REQUIREMENTS

A. Notification: The Owner shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to – end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. Errors: when errors are found, the source of each shall be determined, corrected and the Cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.

E. Twisted Pair Cable Testing:

a. At a minimum, the Contractor shall test all station drop Cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Enhanced category 6 products shall be tested for compliance to ANSI/TIA/EIA 568A and ISO/IEs 11801 for Enhanced Category 6 rated installation. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the Contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.

b. Each wire/pair shall be tested at both ends for the following:

i. Wire map (pin to pin connectivity)
ii. Length (in feet)
iii. Attenuation
iv. Near end cross talk (NEXT)
v. Power Sum

c. Test equipment shall provide an electronic and printed record of these tests
d. Test results for each Enhanced Category ^6 four pair UTO Cable must be submitted with identification to match labels on all patch panel ports and RJ45jacks and must match as-builts associated with that Cable.
e. All testing of Category 6 twisted pair Cable testing shall be performed as described above and comply with all current Category 6 testing parameters and standards.
f. All testing of Category 6 twisted pair Cable testing shall be preformed as described above and comply with all current Category 6 testing parameters and standards.

F. Testing: Once installed the cabling will be tested for continuity, shorts and grounds.

a. Cabling:
i. Continuity-100 % continuity testing is required and will be tested from the MDF/IDF location to each classroom drop. A checklist of each Cable and test performed on that Cable will be submitted once the testing has been completed.
ii. Shorts- No Cable shorts will be permitted on the system. If a short is detected, the connector or Cable will be repaired or replaced.
iii. Grounds – no direct ground on the center conductor of the AVDN Cables are permitted.

b. System:
i. Continuity- as tested in the above testing requirements.
ii. Power readings- a power reading will be required at each drop of each of the cabling systems. A +3 dB to a +7 dB is required at each drop with a common feed signal of +15 dB into the head end amplifier. These measurements to be taken with an approved field strength meter of know calibration. These measurements to be performed at low channel, mid-band channel; and high channel to determine Cable slope.
iii. Signal Quality- a standard receiver, typical of those used in the system, shall randomly be connected to 10% of the outlets across the system and tuned to a reference channel of known quality. No visible indication of co-channel interference, noise, ghosting, or beat interference may be observed.
iv. Carrier to Noise- Carrier to Noise shall be measured at random outlets representing an average cross section of the drops with an approved field strength meter by the following process. With normal operating levels the field set shall be tuned to each channels visual carrier and the level recorded. The input signal to the head end amplifier shall be removed and the input of the amplifier terminated with a short. Each

channel shall be re-measured and the noise levels recorded. The carrier to Noise measurement is the difference of the two figures.

v. Documentation of Results- all recorded measurements are to be tabulated and included in the system documentation manual for reference during maintenance of the system.

3.6 INSPECTION

A. General: Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.

END OF SECTION

SECTION 28 23 00 - VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: Include detailed manufacturer's specifications for each component specified. Include data on features, ratings, and performance.

B. Shop Drawings: For VIDEO SURVEILLANCE equipment. Include plans, elevations, sections, details, and attachments to other Work.

1. Design Calculations: Calculate requirements and perform structural analysis for installed products including selection of seismic restraints, signed and sealed by the qualified professional engineer responsible for their preparation.
2. Include dimensioned plan and elevation views of components and enclosures, and details of control panels. Show access and workspace requirements.
3. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Coordination Drawings: Plans drawn to scale and coordinating locations of VIDEO SURVEILLANCE equipment. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Location of items requiring installation coordination including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and other architectural features.

D. Product Certificates: Signed by manufacturers of VIDEO SURVEILLANCE equipment and components certifying that products furnished comply with requirements.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements of installed systems.

G. Maintenance Data: For television equipment and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Detailed operating instructions covering operation under both normal and abnormal conditions.

2. Routine maintenance requirements for system components.
3. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

H. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the VIDEO SURVEILLANCE equipment manufacturer, for both installation and maintenance of units required for this Project, to supervise installation of the system. Contractor shall be certified to install equipment specified. Proof of certification is required and shall be included in the submittal.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of television equipment and are based on the specific system indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. Comply with 47 CFR 15, 17, and 76.

F. The installer shall have an office within 50 miles of the job site staffed with trained technicians who are qualified to manage the installation, to be responsible that the system is installed as submitted, to conduct system start-up, to instruct the project coordinators representatives and local authorities in the proper operation of the system, and to provide service throughout the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS (No substitutions)

A. Provide the following equipment. Note: Refer to plans for quantities. Include all cost for a complete operable system.

B.

1. Verkada Cameras
   a. 90-degrees camera: D40 (include all mounting brackets)
      1) 12 MP
      2) Lens-fixed
      3) IP66, IK10 vandal resistance, IEC62368
      4) POE
   b. 180-degrees camera: D80-HW (include all mounting brackets)
      1) 5 MP
      2) Lens fixed
      3) IK08 vandal resistance, IEC62368
      4) POE

2. Interior wall mount : #D80-HW
3. Interior ceiling mount # D40
4. Exterior wall mount # D80-HW

C. Warranty
   1. 10 years parts and labor

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cable. Check raceways, cables trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

3.2 INSTALLATION

A. Outdoor Installation: Comply with ANSI C2, "National Electrical Safety Code."

B. Provide data drop, category 6 cable to each camera from the switch located in IDF room. Cable by others as specified on specification 17300. No exposed cable.

C. Support and anchor masts, and mountings.

   1. Concrete Foundations: Reinforced concrete complying with Division 3 Section "Cast-in-Place Concrete."
   2. Steel Anchorage Components: Galvanized-steel shapes and plates complying with Division 5 Section "Structural Steel."

D. Wiring Method: Install cables in raceways, except in accessible indoor ceiling spaces and attics, in hollow gypsum board partitions, and as otherwise indicated. Conceal raceways and wiring except in unfinished spaces.

E. Wiring Method: Install cables concealed in accessible ceilings, walls, and floors where possible.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

G. Pulling Cable: Do not exceed manufacturer's recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

H. Exposed Cable: Install parallel to building lines, follow surface contours, and support the cable according to manufacturer's written instructions. Do not run adjacent and parallel to power or data cables.

I. Grounding: Provide independent signal circuit grounding recommended by manufacturer.

J. Install cameras at final locations defined by camera location tests. Install cameras with 84-inch-(2134-mm-) minimum clear space below cameras and their mountings. Change type of mounting to achieve required clearance.

K. Install power supplies and other auxiliary components at control stations. Do not install such items near the devices they serve, unless otherwise indicated.

L. Install tamper switches arranged to detect unauthorized entry into system component enclosures and mount in self-protected, inconspicuous positions.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Basic Electrical Materials and Methods."

B. Identify system components, wiring, cabling, and terminals according to Division 16 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation and supervise pretesting, testing, and adjusting of new equipment. Coordinate with owner for final location prior to any work.

B. Inspection: Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.

C. VIDEO SURVEILLANCE Camera Location Test: Demonstrate proposed location with owner for approval. Adjust location per owners direction at no cost to contract..

3.5 CLEANING

A. Clean installed items using methods and materials recommended by manufacturer.

B. Clean VIDEO SURVEILLANCE system components, including camera-housing windows, lenses, and monitor screens.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain television equipment.

1. Train Owner's maintenance personnel on procedures and schedules for troubleshooting, servicing, and maintaining equipment.
2. Demonstrate methods of determining optimum alignment and adjustment of components and settings for system controls.
3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
4. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
5. Schedule training with Owner, through Architect, with at least seven days' advance notice.
6. Conduct a minimum of 2 hours' training as specified in instructions to Owner's employees in Division 1 Section "Contract Closeout."

3.7 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested by Owner within one year of date of Substantial Completion, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance. Provide up to two adjustments at Project site for this purpose, without additional cost.

END OF SECTION

DIVISION 28 31 00 - INTRUSION / ACCESS INTEGRATED SYSTEM

1.0 GENERAL

1.1 Manufacturer

A. The manufacturer shall have at least thirty-five (35) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (25) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.

B. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines, network, and cellular network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.

C. Commercial Intrusion detection/Access control /Household Fire Alarm Control Panel equipment manufacturer shall be:

Digital Monitoring Products, Incorporated (DMP)
2500 N. Partnership Boulevard, Springfield, MO 65803
Telephone (417) 831-9362 FAX (417) 831-1325

1.2 Installer

A. The installing company shall show proof of having regular experience with design, installation, service, and maintenance of manufactured systems for a minimum of the last twelve (12) calendar months from the project start date. Each system installer and service person must provide manufacturer certification of technical training for installation, service, and system maintenance. Certification shall be proven with an official document issued by the manufacturer.

B. The installing company shall provide a minimum of 8 (eight) verifiable references from its clients where the manufacturer's system has been installed within the last twelve (12) calendar months from the project start date.

C. The installing company shall furnish and install a complete electrically supervised DMP panel, as detailed in this specification. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.

E. The installing company shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work. Materials shall be installed in strict compliance with local building codes. All work shall be performed in accordance with Digital Monitoring Products, Inc. instructions. Components must be installed and serviced by a dealer in good standing that is factory-trained by Digital Monitoring Products.

1.3 Central Reporting Station

A. The central reporting station contractor must possess an Underwriter's Laboratory (UL) listing as a "Mercantile Police Station" or "Mercantile Burglar Alarm Systems" company. A copy of the listing shall be attached as a part of this bid package.

B. The actual alarm signal receipt and processing is a significant portion of the scope of work. Third party and/or contract stations are permitted. UL must list the monitoring station for Protective Signaling Services or Central Reporting Station Signaling Services. A copy of the station UL listing shall be attached as part of this bid package.

C. The monitoring station must provide openings/closing activity reports, activity day and time, authorized individual, office name and account number and the system type being monitored. These reports are to be mailed to the user's office at the end of each month. The Office Manager or Contract Administrator may request an additional report if an incident occurs.

D. The contractor must have a valid Alarm Operator License. A copy of licenses shall be attached as part of this bid package.

E. The contractor may be required to monitor a portion of the alarm systems by way of the end user data network.

F. The contractor shall become familiar with all work details, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work.

G. The end user shall not incur any central station setup charges by the contractor to receive alarm signals by way of the end user data network.

2.0 SCOPE

2.1 Requirements

A. Furnish and install a complete Intrusion Detection/Access Control system with the performance criteria detailed in this specification. The system shall be inclusive of all necessary functions, monitoring, and control capability as detailed herein and on accompanying Shop drawings.

- On-site or remote video monitoring
- Heating, air conditioning, and lighting management
- Temperature threshold detection and monitoring
- Humidity threshold detection and monitoring
- Pressure threshold detection and monitoring
- Power loss detection and monitoring, generator switching
- Leak detection and monitoring
- Carbon Monoxide detection and monitoring
- Tank level threshold detection and monitoring

B. This specification document provides the requirements for the installation, programming, and configuration of a complete DMP panel. This system shall include, but not be limited to:

- Control panel
- System cabinet
- Power supply
- Digital Signaling Line Circuits (SLC)
- Notification Appliance Circuits (NAC)
- Annunciator/keypad bus
- Batteries
- Wiring
- Conduit
- Associated peripheral devices
- Other relevant components and accessories required to furnish and install a complete and operational addressable reporting Life Safety System.

2.2 Standards

The system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Burglary Listings	**U.S. Government Standards/Listings**
UL 1023 Household Burglar Alarm System Units	Meets ICD 705 Chapter 7 Intrusion Detection Systems (IDS)
UL 1076 Proprietary Burglar	Meets DoD/NIST SCIF Standards
UL 1610 Central Station Burglar Alarm Units	**Related Standards**
UL 1635 Digital Burglar Alarm Communicator System Units	NFPA 70 National Electric Code (NEC)
Fire Listings	NFPA 72 Local Protective Signaling
UL 864 Control Units for Fire Protective	NFPA 72 Remote Station Protective Signaling

Signaling Systems	
UL 985 Household Fire Warning	NFPA 72 Proprietary Protective Signaling
California State Fire Marshal	NFPA 72 Household Fire Warning
New York City FDNY COA #6167	**Canadian Burglary Listings**
Access Control Listings	ULC C1023 Household Burglar
UL 294 Access Control System Units	ULC/ORD-C1076 Proprietary Burglar
NIST	ULC S304 Central Station Burglar
AES Algorithm Certificate #2350 128	**Canadian Fire Listings**
AES Algorithm Certificate #2595 256	ULC S545 Household Fire
	ULC S559 Fire Signal Receiving Centres and Systems

2.3 Americans with Disabilities

All indicating and notification appliances shall comply with the Americans with Disabilities Act (ADA) requirements.

3.0 SUBMITTALS

3.1 General Requirements

The contractor shall submit three (3) complete sets of documentation within thirty (30) calendar days after contract award date. Indicated in the document shall be the manufacturers' names, catalog number, type, size, style, rating, and catalog data sheets for all items proposed to meet these specifications.

3.2 Shop Drawings

Shop drawings shall be submitted in accordance with Section 3.0 Submittals and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

3.3 As-Built Drawings

The contractor shall provide a complete set of as-built drawings for the entire system upon installation completion. These drawings shall include, but not be limited to, the exact locations of all equipment, connections between all equipment, and wiring for all equipment as the system is installed.

3.4 Spare Parts Data

After shop drawings are approved, and not later than thirty (30) calendar days prior to the date of beneficial occupancy, a list of spare parts data for each item of specified materials and equipment shall be submitted. The data shall include a complete list of parts and supplies with current unit prices and source of supply. Spare parts shall consist of, but not be limited to, five (5) percent of all initiating and notification appliances with a minimum of one (1) each. All spare parts shall be on site prior to commencement of acceptance testing. Depleted spare parts shall be replaced prior to beneficial occupancy.

3.5 Operating Documents

The contractor shall furnish to the architect operating instructions outlining the step-by-step procedures required for system start-up, operation, and shutdown at least thirty (30) calendar days prior to acceptance test. The instructions shall include the manufacturer's name, system model number, service manual, parts list, and a description of all equipment and their basic operating features.

3.6 Maintenance Documents

The contractor shall furnish maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides at least 30 calendar days prior to acceptance test.

3.7 Performance Test Reports

Upon the installed system completion and testing, test reports shall be submitted in booklet form showing all field tests performed to prove compliance with specified performance criteria.

3.8 Warranty

A copy of the manufacturer's warranty for all equipment and materials shall be provided. Warranty shall be for all equipment, materials, installation, and workmanship for a minimum of three (3) years, unless otherwise specified.

4.0 GENERAL COMPONENT REQUIREMENTS

4.1. Component Enclosure

Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18 gauge door with a 20 gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tampers listed for use with the XR150/XR350/XR550 with Network and Encryption shall be used.

4.2 Electronic Components

A. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.

B. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and Loop Expansion LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the Loop Expansion LX-Bus(es) and Keypad bus are shut down.

4.3 Control Unit

A. A battery test shall be automatically performed to test the integrity of the standby battery. The test shall disconnect the standby battery from the charging circuit and place a load on the battery. This test shall be performed no more than every 180 seconds.

B. The control unit shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.

C. Control unit must be "Flash ROM" updatable, and program must be held in non-volatile RAM. The panel shall be able to function while the update is in process.

D. Control unit shall be capable of operating using an optional built in Encrypted Alarm Router for SCIF (Sensitive Compartmented Information Facility) application that is certified by NIST (National Institute of Standards and Technology) for 128-bit or 256-bit AES (Advanced Encryption Standard) Encryption communications.

E. The optional built-in Encrypted Alarm Router shall be capable of compliance with ICD 705 Chapter 7 Intrusion Detection Systems (IDS) and UL 2050 standards.

4.4 Remote Annunciators

A. The system shall support a maximum of sixteen (16) supervised remote annunciators with the identical capabilities, functions and display layout. Operation of the remote annunciators shall be limited to authorized users by the use of a code or key.

B. The remote annunciators shall be capable of operating at a maximum wiring distance of 15,000 feet from the control unit on unshielded, non-twisted cable.

4.5 Control Designations

Controls shall be provided to ensure ease of operation of all specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function; controls, switches, visual signals and indicating devices, input and output connectors, terminals and test points shall be clearly marked or labeled on the hardware to permit quick identification of intended use and location.

4.6 Test Function

A. The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.

B. The system shall include a provision for an automatic, hourly, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.

C. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.

4.7 Power Supplies

A. Power supplies for the control unit shall operate from 120 VAC, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.

B. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.

C. Approved power supplies shall meet or exceed the following power supply model specifications:

- UL Listed DMP 505-12: 12VDC 5 Amp with transformer and enclosure.

4.8 Software

A. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:

- Direct cable connection interface card
- Receiver phone line connection
- Standard phone line connection
- Ethernet network connection
- Network connection across the Internet
- Cellular network connection using the 263C or 263H Cellular Communicators

B. The system shall interface with computer software capable of locking down all controlled doors.

C. The system shall interface with computer software capable of monitoring and logging all events.

D. The system shall interface with computer software capable of exporting reports in the following file formats:

Excel spreadsheet (*.xls	Text (*.txt)
Rich Text (*.rtf)	Comma-separated (*.csv)
Windows Metafile (*.wmf)	HTML document (*.htm)
QuickReport (*.qrp)	

E. The system shall interface with computer software capable of printing custom, filtered reports including:

All Events	Door Access Granted
Zone Action	Door Access Denied
Arming/Disarming	Opening/Closing Schedule Changes
Area Late to Close	System Monitors
User Code Changes	System Events

4.9 Graphic User Interface (GUI)

Entré – Access and Security Management Software

System Features:

A. The software shall be available in three package sizes.

Entré Lite™: Shall have 16 doors included, and a maximum of four XR150/XR350/XR550 Series panels, personnel management, full reports, and event management.

Entré Business™: Shall have the same features as Entré Lite with the option of expansion to 96 doors maximum and up to 24 XR150/XR350/XR550 Series panels.

Entré Enterprise™: Shall have the same features as Entré Business with 96 doors included with the ability to expand to an unlimited number of doors, users and XR150/XR350/XR550 Series panels.

B. Shall have simple user management, with the ability to import users from existing databases.

C. Shall be able to assign user access by group, facility or other parameters.

D. Shall have drop down lists for devices, user data and other information to facilitate fast and accurate searches.

E. Shall be able to view system status in one of a variety of views for simplified alarm monitoring management.

F. Shall have the capability to customize reports for added flexibility.

User Management:

A. It shall have the ability to import into Entré from existing systems via standard comma-separated value (CSV) format files. It shall easily add new users, capture and edit their photo for badging or visual verification from within the application.

B. User fields shall be fully customizable. Assign specific rights or events by user or by group. The software shall be able to create effective/expiration time for users, limiting access to only certain times of the day, and only certain days, or for only a defined period of time.

AES Encryption:

A. Entré Enterprise shall support the XR550 Series with Encryption panel AES (Advanced Encryption Standard) strong data security for sensitive personnel and facility data.

Highly Customizable:

A. The software shall be extensively customizable to create a system that matches the end user's application's needs.

B. Shall define what events are considered "alarms," and what response is required from the system operator.

C. Shall be able to tailor user data with up to 20 available user-defined fields.

Hierarchical Views:

A. The software shall have the ability to select from four different system views, with the ability to have multiple views open simultaneously. Select the graphical Map view, tabular Event view, or hierarchical Tree view.

B. The software shall be able to click on a device or alert to access additional information and process the event. In text-based views, software shall have simple drill downs to allow fast navigation to the desired item.

Powerful Search:

The software shall employ industry standard SQL database for quick and easy search to identify any desired device or user which is compatible with nearly any database.

Single-System Control:

The software shall employ a network solution to manage installations and users from any location. A single, unified database means there's one badge, one face or one fingerprint, worldwide.

Entré – Access & Security Management Software

Optional System Modules:

- ENTRE-4DR Additional 4-Doors
- ENTRE-16DR Additional 16-Doors
- ENTRE-32DR Additional 32-Doors
- ENTRE-64DR Additional 64-Doors
- ENTRE-STD Standard Client
- ENTRE-WEB Web Client
- ENTRE-MAPS Alarm Graphics
- ENTRE-AUTO Automation Module
- ENTRE-DVR DVR Module
- ENTRE-PART Database Partitioning
- ENTRE-LANG Multiple Language module
- ENTRE-LDAP Lightweight Directory Access Protocol
- ENTRE-IMAGE Personnel Image Capture
- ENTRE-BADGE Badge Designer
- ENTRE-SIGN Signature Capture

Optional System Modules Features:

A. Shall be able to Point-and-click control of alarms and devices.

B. Shall have a modular design to enable customization, with optional modules for added features.

C. Shall be available in French, Spanish, or English, with dual- language operation mode.

D. Shall have full reporting, including at-a-glance dashboard graphics and charts or traditional tabular displays, with the ability to produce reports in a variety of file types.

E. Shall have DVR integration.

F. Shall have image management of users and event photos.

G. Shall have a custom badge builder and video badging.

Door Modules:

The software shall allow for the addition of additional doors to support Entré Business or Enterprise systems.

Alarm Graphics:

A. The software shall allow for the addition of additional doors to support Entré Business or Enterprise systems.

B. Shall have the ability to give graphical representation of events and alarms at-a-glance and give feedback of system status.

C. Shall have the capability to upload an unlimited number of graphical images of protected facilities in a variety of file formats.

D. System maps are linked from level to level, allowing drill down from a macro view to a specific room or area.

E. View alarm status at every level of zoom.

F. User-defined layers representing different alarm types allow you to customize the graphical interface to meet application needs.

G. Once loaded, it shall have the ability to plot alarm devices on the graphics using drag-and-drop selections from a hierarchical list of hardware. Identify the areas on your site maps, defining them by Classification, Entrances, Zones, and Partitions.

H. It shall have total picture-based monitoring and control of the system. It shall from facility-wide views be able to click to zoom in on any area of the facility and view the real-time status of any device.

I. The software shall be able to click on the alarm display icon to acknowledge an alarm or to request additional information

Automation Module:

A. The software shall be able to give advanced users the power to create automated system actions.

B. The software shall be able to define automatic responses to any system alarm or events. These include generating a report, generating an alert email, or sending commands to selected devices.

C. Shall be able to create scheduled system actions to run once at a specified time and date, or scheduled events that repeat at user defined time and date intervals.

D. System automation enables configuration of unattended activities, freeing system managers from many routine responsibilities.

DVR:

A. The software shall be able to quickly connect to a DVR to review video based on a received alarm from a control panel.

B. Connect to DVR from a graphical map of the area to review activity.

- Verint
  - NetDVR I, firmware 6.47.x or higher
  - NetDVR II, firmware 8.7.x or higher
  - EdgeVR, all firmware versions
- 3VR
  - E-Series
  - P-Series
  - S-Series
  - ServerClass
- March Networks™
  - 3204 Digital Video Recorder (3000 Series)
  - 4000 C NVR (4000 C Series)
- Dedicated Micros
  - All NetVU compatible series 2 and 3 DVRs

Database Partitioning:

A. The software shall allow system information to be contained in a single unified database allowing system managers to limit user access to only certain areas of the database to partition the information.

B. The software shall allow organization of data into separate collections by physical area, hardware types, events, or other parameters.

Multi-Language:

A. The software shall support multiple languages enabling multiple operators to select a language during their login process. The software shall allow text shown both in English and a second selected language.

B. Available languages shall include:

- English
- French
- Spanish

LDAP (Lightweight Directory Access Protocol):

A. The software shall provide LDAP single sign-on for users, enabling them to use one password to access multiple system services.

B. System user information can be imported directly from an existing LDAP Tree.

Badge Image Capture:

The software shall allow the transfer of pictures of users from a digital camera directly onto a badge. Select a TWAIN source to capture the image to allow up to date images on employee badges.

Badge Designer:

A. The software shall have the ability to create one or more badge designs, customizing badges by facility, user level, or other parameters.

B. When badging employees or visitors, select the desired badge template from library. The template automatically populates with the appropriate data, ready for printing.

Signature Capture:

Shall use a signature capture device to provide the ability to capture employee or visitor signatures and store the images.

Reporting Dashboard:

A. The software shall have interactive graphics for instant feedback on system activity.

B. The software shall be able to choose a number of charts for functions such as Access Granted /Denied at a particular access point or an entire facility to get a snapshot of activities within any defined time period.

C. Shall have ability to filter through user, activity, or event data to narrow results and show precisely the information needed.

D. Shall have the ability to view reports from within the application, or saved and exported to PDF, HTML, XLS, CSV, or XML format for distribution.

E. Shall automate custom reports to generate and distribute each day at desired times.

4.10 Control Panel Capability

A. The basic control panel shall provide:

- Expansion to a total of at least 10,000 user codes with 99 user profile definitions.
- Temporary user codes that can be entered with a finite date and specific time to expire.
- Sixteen (16) independent door/keypad addresses, each with four zones on XR550 and XR350, with eight (8) on the XR150.
- A total door access granted event buffer of at least 10,000 events.
- Anti-passback access control selectable by area and user.
- A total of at least 99 programmable Schedules for output relay schedules, area schedules, door schedules, holiday schedules, and user profiles. The same schedule may be assigned to more than one area, door, or output, making them reusable. There shall be at least two schedules per user profile with up to four profiles per user. Up to 8 Schedules per user, per door, per area, and per output.
- Eight Areas (8) individual reporting areas XR150, Sixteen (16) individual reporting areas XR350, and Thirty-two (32) individual reporting areas XR550.
- Built-in bell and telephone line supervision.

B. The networked control panel shall provide the entire above plus:

- All of the above features plus.
- Require two-man access code or credentials. Require two user code entries to disarm and/or allow door access to this area.
- Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.
- Early Morning Ambush. Must disarm a second time with in a programmed period of time or an early morning ambush silent alarm is sent.
- Bank Safe & Vault features. Schedules set for this area and the time of day cannot be changed while the area is armed.

C. The XR550 encrypted control panel shall provide the entire above plus:

- All of the basic and network features listed plus.
- Built-in Encrypted Alarm Router.

- Certified operation that meets NIST (National Institute of Standards and Technology) standards for 128-bit and 256-bit AES (Advanced Encryption Standard) Encryption.
- Certification that encrypted panel is capable of meeting ICD 705 Chapter 7 Intrusion Detection Systems (IDS) Standard.
- Certification that encrypted panel is capable of meeting UL 2050 standards.
- Card plus Pin for High security card access is provided by the Card Plus Pin feature that requires both a card read and a PIN (4-6 digit user ID) entry for arming/disarming and access by area. This Card Plus Pin operation complies with the ICD 705 requirement for dual id authentication and operates with a DMP Prox Keypad and a HID ProxPro reader with the keypad connected to a DMP Wiegand Interface module.
- Panic Test allows the panic zone test verification and failure results to be sent to the central station receiver.
- Passphrase of 8-16 characters to validate encryption between the XR550 with Encryption and the Central Station Receiver.

5.0 FUNCTIONAL DESCRIPTIONS

5.1 System Description

A. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.

B. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.

C. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.

D. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, Text messaging, or Smart Phone Application using integrated or auxiliary devices provided by the system manufacturer.

E. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/or wireless zone expansion equipment for at least 500 wireless zones and/or a maximum of 574 hardwired zones.

F. The system shall be capable of offering up to five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.

G. The system shall provide a seamless capability to provide up to 506 addressable relays, which can be located at any connection location upon a zone expansion bus.

H. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.

I. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.

J. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet, cellular communications paths.

K. The control unit shall be completely programmable remotely using remote annunciators, and/or using upload/download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.

L. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.

5.2 Input/output Capacity

A. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 506 output relays.

B. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 VDC and four open collector 12 VDC outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 506 auxiliary relays (Form C rated at 1.0 Amp at 30 VDC).

C. The panel shall also provide 99 programmable output profiles for schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.

D. The system shall be capable of supporting and controlling up to 232 Z-Wave devices and up to 20 Z-Wave Favorites for group control.

5.3 User/Authorization Level Capacity

The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.

5.4 Keypads

A. The system shall support a maximum of sixteen (16) keypads on XR550/XR350 Series or eight (8) keypads on XR150 Series with alphanumeric display. Each keypad shall be capable of arming and disarming any system area based on a pass code or Proximity key authorization. The keypad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.

B. Communication between the control panel and all keypads and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all keypads, zone expanders, output expanders, and other power consuming detection devices.

C. If at any time a keypad does not detect polling; the alphanumeric display shall indicate “SYSTEM TROUBLE”. If at any time two devices are programmed for the same address, the alphanumeric keypad shall display “4 WIRE BUS TROUBLE”. If at any time a keypad detects polling but not for its particular address, the alphanumeric display shall indicate “NON POLLED ADDR”. The system shall display all system troubles at selected keypads with distinct alphanumeric messages.

D. The keypad shall include self-test diagnostics enabling the installer to test all keypad functions: display test, key test, zone test, LED test, relay test, tone test, and address test.

E. The keypad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, keypad displays, and central station reports.

F. The keypad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.

G. The control panel shall support a keypad interface accessible on the World Wide Web in a browser window. The web-accessible keypad interface shall provide at least five (5) programmable hyperlinks for camera access or other use.

5.5 Zone Configuration

A. A minimum of 4 Class B ungrounded zones shall be available at each keypad or zone expander on the system.
The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders on the XR550. It shall also have the capacity of a maximum of 125 supervised relay output expanders. The XR350 shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders. It shall also have the capacity of a maximum of 75 supervised relay output expanders. The XR150 shall have the capacity for a maximum of eight (8) keypads and a maximum of 25 four (4) zone expanders It shall also

have the capacity of a maximum of 25 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.

B. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.

C. The digital SLCs and the annunciator/keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This distance may be extended to a total of 15,000 feet when bus repeater modules are installed.

D. Each zone shall function in any of the following configurations:

Night	Supervisory	Auxiliary 1	Cross-Zone
Day	Emergency	Auxiliary 2	Priority
Exit	Panic	Fire Verification	Arming
Fire			

5.6 Communication

A. The system shall be capable of signaling to as many as 8 remote monitoring station receivers. Seven (7) of the eight (8) paths shall be capable of being assigned as either a “primary” or “backup” path. In such a manner the system shall have multiple primary paths to multiple remote monitoring stations as well as multiple backup paths to multiple monitoring stations.

B. The system shall employ Adaptive Technology that allows a Backup communication path programmed for Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable. This creates a seamless transition for communication.

C. The system shall be capable of dialing up to (2) remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing sequence shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.

D. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least one other standard industry format.

E. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

5.7 Network Communication

A. The control panel shall be capable of asynchronous network communication with a retry time between 2 and 240 minutes and a fail time of 2 and 240 minutes. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.

B. The control panel shall employee adaptive communication technology. Adaptive Technology allows a Backup communication path programmed to use Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable, creating a seamless transition for communication of messages. Select Adapt when programming the Checkin option. This allows a system to be fully supervised even if a path fails, while also keeping wireless charges low when the network is good.

C. Network communication between the control panel and the receiver shall be in a proprietary communication format.

D. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.

E. Underwriters Laboratories (UL) shall list network communication by the control panel for Standard or Encrypted Line Security.

F. The control panel shall be capable of two-way network communication using standard Ethernet 10/100 BaseT in a LAN, WAN, or Internet configuration.

G. The control panel shall be capable of communication by means of a 128-bit or 256-bit AES (Advanced Encryption Standard) Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with an SCS-104 line card or SCS-VR (SCS-VR currently supports 128-bit encryption only).

H. The control panel shall be capable of meeting ICD 705 Chapter 7 Intrusion Detection Systems (IDS) and UL 2050 standards.

I. The control panel shall be capable of sending text messaging to up to three Cellular Phone Numbers using cellular communications.

J. The control panel shall be capable of sending the following SMS messages:

Zone Alarms by Zone Name	AC Power Trouble and Restoral
Zone Troubles by Zone Name	System Low Battery
Zone Bypass by User	Ambush
Arming (Closings) by User	Abort, Cancel and Alarm Verified by User
Disarming (Openings) by User	Check-in by user
Late to Close	

5.8 Cellular Communications

A. The control panel shall have the capability to communicate with a plug-in cellular HSPA+ communicator model number 263H or CDMA communicator model number 263C that shall plug into the control panel J24 connector which shall supply full data communication and power to the 263H or 263C cellular communicator. The cellular communicator shall be capable of communicating full panel alarm and auxiliary messages to the DMP SCS-1R Central Station or SCS-VR Receiver as well as SMS text messaging to a PC, PDA, or Cellular telephone.

B. The control panel shall be capable of sending the following SMS messages

Zone Alarms by Zone Name	AC Power Trouble and Restoral
Zone Troubles by Zone Name	System Low Battery
Zone Bypass by User	Ambush
Arming (Closings) by User	Abort, Cancel and Alarm Verified by User
Disarming (Openings) by User	Check-in by user
Late to Close	

5.9 TCP/IP Network Trapping

A. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the SCS-104 installed in an SCS-1R receiver.

B. The receiver SCS-104 shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver SCS-104 shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.

C. The trap message shall be stored in the receiver SCS-104 for up to four hours. If the trap message is not sent to the panel within the four-hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.

D. The user shall be able to view the trap status in the receiver SCS-104 in Remote Link using the Trap Query function.

6.0 INTEGRATED INTRUSION ALARM AND ACCESS CONTROL OPERATION

6.1 Access Authority Levels

The system shall be capable of programming access credentials authority levels to check whether the user has access to a specific area and also has the authority to disarm or arm the area. If the user access credential has access and disarm/arm authority the system shall provide the user the option to disarm the area simultaneously upon opening the door, or to open the door and begin an entry delay timer. With the timer option the user then disarms the area using an intrusion control keypad inside the area. If the user only has access authority to the area and the area is in an armed condition, the user is denied access to the area.

6.2 Door Open Schedule Override

The system shall be capable of programming certain area doors to be scheduled to unlock and lock at specific times of the day or night. The lock/unlock function shall be capable of an override option depending upon the area armed/disarmed status. If the area remains in an armed status at the scheduled unlock time the armed status overrides the unlock schedule ensuring the doors remain locked and armed in situations where the business might open late, close early, is affected by inclement weather, or another emergency.

6.3 Common Area

The system shall be capable of programming a common area to be armed when the last area in the system is armed and disarmed when the first area in the system is disarmed. To ensure the common area works properly it shall not have any user codes assigned to the common area. The system shall also be capable of programming multiple common areas.

6.4 Area Access Control

A. The system shall be capable of integrating area access control capability where specified into the same control panel with the ability to have up to 10,000 user credentials. User access is limited to custom profiles and/or schedules. Anti-passback shall be available. The networked version shall support a Two-Man Rule feature. The system shall support up to sixteen (16) access doors, connected to the system using a manufacturer-approved interface module.

B. Area door access products shall meet or exceed features offered by the following products:

- Keypad reader/administration device – DMP Model 7063/7063A, 7073/7073A, 7163/7173, 7872, 7873
- Wiegand Interface – DMP Model 734, 734N, or 734N-WIFI
- Reader – DMP Model PP-6005B, Model PR-5455, Model MP-5365
- Cards or credentials – DMP Model 1326, DMP Model 1306P, DMP Model 1346, DMP Model 1386

6.5 Access Control Equipment

Access Control equipment shall communicate to the system by way of the control panel keypad bus. The equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 11.5 of this document.

6.6 Early Morning Ambush (XR550 only)

A. The system shall be capable of programming an area to require two user codes be entered within a programmed number of minutes to prevent an ambush message from being sent to the Central Station Receiver. If both user codes are not entered within the time an ambush message is sent to the central station receiver.

B. Both user codes shall have the authority to disarm the specific area and must be entered at the same keypad or reader. The keypad shall not display any indication that the ambush timer is running.

C. The system shall be capable of programming an output to provide an external indicator that an ambush situation is taking place.

6.7 Two-Man Rule (XR550 only)

The system shall be capable of programming an area to require two separate user codes be entered in order to disarm and/or allow access to a specific area. Both required codes shall have at least the same or greater authority level. Both required codes shall be entered within 30 seconds or an alarm shall activate.

6.8 Panic Button Summary Test

A. The system shall have the ability to test panic buttons without sending a panic alarm to the Central Station Receiver.

B. The system shall also have the ability to send panic zone test verification and failure results to the Central Station Receiver.

C. During the test, each time a panic zone trips, the display number shall increment and the keypad buzzer sound for two seconds.

D. The number of panic zones tripped shall constantly display until the test ends or no panic zone activity has occurred for 20 minutes.

E. When the Panic Zone Test ends and a zone failed (did not trip) during the test, the keypad shall be able to display the zone name and number and have the buzzer sounds for one second. Additional zone failed zones shall display when a button is pressed.

6.9 One-man Walk Test

A special code is also available for installers to test the system. The One-Man Walk Test feature allows a single technician to check the panel response to burglary, fire, panic, and supervisory zones.

6.10 Multi-lingual Display Option

The system shall be programmed to display the User Menu and Status Display text in multiple languages.

6.11 User Inactivity Audit

System shall allow user code inactivity to notify the central station after a programmable period of days of no activity. The system shall be programmable from 0-365 days.

6.12 Lock Down

The system shall for emergency situations, a lock down command can be issued from the keypad menu or via remote command and locks all doors designated as public.

6.13 Communication Function Diagnostics

The system shall have enhanced diagnostic menu that enables technicians to check network and cellular communication status and cell signal strength from the keypad.

6.14 GUEST Operation

The system shall be capable of in the Home/Sleep/Away with Guest House operation, create up to three separate systems (main and two guests). Keypads in each system can selectively arm the perimeter, interior, or bedrooms for only their protected areas. Main system users can add authorized users to all protected areas, but guests can add users only for their protected system.

7.0 FALSE ALARM REDUCTION FEATURES

The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.

7.1 Exit Error Alert and Reporting

The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.

7.2 Entry and Exit Delay Annunciation

A. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.

B. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.

7.3 Remote Annunciation

The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.

7.4 Abort Reporting

The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent after the alarm report to notify the central station that an authorized user has cancelled the alarm.

7.5 System Testing

The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.

7.6 Ambush Code

The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.

7.7 Two-Button Panic Feature

The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.

7.8 Fire Verify Zones

The system shall support Fire Verify zones to help the panel verify the existence of an actual fire condition before it sends an alarm report to the central station. The Fire Verify zone shall require the panel to perform a Sensor Reset whenever a device connected to a Fire Verify zone initiates an alarm. This shall begin a verification period during which the panel waits for a second alarm initiation. If the original zone or any other Fire Verify zone on the panel initiates an alarm within the next 120 seconds, the panel shall recognize this as an actual alarm and send an alarm report to the central station.

7.9 Cross-Zoning Protection

The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once.

7.10 Swinger Zone Bypassing

The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.

7.11 Recently Armed Report

The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a “call the subscriber first” procedure instead of immediately dispatching the police to what could be a false alarm.

7.12 Transmit Delay

The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.

7.13 Call Waiting Cancel

The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.

7.14 Cancel/Verify

The system shall be capable of sending either a Cancel Report or Verify Report to the Central Station to signify that the end user has Canceled an Alarm or Verified an Alarm condition. Also the system shall be programmable to instead of Cancel/Verify show “IS THIS A FALSE ALARM? NO YES”. If YES send validation of alarm to Central Station, if NO send alarm cancel.

8.0 Must meet ANSI/SIA CP-01-2010 Standards for False Alarm Reduction

The system shall be capable of meeting ANSI/SIA CP-01-2010 Standards for False Alarm Reduction.

8.1 Shall Meet Exit Delay Standards

- Default – 60 seconds (Minimum 45 seconds)
- Progress Annunciation – different sound last ten seconds of delay
- Automatic Restart of running exit delay, one time upon re-entry
- Recent Closing – signal sent if alarm within 2 minutes of Exit time expiration (change from 5 min)
- Exit Error – Immediate local alarm and entry delay starts

8.2 Shall Meet Entry Delay Standards

- Default – 30 seconds (Minimum 30 seconds)
- Pre-Warning Silenced – after first digit code entry
- Cancel Message sent if disarmed after alarm sent

8.3 Shall Meet Fail-to-Exit Standards

When perimeter and exterior areas are defined and the user does not leave the building before the system arms, the system only arms the perimeter and leaves the interior unarmed

8.4 Shall Meet Automatic Restart Standards

The system shall stop the Exit countdown once and restart it to allow the user to pick up a forgotten jacket or briefcase and exit the building without sending an alarm to the central station.

9.0 NOT USED

10.0 BURGLARY CONTROL SPECIFICATIONS

10.1 Burglary Standards

The Burglary system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Burglary Listings	**Canadian Burglary Listings**
UL 1023 Household Burglar Alarm System Units	ULC C1023 Household Burglar Alarm System Units
UL 1076 Proprietary Burglar	ULC/ORD-C1076 Proprietary Burglar
UL 1610 Central Station Burglar Alarm Units	ULC S304 Central Station Burglar Alarm Units
UL 1635 Digital Burglar Alarm Communicator System Units	
U.S. Government Standards	
Meets ICD 705 Chapter 7 Intrusion Detection Systems (IDS)	
Meets DoD/NIST SCIF Standards	
Meets ANSI/SIA CP-01-2010 False Alarm Reduction	

10.2 Area System Mode

A. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a thirty-two (32) character length name programmed for each area.

B. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.

C. The networked system shall have the ability to comply with Bank Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.

D. The Encrypted system shall have the feature of Card Plus Pin by area High security card access is provided by the Card Plus Pin feature that requires both a card read and a PIN (4-6 digit user ID) entry for arming/disarming and access by area. This Card Plus Pin operation complies with the ICPG 705 requirement for dual id authentication and operates with a DMP Prox Keypad and a HID ProxPro reader with the keypad connected to a DMP Wiegand Interface module.

10.3 Home/Sleep/Away Mode

The system shall be capable of being configured in a Home/Sleep/Away configuration for Residential applications. The system shall consist of a Main House system and up to two Guest House systems within one single control Panel with each house being controlled with its own keypad as if it were separate alarm systems.

10.4 All/Perimeter Mode

The system shall be capable of being configured into the All/Perimeter configuration to enable the selective arming of both the interior and perimeter when armed “All” or arming just the perimeter devices if arming “Perimeter”.

10.5 Zones

The system shall have a minimum of eight (8) grounded burglary zones available from the control panel, and two floating ground powered zones for two wire type compatible smoke detectors. The system shall have the ability to expand using the panel’s keypad bus for up to sixty-four additional zones. The system shall also have five built-in zone expansion bus (LX500 – LX900) for an additional 500 zones of expansion. The system shall have the ability to integrate up to 500 wireless zones for a total of 574 zones overall.

10.6 Burglary Equipment

Burglary detection equipment shall communicate to the system by way of the control panel loop expansion bus or 900MHz bi-directional spread spectrum receiver. The detection equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 11.0 of this document.

10.7 Z-Wave Equipment

The system shall be capable of 232 Z-Wave devices by means of the use of the model 738Z module. The system shall have the capability of up to 20 Z-Wave favorites for grouping Z-Wave devices into a favorite response or control.

11.0 ACCESS CONTROL SPECIFICATIONS

11.1 Access Control Standards

The access control system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Access Control Listings	U.S. Government Standards
UL 294 Access Control System Units	Meets ICD/ICS 705 Chapter 7 Intrusion Detection Systems (IDS)

	Meets DoD/NIST SCIF Standards

11.2 Keypad

A. The system shall display a message at any keypad when any system area remains disarmed past the scheduled closing time. The message shall be displayed at one minute past the scheduled closing time. A pre-warn tone shall also begin sounding. If the system is not armed or a schedule extended within ten minutes past the scheduled closing time, the system shall provide the option of sending a Late to Close report to the central station.

B. The keypad shall include a door strike relay capable of sending a report to the central station when activated.

C. The keypad shall be capable of proximity arming and disarming functions.

D. The keypad shall display red backlighting when in alarm condition notifying an individual of an unacknowledged alarm condition.

E. The keypad shall annunciate when canceling an alarm condition the words “Cancel” or “Verify” to allow the end user the ability to cancel a user generated alarm or to select verify to send a message to the central station that the alarm has been verified by the end user and to send emergency response personnel. This is to comply with Alarm Verification.

11.3 Area Access Control

A. The system shall be capable of integrating area access control capability where specified into the same control panel with the ability to have up to 10,000 user credentials. User access is limited to custom profiles and/or schedules. Anti-passback shall be available. The networked version shall support a Two-Man Rule feature. The system shall support up to sixteen (16) access doors, connected to the system using a manufacturer-approved interface module.

B. Area door access products shall meet or exceed features offered by the following products:

- Keypad reader/administration device – DMP Model 7063/7063A, 7073/7073A, 7163/7173, 7872, 7873
- Wiegand Interface – DMP Model 734, 734N, or 734N-WIFI
- Reader – DMP Model PP-6005B, Model PR-5455, Model MP-5365
- Cards or credentials – DMP Model 1326, DMP Model 1306P, DMP Model 1346, DMP Model 1386

11.4 Access Control Equipment

Access Control equipment shall communicate to the system by way of the control panel keypad bus. The equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 11 of this document.

12.0 COMPILED DETECTION EQUIPMENT LISTING

12.1 Hard-wired

Hard-wired detection equipment shall communicate to the system by way of the control panel loop expansion bus. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

- Network Transient Suppressor – DMP Model 270
- Trouble Sounder – DMP Model 277
- Bus Splitter/Repeater Module – DMP Model 710
- Door Contact – DMP Model SM-20WG (surface applications – requires DMP zone expander)
- Output Expansion Module - DMP Model 716
- Graphic Annunciator Module - DMP Model 717
- Dual Phone Line Module – DMP Model 893A

Other product types shall connect directly to zone expansion modules such as:

- Addressable - DMP Models 521LX, 521LXT, 850S/711, 850D/711
- Non-Addressable - DMP Models 521B, 521-BXT, 850S, 850D
- Addressable - DMP Model 711

- Addressable - DMP Models 714, 714-8, 714-16
- Addressable - DMP Models 712-8
- Addressable - DMP Models 715, 715-8, 715-16
- Manual Fire Alarms – DMP Models 850S, 850D

12.2 Wireless

Wireless detection equipment shall communicate to the system by way of a compatible 900MHz receiver utilizing two-way communications, capable of receiving up to 500 wireless zones. The wireless system shall be programmed directly from the control panel, and shall not require a separate device programmer. The wireless detection equipment shall have a one (1) year warranty. It shall be capable of sending transmitter and battery status to the control panel's compatible receiver up to once every 60 seconds and must meet or exceed the following products:

- Wireless Receiver – DMP Model 1100X-W or 1100XH-W
- Wireless Repeater – DMP Model 1100R
- Universal transmitter – DMP Model 1101-W, 1102-W
- Universal Transmitter – DMP Model 1103-W
- Universal Transmitter – DMP Model 1105-W
- Wireless Window Transmitter – DMP Model 1107-W
- Wireless Zone Expander – DMP Model 1114-W
- Wireless Relay Output – DMP Model 1116-W
- Wireless LED Annunciator – DMP Model 1117R-B or 1117R-W
- Wireless Remote Indicator Light – DMP Model 1118R-B or 1118R-W
- Wireless Door Sounder – DMP Model 1119-W
- Motion Detector – DMP Model 1121-W, 1125-W, 1126R-W, 1126C-W, 1127W-W, and 1127C-W
- Glass Break Detector – DMP Model 1129-W
- Recessed Contact – DMP Model 1131-W
- Bill Trap – DMP Model 1139-I
- Panic Transmitter – DMP Model 1142-B, 1142-W, 1142BC-B, 1142BC-W
- Pendant Panic Transmitter – DMP Model 1145-1-B, 1145-2-B, and 1145-4-B
- Smoke Detector Transmitter – DMP Model 1161-W, 1162-W
- Wireless Smoke Detector – DMP Model 1165-W, 1165H-W, 1165HS-W
- Wireless Post Indicator Valve (PIV) – DMP Model 1181-R
- Wireless Outside Screw and Yoke Valve (OS & Y) – DMP Model 1182-R
- Wireless Heat Detectors 1183-135F and 1183-135R
- Wireless Carbon Monoxide Detector 1184-W

12.3 Power Supplies and Transformers

Power supply and transformer shall maintain system operation. The batteries shall be checked and replaced every three to five years. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

- Power Supply – DMP Model 505-12, 115 VAC, 12 VDC
- Power Supply – DMP Model 505-12LX, 115 VAC, 12 VDC
- Power Supply – DMP Model 505-12L, 12 VDC
- Transformer - DMP Model 327, 16.5 VAC 50 VA, Plug-in
- Transformer - DMP Model 322, 16.5 VAC 56 VA, Wire-in
- Transformer - DMP Model 323, 16.5 VAC 56 VA, Wire-in
- Transformer – DMP Model 324, 16.5 VAC 100 VA, Wire-in
- Transformer – DMP Model 324P, 16.5 VAC 100 VA, Wire-in

12.4 Access Control Equipment

- Access control equipment shall provide access control functions between the panel and controller door access points. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
- □ Interface Module – DMP Model 734, 734N, or 734N-WIFI Wiegand Interface Module
- □ Egress Module – DMP Model PB-2 REX Button
-
- □ Reader – DMP Model PP-6005B Proxpoint Plus©
- □ Reader – DMP Model MP-5365 Miniprox©
- □ Reader – DMP Model MX-5375 Maxi-Prox™
- □ Reader – DMP Model TL-5395 Thinline II™
- □ Door Controller – DMP Model 1306P Prox Patch™
- □ Door Controller – DMP Model 1306PW Prox Patch™
- □ Access Card – DMP Model 1351 ProxPass© Card
- □ Access Card – DMP Model 1326 Proxcard II© Card
- □ Access Device – DMP Model 1346 Proxkey II™ Keyfob, 1386 Isoprox II©
- 12.5 Cellular Communications Equipment
- Cellular Communications equipment shall plug directly into the XR150/XR350/XR550 PCB J24 connector and shall be supervised by the XR150/XR350/XR550 control panel. The Cellular Communications Equipment shall be of a low current draw and powered directly by the XR150/XR350/XR550 Control Communicator.
- The Cellular Communicator shall communicate in the SDLC Serial 3 Format for communications directly to a SCS-1R or SCS-VR DMP Central Station Receiver. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
- □ 263H Digital HSPA+ Digital Cellular Communicator
- □ 263C CDMA Digital Cellular Communicator
- □ 380-400 Level 400 SIM Card (263H only)
- □ 381-2 18” Coax Cable
- □ 381-12 12’ Coax Extension
- □ 381-25 25’ Coax Extension
- □ 383 Rubber Duck Antenna
- □ 386 Wall Mount Antenna Bracket
- □ 387-1 3DB Fiberglass Antenna w/Bracket
- □ 387-3 3DB MEG Antenna
- □ 387-4 SMA to N Cable, 4ft
- □ 387-25 SMA to N Cable, 25ft
- □ 387-50 SMA to N Cable, 50ft
-
- 12.6 Z-Wave Wireless Devices
- The system shall be capable of 232 Z-Wave devices by means of the use of the model 738Z module. The following are compatible Z-Wave devices.
- □ 738Z Z-Wave Module
- □ Z-TZEMT400BB3X Z-Wave Thermostat
- □ Z-45602 Z-Wave Light Control Module with Dimmer
- □ Z-45603 Z-Wave Light Control and Appliance Module
- □ Z-99100-004 Z-Wave Door Deadbolt, Polished Brass
- □ Z-99100-005 Z-Wave Door Deadbolt, Satin Nickel

- Z-99100-006 Z-Wave Door Deadbolt, Venetian Bronze

13.0 INSTALLATION

13.1 System Component Installation

Materials shall be installed in strict compliance with all local, state, county, province, district, federal and other applicable building, safety, and fire standards, laws, codes, regulations, and guidelines including, but not limited to, all appendices and amendments and the requirements of the local authority having jurisdiction (AHJ).

14.0 EQUIPMENT:

Provide the following equipment.

XR550N DMP SECURITY PANEL

- 32 individual reporting areas, with common areas
- Up to 16 supervised door access-points and/or keypads
- Fully supervised 10/100 network and 3G/4G cellular communication
- Communications Diagnostics check network and cellular communication status from the keypad.
- 128 Bit AES (Advanced Encryption Standard) Encryption
- Flexible system arming features, with Instant Arming option
- Card plus pin and temporary codes
- Lock Down operation from keypad or remotely
- 10,000 user codes with 99 profiles
- 506 Outputs
- 12,000 event buffer
- 1.5 Amps 12 VDC smoke and auxiliary output with OVC protection
- Two Man Rule, Panic Button Test and Early Morning Ambush

7073 DMP KEYPAD / PROXIMITY READER

- Codeless arming and disarming
- On‑board DMP proximity reader that allows users to simply present their proximity credentials to the keypad to gain access to a protected area.
- Momentary bypass to provide an entry and exit window on systems with 24-hour perimeter protection, DMP offers the momentary bypass feature.

DMP ZONE EXPANSION MODULES

- Provides Class B zones for burglary and fire
- Compatible with DMP Panels that allow zone expansion
- Suitable for mounting near protection devices
- Connect devices using 4-wire bus
- Compatible with all panel zone types
- Easy connection to 4-wire Keypad or LX-Bus™
- Proven design ensures stability and performance
- Data LED on zone expander indicates good panel communication
- Durable and attractive plastic or metal housing
- Low current draw
- Can be powered from panel or auxiliary power supply

505 SERIES DMP POWER SUPPLY

- Regulated and filtered power system
- Power-indicating LEDs
- Built-in overload protection
- Battery backup/charging circuit ,5 Amp output , 12 VDC power supplies
- Battery cutoff to prevent deep discharge of batteries

1386/10 HID ISOPROXII CARD (20 PKG)

 ISOProx II is extremely thin, durable, and the size of a credit card. Passive, no-battery design allows an infinite number of reads. Provided blank for customization or badging applications

END OF SECTION

SECTION 28 46 21.11- ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification Sections apply to Work covered by this Section.

B. Comply with applicable sections in division 26. Refer to other Sections for coordination of the Work.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing additional and new devices for new building.

1. Fire alarm control panel
2. Remote Annunciator
3. Addressable or conventional manual fire alarm stations.
4. Addressable analog and conventional area smoke detectors.
5. Conventional beam detectors.
6. Addressable analog and conventional duct smoke detectors.
7. Addressable analog and conventional heat detectors.
8. Sprinkler water flow alarm switches.
9. Audible notification appliances; bells, horns, chimes.
10. Visual notification appliances; strobes.
11. Central station alarm connection control.
12. Air handling systems shutdown control.
13. Magnetic door holder release.
14. Dry pipe sprinkler release valve/deluge valve control.
15. Sprinkler supervisory switches and tamper switch supervision.
16. Dry pipe sprinkler release valve/deluge valve supervision.
17. Battery standby.
18. System shall activate the overhead gates. Provide all accessories for an active system.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with other Sections for products specified under PART 2 - PRODUCTS. Shop drawings shall be generated by the Fire Alarm Contractor without the Engineers plans.

B. The submittal data shall include, but not necessarily be limited to, the following:

1. Complete bill of material indicating quantity, part numbers and brief description.
2. Data sheets for all products. If multiple models are shown on the same data sheet, highlight the specific model used.
3. Provide drawing with all devices.

1.4 REFERENCE STANDARDS

A. The fire alarm system devices specified herein shall be designed, manufactured, installed and tested according to the latest version of the following standards:

1 National Fire Protection Association Standards

1. NFPA 70 - National Electric Code (NEC), Articles 725 & 760.
2. NFPA 71 - Central Station Signaling Systems
3. NFPA 72 - National Fire Alarm Code (NFAC)
4. NFPA 92A - Smoke Control Systems
5. NFPA 101 - Life Safety Code
6. Underwriters Laboratories, Inc.
7. UL 38 - Manually Activated Signaling Boxes
8. UL 228 - Door Holders for Fire Protective Signaling Systems
9. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
10. UL268A - Smoke Detectors for Duct Applications
11. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems
12. UL 464 - Audible Signaling Appliances
13. UL 864/UOJZ/APOU - Control Units for Fire Protective Signaling Systems
14. UL 1481 - Power Supplies for Fire Protective Signaling Systems
15. UL 1638 - Visual Signaling Appliances

16. UL 1711 - Amplifiers for Fire Protective Signaling Systems
17. UL 1971 - Standard for Fire Protective Signaling Systems
18. Americans with Disabilities Act (ADA)
19. Local and State Building Codes
20. Local Authorities Having Jurisdiction (LAHJ)

1.5 QUALITY ASSURANCE

A. The fire alarm system devices shall be listed and labeled by Underwriters Laboratories, Inc. for use in fire protective signaling system.
B. The Installing Contractor shall be factory authorized and trained and shall be NICET certified in the sub-field of Fire Alarm Systems, for the engineering and technical installation and supervision of the system. This certification shall be Level III for engineering and Level II for technical installation and supervision. Proof of certification shall be provided. All work shall be performed by skilled technicians, under the supervision and direction of the designated NICET engineering technician, all of whom shall be properly trained and qualified for the work.
C. The fire alarm contractor shall not sub out portion of the work. The fire alarm shall be responsible to complete the job.
D. Submission to Authority Having Jurisdiction: Submit copies of State Certificate as required by State Fire Marshall. Provide copy with operating and maintenance manual.

1.6 QUALIFICATIONS

1. The fire alarm contractor, as a business entity, shall be an authorized and designated representative of the equipment manufacturer and shall have been actively engaged in the business of selling, installation and servicing fire alarm systems for a period of at least (5) years prior to the bid date.
2. The fire alarm contractor shall have an office within the Rio Grande Valley with trained technicians who are qualified to manage the installation, to be responsible that the system is installed as submitted, to conduct system start-up, to instruct the project coordinators representatives and local authorities in the proper operation of the system, and to provide service throughout the warranty period. 3. The fire alarm contractor SHALL NOT HAVE any grievances or complaints on record regarding workmanship, code compliance, or service response with either the project coordinator, Architect, Engineer, Owner or the State Fire Marshals office. A contractor that has any prior finding(s) of a Fire Alarm license violation or has any litigation in process with the State Fire Marshal is unacceptable.
3. The fire alarm contractor shall be an active installer on the approved manufacturer for a minimum of 5 years.

1.7 WARRANTY

1. Warranty of all control equipment, sensors, I/O modules and all other peripherals and of materials, installation and workmanship shall be for one (1) year from date of acceptance.
2. The Contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Silent Knight

2.2 CIRCUITING GUIDELINES

B. Each addressable analog loop shall be circuited as shown on the drawings but device loading in not to exceed 80% of loop capacity in order to leave for space for future devices. The loop shall have Class A operation. When it is necessary to interface conventional initiating devices provide intelligent input modules to supervise Class A zone wiring. The audio system components shall be an integral part of the fire alarm system control panel.
C. Audio Amplifiers
1. Each audio power amplifier shall have integral audio signal de-multiplexers, allowing the amplifier to select any digitized audio channels. The channel selection shall be directed by the system software. Multiple and different audio signals shall be able to be broadcast simultaneously from the same system network node.
2. Each amplifier output shall include a dedicated, supervised speaker circuit which is suitable for connection of emergency speaker appliances. Each amplifier shall also include a notification appliance circuit for connection of visual (strobe) appliances. This circuit shall be fully programmable and it shall be possible to define the circuit for the support of audible, visible, or ancillary devices.
3. Standby audio amplifiers shall be provided that automatically sense the failure of a primary amplifier, and automatically program themselves to select and de-multiplex the same audio information channel of the failed primary amplifier, and fully replace the function of the failed amplifier.
4. In the event of a total loss of audio data communications, all amplifiers will default to the local “EVAC” tone generator channel. If the local panel has an alarm condition, then all amplifiers will sound the EVAC signal on

their connected speaker circuits.

5. In the event of a loss of the fully digitized, multiplexed audio riser, the audio amplifiers shall automatically default to an internally generated alarm tone.
6. Audio amplifiers shall automatically detect a short circuit condition on the connected speaker circuit wiring, and shall inhibit itself from driving into that short circuit condition.

2.3 DETECTORS

D. General

1. Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters.
2. Detectors shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total loop response time for detectors shall be 0.5 seconds.
3. Detectors shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm-standalone mode status. Both LEDs shall be visible through a full 360 degree viewing angle.
4. Detectors shall be capable of identifying diagnostic codes to be used for system maintenance. The diagnostic codes shall be stored at the detector.
5. Detectors shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each detector shall be individually programmable to operate at various sensibility settings.
6. The detector microprocessor shall contain an environmental compensation algorithm which identifies and sets ambient "environmental thresholds." The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both long term and short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned" base line sensitivity. The base line sensitivity information shall be permanently stored at the detector.
7. The detector and loop controller shall provide increased reliability and inherent survivability through intelligent conventional operation. The device shall automatically change to stand alone, conventional device operation in the event of a loop controller polling communications failure. In the standalone detector mode, the detector shall continue to operate using sensitivity and environmental compensation information, stored in its microprocessor at the time of communications failure. The loop controller shall monitor the loop and activate a loop alarm if a detector reaches its alarm sensitivity threshold.
8. Detectors shall be capable of automatic electronic addressing and/or custom addressing. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.
9. Detectors shall be suitable for operation in the following environment:
    1. Temperature: 32ºF to 120ºF
    2. Humidity: 0-93% RH, non-condensing
    3. Elevation: Up to 6,000 ft.
10. Photoelectric Smoke Detectors

ii. Addressable intelligent photoelectric smoke detectors shall be provided as indicated on the Drawings. The detector shall use a light scattering type photo electric smoke sensor to sense changes in air samples from its surroundings. An integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. The detector shall utilize digital filters to remove signal patterns that are not typical of fires. Each detector shall have twin red/green status LEDs. The red LED shall indicate alarm condition and green LED shall indicate normal.

iii. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature and humidity. The information shall be stored in the integral processor and transferred to the loop controller.

iv. Detector shall be programmable for different sensitivity during day and night periods.

v. The detector shall be suitable for direct insertion into air ducts up to 3 ft. high and 3 ft. wide with air velocities up to 5,000 ft/min.
vi. The detector shall be rated for ceiling installation at a minimum of 30 foot centers.
vii. The percent smoke obscuration per foot alarm setpoint for the detector shall be field selectable to various sensitive settings ranging from 1.0% to 3.5%.

b. Detector Mounting Bases

i. Detector mounting bases shall be suitable for mounting on a standard 4" square electrical outlet box. The base shall contain no electronics, support all detector types and have the following minimum requirements:
1. Removal of the respective detector shall not affect communications with other detectors.
2. Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
3. Capable of supporting a remote LED indicator and test station. Provide remote LED indicators and test stations as indicated on the Drawings.

c. Detector Mounting Plates

i. Provide detector mounting plate assemblies to facilitate mounting detectors for direct insertion into low velocity ductwork. The mounting plate shall be code gauge steel with corrosion resistant red enamel finish.

d. Duct Smoke Detectors

i. Air duct mounted smoke detectors shall be provided in the air supply stream of all central air handling equipment above 2000 cfm, i.e. Provide all necessary interface wiring for proper system operation.
ii. The duct smoke detector shall be UL listed per UL 268A specifically for use in air handling systems. The detector shall operate at velocities of 300-4000 ft./min. The detector housing shall be equipped with an integral mounting base. It shall be capable of local testing via magnetic switch or remote testing using a remote test station. The duct detector housing shall incorporate an airtight smoke chamber in compliance with UL 268A. The housing shall be capable of mounting to either rectangular or round ducts without adaptor brackets. An integral filter system shall be included to reduce dust and residue effects on detector housing, thereby reducing maintenance and servicing. Sampling tubes shall be easily installed after the housing is mounted to the duct by passing through the duct housing. The housing shall have a red enamel finish.
iii. For each duct smoke detector provide a remote LED indicator and test station to be mounted in a location indicated on the Drawings and approved by the local authority having jurisdiction.
iv. F. Beam Type Smoke Detectors 1. Provide projected beam type smoke detectors. Then beam detectors shall be four wire 24 Vdc and powered from the control panel 4 wire smoke power source. This unit shall consist of a separate transmitter and receiver capable of being powered separately or together. This unit shall operate in either a short range of 30 to 100 ft. (9.14 to 30.4m) or a long range of 100 to 300 ft. (30.4 to 91.4m). The detector shall feature a bank of four alignment LEDs on both the receiver and transmitter that are used to ensure proper alignment without the use of special tools. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses. Ceiling or mount as shown on the plans. Testing shall be carried out using calibrated test filters. Provide an activated remote test station>.

b) SYSTEM MODULES

a. Addressable intelligent modules shall support supervised Class A circuits. The modules shall be multi-function capable of field programming. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing diagnostic codes which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
i. Temperature: 32°F to 120°F (0°C to 49°C)
ii. Humidity: 0-93% RH, non-condensing

b. Single Input Module

i. Addressable intelligent single input modules shall be provided as required for the system configuration. The single input module shall provide one (1) supervised Class A input circuit. The module shall be suitable for mounting on 4” square electrical box. The single input module shall support the following input circuit types:
1. Normally-Open Alarm Latching (Manual Stations, Smoke Detectors, etc.)
2. Normally-Open Alarm Delayed Latching (Waterflow Switches)
3. Normally-Open Active Non-Latching (Monitors, Fans, Dampers, Doors, etc.)
4. Normally-Open Active Latching (Supervisory, Tamper Switches)

c. Dual Input Module

1. Addressable intelligent dual input modules shall be provided as required for the system configuration. The dual input module shall provide two (2) supervisedCLASS A input circuits. The module shall be suitable for mounting on a standard 4" square electrical box. The dual input module shall support the following input circuit types:
2. Normally-Open Alarm Latching (Manual Stations, Smoke Detectors, etc.)
3. Normally-Open Alarm Delayed Latching (Waterflow Switches)
4. Normally-Open Active Non-Latching (Monitors, Fans, Dampers, Doors, etc.)
5. Normally-Open Active Latching (Supervisory, Tamper Switches)

d. Monitor Module
   1. Addressable intelligent monitor modules shall be provided as required for the system configuration. The monitor module shall support one (1) supervised Class A normally-open active non-latching monitor circuit. The monitor module shall be suitable for mounting on a standard 4" square electrical box.

e. Waterflow/Tamper Module
   1. Addressable intelligent waterflow/tamper modules shall be provided as required for the system configuration. The waterflow/tamper module shall support two (2) supervised Class A input circuits. Channel A shall support a normally-open alarm delayed latching waterflow switch circuit. Channel B shall support a normally-open active latching tamper switch. The waterflow/tamper module shall be suitable for mounting on a standard 4" square electrical box.

f. Single Input Signal Module
   1. Addressable intelligent single input signal modules shall be provided as required for the system configuration. The single input signal module shall provide one (1) supervised Class A output circuit capable of supporting the operation of an audible/ visual signal power selector and a telephone power selector with ring tone for fire fighter's telephone. The module shall be suitable for mounting on a standard 4" square electrical box.

g. Dual Input Signal Module
   1. Addressable intelligent dual input signal modules shall be provided as required for the system configuration. The dual input signal module shall provide a means to selectively connect one of two (2) signaling circuits to one (1) supervised output circuit. The dual input signal modules shall be capable of supporting the operation of an audible/visual signal power selector. The module shall be suitable for mounting on a standard 4" square electrical box.

h. Control Relay Module
   1. Addressable intelligent control relay modules shall be provided as required for the system configuration. The control relay module shall provide one form "C" dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on a standard 4" square electrical box.

i. Universal Class A Module

i. Addressable intelligent class A modules shall be provided as required for the system configuration. The universal class A module shall be capable of numerous operations. The module shall be suitable for mounting on a standard 4" square electrical box. The universal class A module shall support the following circuit types:

1. Two (2) supervised Class A Normally-Open Alarm Latching.
2. Two (2) supervised Class A Normally-Open Alarm Delayed Latching.
3. Two (2) supervised Class A Normally-Open Active Non-Latching.
4. Two (2) supervised Class A Normally-Open Active Latching.
5. One (1) form "C" dry relay contact rated at 2 amps @ 24 Vdc.
6. One (1) supervised Class A Normally-Open Alarm Latching.
7. One (1) supervised Class A Normally-Open Alarm Delayed Latching.
8. One (1) supervised Class A Normally-Open Active Non-Latching.
9. One (1) supervised Class A Normally-Open Active Latching.
10. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
11. One (1) supervised Class A 2-wire Smoke Alarm Non-Verified.
12. One (1) supervised Class A 2-wire Smoke Alarm Verified
13. One (1) supervised Class A 2-wire Smoke Alarm Verified

14. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.
15. One (1) supervised Class A Signal Circuit, 24Vdc @ 2A.

c) MANUAL PULL STATIONS

a. Addressable intelligent dual action, non-break glass type, key reset, semi-flush mounted manual pull stations shall be provided as indicated on the Drawings. The stations shall be of Lexan construction, finished in red with white molded raised letters "PULL IN CASE OF FIRE". The station shall be suitable for mounting on a standard 4" square electrical box. The station shall have a minimum of 2 diagnostic LEDs mounted on their integral, factory assembled single or two stage input module. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The station shall be capable of storing diagnostic codes which can be retrieved for troubleshooting assistance. Input circuit wiring shall be supervised for open and ground faults. The fire alarm pull station shall be suitable for operation in the following environment:

i. Temperature: 32ºF to 120ºF (0ºC to 49ºC)
ii. Humidity: 0-93% RH, non-condensing

d) NOTIFICATION APPLIANCES

a. General

i. All appliances shall be UL listed for Fire Protective Service. All audible appliances, visual appliances and combination audible/visual appliances shall be capable of providing the equivalent facilitation which is allowed under the Americans with Disabilities Act Accesabilities Guidelines (ADA/AG), and shall be UL 1971, and ULC S526 listed.

b. Audible Only Notification Appliances

i. Audible appliances shall be a mylar cone type speaker. Paper type cones are not acceptable. The rear of the speaker shall be completely sealed protecting the cone during and after installation. Speakers shall provide power taps at 1/4w, 1/2w, 1w, and 2w. Speakers shall provide UL confirmed 90 dBA sound output at 2w.
ii. Audible appliances shall be provided with in/out wiring terminals.
iii. Audible appliances shall be flush for ceiling mounted and flush/semi-flush for wall mounted as indicated on the Drawings. They shall have a white faceplate for ceiling mounting and red faceplate for wall mounting. They shall mount to a standard 4" square electrical box.

c. Visual Only Notification Appliances

i. Visual appliances shall be a self-synchronized strobe. The strobe flashtube shall be enclosed in a rugged lexan lens with solid state circuitry. The strobe shall provide 15, 15/75, 30, 60 and 110 candela synchronized flash outputs. The strobe intensity selection shall be based on the installed location within the building.
ii. Visual appliances shall be provided with in/out field wiring terminals.
iii. Visual appliances shall have lens markings oriented for wall mounting where indicated on the Drawings. They shall have a red faceplate for flush/semi-flush wall mounting. They shall mount to a standard 4" square electrical outlet box.

d. Combination Audible/Visual Notification Appliances

i. Combination appliances shall be a combination of the audible and visual appliances specified previously. They shall have a red faceplate for flush/semi-flush wall mounting.
ii. The majority, if not all, of the notification appliances shall be combination devices such that the visual and audible requirements of ADA shall be complied with. Visual notification appliances shall be located in all areas of common use, i.e. lobbies, hallways, restrooms, meeting/conference/assembly areas, break rooms, copy/fax/mail rooms, etc. Audible notification appliances shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15dbA or exceeds any maximum sound level with a duration of 60 seconds by 5dbA, whichever is louder. Sound levels for alarm signals shall not exceed 120 dbA. It is the intent of the Drawings to show all devices that are required. The fire alarm system vendor/bidder shall provide all appliances shown and/or required by these specifications but it others are anticipated to be required the vendor/bidder shall qualify the provisions for the system making note of the additional cost for the anticipated additional requirements.

e) ANCILLARY DEVICES

a. Remote Relays

i. Multi-Voltage Control Relays

1. Remote control relays shall be provided as required for the system configuration for connection to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT or DPDT, as required, and rated for 10 amperes at 115 Vac. A single relay may be energized from a voltage source of 12 Vdc, 12 Vac, 24 Vdc, 24 Vac, 115 Vac, or 230 Vac, as required. A red

LED shall indicate the relay is energized. A metal enclosure shall be provided.

ii. Manual Override Control Relays

1. Remote control relays with a manual override shall be provided as required for the system configuration for connection to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be SPDT and rated for 10 amperes at 115 Vac or 24 Vdc. A single relay may be energized from a voltage source of 24 Vdc or 24 Vac. A red LED shall indicate the relay is energized.

iii. Heavy Duty Power Relays

1. Remote control relays shall be provided as required for the system configuration for connection to supervised ancillary circuits for control of fans, dampers, door releases, etc. Relay contact ratings shall be DPDT and rated for 30 amperes at 300 Vac or 2 HP motor load. A single relay may be energized from a voltage source of 24 Vac,115 Vac, as required. A metal enclosure shall be provided.

f) ELECTROMAGNETIC DOOR HOLDERS

a. Provide single or double door, floor or wall mounted electromagnetic door holder/release devices as indicated on the Drawings. The devices shall be rated for 24V ac/dc input. The devices shall be brushed zinc finished.

g) FIRE ALARM CABLE

a. The fire alarm cable shall plenum rated and be UL listed and suitable for use as power limited fire protective signaling circuit cable in accordance with National Electric Code Article 760 (Fire Alarm Systems) and Article 725 (Class 1, Class 2 and Class 3 - Remote Control, Signaling and Power-Limited Circuits).

b. Cable Construction

i. Conductors shall be solid, soft annealed, uncoated copper.
ii. Insulation shall be 300 volt, 105ºC polyvinylchloride.
iii. Two conductor, non-shielded cables shall be parallel; shielded and three or more conductors shall be cabled round.
iv. Shielding shall be mylar backed aluminum foil, helically wrapped to provide 100% coverage. A suitable copper drain wire shall be provided with shielded cables.
v. Jacket shall be red, 105ºC polyvinylchloride, rated 300 volt.
vi. Cable shall be plenum rated when installed in air handling plenums.

c. In general, non-shielded cable is acceptable for use throughout except on voice circuits. All voice circuits shall utilize shielded, twisted pair cable.

PART 3 - EXECUTION

3.1 APPROVALS

A. Complete fire alarm system drawings shall be issued to the Local Authority Having Jurisdiction for approval prior to the installation of the fire alarm system.

3.2 INSTALLATION

A. Installation of the Fire Alarm System shall be in strict compliance with manufacturers recommendations. The entire system shall be installed in accordance with approved manufacturers manuals and wiring diagrams and as approved by the Local Authority Having Jurisdiction.

B. Fire alarm cable shall be installed in conduit in areas of exposed structure and within inaccessible ceilings. Conduit shall also be provided from outlet boxes within walls stubbed up to accessible ceilings. Provide end bushings on conduit stub-ups. Cable only is acceptable in accessible ceilings.

C. All conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation shall be included as part of the system. All junction box blank coverplates shall be labeled with a red “F.A.” for identification purposes.

D. All wiring shall be color coded throughout.

E. The system shall be installed and fully tested under the supervision of trained manufacturer's representatives. The system shall be demonstrated to perform all the functions as specified.

END OF SECTION

CIVIL TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS
SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2-3 – TECHNICAL CIVIL SPECIFICATIONS

END OF DOCUMENT

Section 02047

FLEXIBLE BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

This work shall consist of furnishing and placing a foundation course for surface courses or for other base courses.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Flexible base will be measured by the square yard of surface area of completed, placed thickness and accepted work based on the width of flexible base as shown on the plans.

2. The accepted quantities of flexible base of the type, grade, and compaction method specified will be paid at the contract unit price per square yard, complete in place.

3. All sprinkling, rolling, and manipulation required will not be paid for directly, but will be considered incidental work.

4. Passing "Density Control" tests shall be paid by the OWNER. Failing "Density Control" tests shall be paid by the CONTRACTOR.

5. The unit prices bid shall each be full compensation for shaping and fine grading the roadbed; for securing and furnishing all materials, including all royalty and freight involved; for furnishing scales and labor involved in weighing the material when required; for loosening, blasting, excavating, screening, crushing and temporary stockpiling when required; for loading all materials for all hauling and delivering. on the road; for spreading, mixing, blading, dragging, shaping and finishing and for all manipulation, labor, tools and incidentals necessary to complete the work.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit material and details of following items for approval:

1. Proposed material source location
2. Proctor of the material
3. Liquid Limit of the material
4. Plasticity Index of the material
5. Wet Ball Mill of the material
6. Gradation of the material

PART 2 PRODUCTS

2.01 MATERIALS

A. Flexible base shall be composed of either caliche (argillaceous limestone, calcareous or calcareous clay particles, with or without stone, conglomerate, gravel, sand or other granular materials), crushed stone, or gravel.

B. When lime stabilization of the sub-grade is specified, the flexible base is to be added in accordance with Section 260, Lime stabilization.

C. Materials for flexible base shall be crushed as necessary to comply with the requirements hereinafter specified.

D. Materials shall consist of durable course aggregate particles mixed with approved binding materials.

2.02 FLEXIBLE BASE LIME STABILIZATION

Where shown on the plans, or directed by the ENGINEER, material for flexible base shall be lime stabilized in accordance with the provisions of Section 020XX – Lime Stabilization.

2.03 FLEXIBLE BASE TYPES

Material Types. Do not use fillers or binders unless approved. Furnish the type specified on the plans in accordance with the following:

Type A. Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.

Type B. Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.

Type C. Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I. Blending of 2 or more sources is allowed.

Type D. Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in Section 247.2.1.3.2., "Recycled Material (Including Crushed Concrete) Requirements," and be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.

Type E. Caliche, iron ore or as otherwise shown on the plans.

TABLE 1

Property	Test Method	Grade 1–2	Grade 3	Grade 4[2]	Grade 5
Sampling	Tex-400-A				
Master gradation sieve size (cumulative % retained)	Tex-110-E			As shown on the plans	
2-1/2"		0	0		0
1-3/4"		0–10	0–10		0–5
7/8"		10–35	–		10–35
3/8"		30–65	–		35–65
#4		45–75	45–75		45–75
#40		65–90	50–85		70–90
Liquid Limit, % Max	Tex-104-E	40	40	As shown on the plans	35
Plasticity Index, Max[1]	Tex-106-E	10	12	As shown on the plans	10
Plasticity index, Min[1]		As shown on the plans	As shown on the plans	As shown on the plans	As shown on the plans
Wet ball mill, % Max	Tex-116-E	40	–	As shown on the plans	40
Wet ball mill, % Max increase passing the #40 sieve		20	–	As shown on the plans	20
Min compressive strength, psi	Tex-117-E			As shown on the plans	
lateral pressure 0 psi		35	–		–
lateral pressure 3 psi		–	–		90
lateral pressure 15 psi		175	–		175

2.04 PHYSICAL REQUIREMENTS

A. All flexible bases shall, when tested in accordance with standard laboratory test procedures, meet the physical requirements set forth in Table 1.

B. Testing of flexible base materials shall be in accordance with the following test procedures:

TEST	TESTING PROCEDURE
Preparation for soil constants and sieve analysis	TEX-101-E
Liquid Limit	TEX-104-E
Plastic Limit	TEX-105-E

Plasticity Limit	TEX-106-E
Sieve Analysis	TEX-110-E
Wet Ball Mill	TEX-116-E
Triaxial Test	TEX-117-E (Part I or II)

C. Unless otherwise specified on the plans, samples for testing the material for Soil Constants, Gradation and Wet Ball Mill shall be taken prior to the compaction operations.

D. Unless otherwise specified on the plans, samples for triaxial tests shall be taken from the stockpile or from production, as directed by the ENGINEER, where stockpiling is required and from production where stockpiling is not required.

2.05 MATERIAL TOLERANCES

A. The limits establishing reasonable close conformity with the specified gradation and plasticity index are defined by the following:

1. The ENGINEER may accept the material, providing not more than 2 of 10 consecutive gradation tests performed are outside the specified limits on any individual or combination of sieves by no more than 5% and where no two consecutive tests are outside the specified limits.

2. The ENGINEER may accept the material providing not more than 2 of 10 consecutive plasticity index samples tested are outside the specified limit by no more than two points and where no two consecutive tests are outside the specified limit.

2.05 STOCKPILING:

A. When specified on the plans, the material shall be stockpiled prior to delivery on the road. The stockpile shall be not less than the height indicated and shall be made up of layers of material not to exceed the depth shown on the plans.

B. After a sufficient stockpile has been constructed as specified on the plans, the CONTRACTOR may proceed with loading from the stockpile for delivery to the road.

C. In loading from the stockpile for delivery to the road, the material shall be loaded by making successive vertical cuts through the entire depth of the stockpile.

D. If the CONTRACTOR elects to produce the Type "A" material from more than one material or more than one source, each material shall be crushed separately and placed in separate stockpiles so that at least 75 percent of the material in the course aggregate stockpiles will be retained on the No. 4 sieve and at least 70 percent of the material in the

fine aggregate stockpile will pass the No. 4 sieve.

E. The materials shall be combined in a central mixing plant in the proportions determined by the ENGINEER to produce a uniform mixture which meets all of the requirements of the specification. In the event that combinations of the materials produced fail to meet all of the specification requirements, the CONTRACTOR will be required to secure other materials which will meet specifications requirements.

F. The central mixing plant shall be either the batch or continuous flow type, and shall be equipped with feeding and metering devices which will add the materials into the mixer in the specified quantities.

G. Mixing shall continue until a uniform mixture is obtained.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE:

A. Flexible base shall be constructed as specified herein in one or more courses in conformance with details, lines and grades shown on the plans, and as established by the ENGINEER.

B. Type roadbed shall be excavated and shaped in conformity with the typical sections shown on the plans and to the lines and grades as established by the ENGINEER.

C. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material.

D. All holes, ruts and depressions shall be filled with approved material and, if required, the subgrade shall be thoroughly wetted with water and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material.

E. The surface of the subgrade shall be finished to line and grade as established and in conformity with the typical section shown on plans, and any deviation in excess of 1/2 inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

F. Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the work.

G. Material excavated in the preparation of the subgrade shall be utilized in the construction of adjacent shoulders and slopes or otherwise disposed on as directed, and any additional material required for the completion of the shoulders and slopes shall be secured from sources indicated on plans or as directed by the Engineer.

3.02 PLACEMENT OF FIRST COURSE - ALL MATERIAL TYPES

A. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section.

B. The material shall be delivered in approved vehicles of a uniform capacity, and it shall be the charge of the CONTRACTOR that the required amount of specified material shall be delivered in each 100- foot station.

C. Material deposited upon the subgrade shall be spread and shaped the same day.

D. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period, the materials shall be scarified and spread as directed by the Engineer.

E. The material shall be sprinkled, if directed, and shall then be bladed, dragged and shaped to conform to typical sections as shown on plans.

F. All areas and "nests" of segregated coarse or fine material shall be corrected to removed and replaced with well graded material, as directed by the ENGINEER.

G. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and supplies in the amount directed by the ENGINEER. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming or by other approved methods.

H. The course shall be compacted by method of compaction hereinafter specified as the "Ordinary Compaction" method or the "Density Control" method of compaction as indicated on the plans, or as directed by the ENGINEER.

1. When the "Ordinary Compaction" method is to be used, the following provisions shall apply:

a. The course shall be sprinkled as required and rolled as directed until a uniform compaction is secured. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical sections shown on plans and to the established lines and grades.

b. In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

c. All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

2. When the "Density Control" method of compaction is to be used, the following provisions shall apply:

a. The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the percent density as hereinafter specified under "Density".

b. In addition to the requirements specified for density, the full depth of the flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment.

c. After each section of flexible base is completed, density tests shall be performed as required by the ENGINEER. If the material fails to meet the density requirements, it shall be reworked as necessary to meet the density requirements.

d. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to the established lines and grades.

e. In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

f. All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

I. Should the base course, due to any reason or cause, lose the required stability, density or finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the CONTRACTOR.

3.05 PLACEMENT OF SUCCEEDING COURSES - ALL MATERIAL TYPES

A. Construction methods shall be the same as prescribed for the first course.

B. Prior to placing the surfacing on the completed base, the base shall be "dry cured" to the extent directed by the ENGINEER.

3.06 DENSITY CONTROL

A. When the "Density Control" method of compaction is indicated on the plans, each course of flexible base shall be compacted to the percent density shown on the plans.

B. The testing will be as outlined in TX DOT Test Method Tex-114-E.

C. It is the intent of this specification to provide the base material below the finished surface of the roadway not less than 98 percent of the density as determined by the compaction ratio method.

D. Field density determination shall be made in accordance with TX DOT Test Method Tex-115-E.

3.07 TOLERANCES

A. When tolerances are permitted by the plans, the limits establishing reasonable close conformity with percent density specified are defined by the following:

1. The ENGINEER may accept the work providing not more than 25 percent of the density tests performed each day are outside the specified density by no more than three pounds per cubic foot and where no two consecutive tests on continuous work are outside the specified limits.

END OF SECTION

Section 02069

DEMOLITION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. This Section includes the removal and disposal of old structures, or portions of old structures at location(s), as shown on PLANS. Also included is all excavation and backfill to complete the removal of these items hereinafter described.

1.02 MEASUREMENT AND PAYMENT

A. Unit Price.

1. Measurement: Work as provided for by this Section to be measured as each individual structure to be removed, except that pipe sewers shall be measured as each structure, and removal of existing curb and gutter shall be measured by the linear foot. The removal of structure is to include all appurtenances thereto.

2. Payment: Work as prescribed for in the Section to be paid for at unit price bid per each for “Removing Old Structures, Large” and “Removing Old Structures, Small” or Removing Old Structures (Pipe)” per each structure and curb and gutter shall be per linear foot, which price to be full compensation for all work, labor, tools, equipment, excavations, backfilling, materials, and incidentals necessary to complete the work.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 P R O D U C T S

2.01 SCHEDULE

A. Coordinate activities with other work if being performed not to cause any interruption during work being completed under this Contract.

PART 3 E X E C U T I O N

3.01 ERECTION/ INSTALLATION/ APPLICATION AND OR CONSTRUCTION:

A. Culverts or Sewers

Unless otherwise shown on the PLANS, remove pipe and appurtenances by careful excavation of all dirt on top and sides in such a manner that pipe will not be damaged.

B. Concrete Structures

Remove concrete structures or concrete portions of structures in sizes, not larger than 1 cubic foot. Concrete portions of structures below the permanent ground line which will not interfere in any manner with the proposed construction may be left in place, but removal to be carried at least 2 feet below the permanent ground line and neatly squared off. Cut off reinforcement flush to the concrete.

C. Steel Structure

Dismantle steel structures, or steel portions of structures, in sections as determined by the ENGINEER. Section to be of such weight and dimensions as to permit convenient handling, hauling, and storing if material is to be reused or salvaged. Remove revits and bolts connecting steel railing members, steel beams of beam spans, and steel stringers of truss spans by cutting heads with a “cold cut” and punching or drilling from the how or by such other method as will not injure members for reuse if materials is to be reused or salvaged and will meet approval of the ENGINEER. Removal of rivets and bolts from connections of truss members, bracing members, and other similar members in the structure not required unless specifically called for on the PLANS. CONTRACTOR to have the option of dismantling these members by flame-cutting the members immediately adjacent to the connections. Flame-cutting is not permitted, however, when shown on PLANS calls for the structure unit to be salvaged in such manner as to permit re-erection. In such case, carefully matchmark all members with paint in accordance with diagram furnished by the ENGINEER prior to dismantling, and remove all rivets and bolts from the connections in the manner specified in the first portion of this paragraph.

D. Timber Structure

Remove timber structures, or timber portions of structures, in such a manner as to not damage the timber as little as possible for further use. Remove all bolts and nails from such lumber as deemed salvageable by the ENGINEER. Unless otherwise shown on PLANS, CONTRACTOR may remove entirely or cut off timber piles at a point not less than 2 feet below ground line.

E. Brick or Stone Structure

Remove brick or stone structures, or stone portions of structures, in size not larger than 1 cubic foot. Portions of such structures below the permanent ground line which will not in any manner interfere with the proposed construction may be left in place, but removal to be carried at least 2 feet below the permanent ground line square off.

F. Material Salvage

All materials such as pipe, timber, railing, etc., which the ENGINEER deems as salvageable for reuse, and all structural steel to be carefully placed in neat piles at convenient loading points which will not interfere with traffic construction. Unless designated point shown on PLANS, all other materials deemed salvageable by the OWNER to be removed by the CONTRACTOR and neatly piled at convenient loading points on site at no cost to OWNER. All of these specified materials to be the property of OWNER. I – beams, stringers, etc., specified to be dismantled with damage for reuse, and all steel members match marked and dismantles for reuse, to be blocked off the ground in an upright position to protect the members against further damage. Materials, other than structural steel, deemed non-salvageable become the property of the CONTRACTOR, to be removed off the site by the CONTRACTOR and disposed of in a satisfactory manner. When temporary structure(s) are necessary for a detour adjacent to the present structure, CONTRACTOR will be permitted to use the material in the old structure for the detour structure, but he is to dismantle and stack or dispose of material as required above, as soon as new structure is complete.

END OF SECTION

SECTION 02100

Site Clearing

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Cleaning and grubbing on project site of trees, stumps, brush, roots, vegetation, logs rubbish and other objectionable matter within limits described in specifications or as shown on plans.

B. Cleaning and grubbing shall be in advance of grading operation except that in cuts over 3 feet in depth, grubbing may be done simultaneously with excavation, provided objectionable matter is removed as specified.

C. Dispose of all debris resulting from clearing and grubbing work.

1.02 PROTECTION OF ADJACENT WORK:

A. Protect all areas outside indicated construction areas.

B. Protect existing improvements, adjacent property, utilities and other facilities, and trees and plants not to be removed from injury or damage.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide materials required to perform work as specified.

PART 3 - EXECUTION

3.01 CLEARING:

A. Clear all areas covered by tables, benches, dikes, roads, structures and embankments within project limits unless otherwise shown in plans.

B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.

C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not removed.

3.02 GRUBBING:

A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:

1.	Footings	18-inches below bottom of footing.
2.	Sidewalks (or other types ofwalks)	12-inches below bottom of walk.
3.	Roadways or Streets	18-inches below bottom of subgrade
4.	Parking Areas	18-inches below bottom of subgrade
5.	Grassed Areas	18-inches below top soil
6.	Fills	24-inches below bottom of fill

B. Blasting not permitted.

3.03 REMOVAL OF DEBRIS AND CLEANUP

A. Burning is not permitted.

B. Dispose of all waste materials not burned by removal from site.

C. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CLEARING AND GRUBBING:

A. Clearing and Grubbing shall be measured for payment either in acres or by lump sum only for areas indicated on the plans, or as provided in the proposal and contract.

B. When not listed as separate contract pay item, Clearing and Grubbing shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor equipment, tools and in incidentals required for the work, all in accordance with the plans and these specifications.

D. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

END OF SECTION

SECTION 02200

EARTHWORK AND SITE GRADING

PART 1 - GENERAL

1.01 SCOPE

A. Perform all work required to complete the project as indicated by the Contract Documents, and furnish all supplementary items necessary for the completion of all work specified in this Section.

B. The work included in this Section shall include furnishing all labor, tools, materials and incidentals required to complete the work; excavate and fill to the lines, elevations and limits shown on the drawings for all pavements, buildings, landscaped areas, etc. as indicated below and cleaning up. The landscaped areas shall be graded to an elevation 6 inches below finished grade allowing for topsoil placement. The pavement areas shall be graded to an elevation below finished grade allowing for pavement placement. Building foundation areas shall be prepared in accordance with the geotechnical investigation and these specifications. The Contractor shall comply with all requirements of the city standards, the E.P.A. requirements and with the standards and specifications stated herein. All earthwork shall be done in accordance with the Geotechnical Investigation.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02100 - Site Clearing
B. Section 02270 - Soil Erosion and Sediment Control
B. Section 03300 - Concrete

1.03 QUALITY ASSURANCE

A. Codes and Standards

1. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction. The contractor shall have a trench safety plan prepared by a registered professional engineer for all excavations in excess of 5 feet deep.

B. Testing and Inspection Service

1. The owner will engage a soil testing and inspection service for quality control testing during earthwork operations to inspect and test all soil materials proposed for use in all excavation and fill operations.

1.04 JOB CONDITIONS

A. Existing Utilities

1. It shall be the Contractor's responsibility to verify the location (horizontal and vertical depth) of all utilities prior to beginning earthwork operations. If utilities are to remain in place, provide protection from damage during construction operations.

2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult owner immediately for directions as to how to proceed.

Cooperate with owner, public and private utility companies in keeping services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

3. Do not interrupt existing utilities serving facilities occupied and used by owner or adjacent properties, except when permitted in writing by property owner and then only after temporary utility services have been provided.

B. Use of Explosives

1. The use of explosives is not permitted.

C. Protection of Persons and Property

1. Barricade open excavations occurring as part of this work and post with warning lights. Provide traffic control as required by the city and as required to protect the public.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill Material:

1. Onsite excavated material free from trash, vegetation, rocks and lumps of earth larger than 4 inches in diameter or other objectionable material. Imported fill, if required, shall also be clean and have a liquid limit less than 50 percent.

B. Select Material:

1. Uniformly blended clayey sand to very sandy with a plasticity index between 6 and 15 and liquid limit of less than 35 percent.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which earthwork and site grading operations are to be performed. After excavation to subgrade, proofroll with a heavy pneumatic tired roller, loaded dump truck or similar equipment weighing approximately 25 tons or greater to help compact pockets of loose soil and expose additional areas of weak, soft or wet soils in the presence of the owner's representative. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 EXCAVATION

A. The Contractor shall excavate to the lines and elevations shown on the drawings, as previously indicated herein, regardless of the type, condition, or moisture content of the material encountered. Conduct excavation operations to provide positive drainage, at contractor's expense, at all times during construction. If positive drainage cannot be maintained, contractor shall keep standing water out of all excavations with adequate dewatering equipment.

B. All areas shall be cut accurately to the indicated grades. Care shall be taken to prevent excavation below the grades indicated and any bottoms or slopes that have been undercut shall be backfilled with approved materials and compacted to the required fill density.

C. Excavation required for rough grading shall be finished within a tolerance of 0.10 foot above or below the rough grade and in no case shall depressions be left that will not completely drain.

3.3 BUILDING SUBGRADE

A. Follow recommendations in geotechnical report and on the structural drawings.

3.4 FILLING

A. Remove all vegetation, organic materials and debris prior to placing fill.

B. Fill used below the parking and landscape areas shall be onsite soils encountered in the excavation or imported fill except grass, weeds, roots, vegetation and similar materials. The largest rock, particle or clod shall be less than 4 inches in diameter prior to compaction.

C. Care should be taken that utility cuts are not left open for extended periods and that cuts are properly backfilled. A positive cut-off of 1' thick compacted clay at the building line shall be used to help prevent water from migrating in the utility trench.

D. Before fill is placed under pavement or if subgrade is in an excavation, subgrade soils shall be scarified to a depth of 8" and recompacted between 95 and 98 percent of maximum dry density per ASTM D698 at a moisture content from +2 to +5 percent above optimum moisture content.

E. Fill below all pavement and landscaped areas shall be placed in 6 to 8 inch loose lifts and compacted to a minimum dry density of 95 percent of the standard proctor density (ASTM D698) under pavement and 95 percent elsewhere. The moisture content shall be between -1 and +3 percent above optimum.

F. Compaction shall be obtained by use of sheeps foot rollers, rubber-tired rollers, or other approved equipment capable of obtaining the required density. In the event the embankment material is too wet or too dry for adequate compaction, the contractor shall add moisture or dry the material as required to the extent necessary to obtain the required density.

3.5 PAVEMENT SUBGRADE

A. Construct subgrades for paved areas to conform to the grades, lines and cross sections shown on the drawings and per the recommendations in the geotechnical report.

B After the pavement subgrades have been shaped and compacted, bring the surface to a firm, unyielding surface by rolling the entire area with an approved vibratory roller. Compact all areas inaccessible to the roller with hand tampers weighing not less than 50 pounds, and with face area not more than 100-square-inches. Unless the material at the time of the rolling contains sufficient moisture to insure proper compaction, add water as directed before compacting. Allow the material containing excess moisture to dry to the proper consistency and moisture content before being compacted.

3.6 MOISTURE CONTROL

A. Where soil material must be moisture conditioned before compaction, uniformly apply required amount of water to surface of soil material in such manner as to prevent free water appearing on surface during, or subsequent to, compaction operations.

B. Remove and replace, or scarify and air dry soil material that is too wet to permit compaction to specified percentage of maximum density.

C. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread on surface where directed by owner's representative and permitted to dry. Assist drying by discing, harrowing or pulverizing until moisture-density relation tests fall within the herein-specified range.

3.7 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction

1. Testing laboratory services shall be in accordance with section 01454.
2. Allow owner's testing service to inspect and approve subgrades and fill layers before further construction work is performed. In the building areas, there will be at least 1 density test per 2500 square feet per lift with a minimum of 3. In the pavement areas there will be at least 1 density test per 5000 square feet per lift with a minimum of 3.
3. If, in the opinion of the owner, based on testing service and inspection, the subgrade or fills which have been placed are below the specified density, the contractor shall provide additional compaction and testing at no additional expense to the owner.
4. The results of density tests which may be selected will be considered satisfactory when they are in each instance equal to or greater than the specified density, and if not more than 1 density test out of 5 has a value greater than 2% below the required density.

3.8 MAINTENANCE

A. Protection of Graded Areas

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
2. Repair and re-establish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Reconditioning Compacted Areas

1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction. Use hand tamping for recompaction over underground utilities.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

Remove all excess excavation, trash, debris and waste materials, and legally dispose of off the owner's property, at no additional cost.

END OF SECTION

Section 02221

REMOVING EXISTING PAVEMENTS AND STRUCTURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removing concrete pavement, asphaltic concrete pavement, and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.

C. Removing pipe culverts and storm sewers.

D. Removing existing inlets and manholes.

E. Removing miscellaneous structures of concrete or masonry.

F. Removing irrigation concrete pipe, stand pipes, valves and related irrigation structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No Separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items for which this work is a component.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REGULATORY REQUIREMENTS

A. Conform to Section 01576 – Waste Material Disposal, applicable codes, and local laws for disposal of debris.

B. Coordinate clearing work with utility companies.

1.04 SUBMITTALS

A. Conform to the requirements of Section 01330 – Submittal Procedures.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Obtain advance approval from Resident Project Representative for dimensions and limits of removal work. Submit preconstruction photographs in accordance with the applicable portions of Section 01321 – Construction Photographs.

B. Locate and identify buried utilities. Identification shall be by flagging and offset staking.

3.02 PROTECTION

A. Protect the following from damage or displacement:

1. Adjacent public and private property.

2. Trees, plants, and other landscape features designated to remain.

3. Utilities designated to remain.

4. Benchmarks, monuments, and existing structures designated to remain.

3.03 REMOVALS

A. Remove pavement and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of 2-inches.

D. Where street and driveway saw cut locations coincide or fall within 3-feet of existing construction or expansion joints, break out to existing joints.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install and 8-in-thick masonry plug in pipe end prior to backfill.

G. Remove all irrigation structure that are to be abandoned as per the construction plans, all underground pipes and appurtenances shall be removed and the disturbed soils shall be replaced and compact to a minimum of 90% density to the elevation equal to the surrounding natural ground.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 02316 – Excavation and Backfill of Structures.

3.05 DISPOSAL

A. Disposal shall in accordance with requirements of Section 01576 – Waste Material Disposal.

B. Remove debris, rubbish, and extracted plant material from the site in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02241

PNEUMATIC TIRE ROLLING

PART 1 -GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This work shall consist of the compaction of embankment, flexible base, surface treatments, or pavements by the operation of approved pneumatic tire rollers.

PART 2 -PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. When used on seal coats, asphaltic surface treatments, and bituminous mixture pavements, the roller shall be self-propelled and equipped with smooth tread tires with a tire pressure of 45 psi.

B. The roller shall be so constructed as to be capable of being operated in both a forward and a reverse direction.

C. When used on bituminous mixture pavements, the roller shall have suitable provision for moistening the surface of the tires while operating.

D. When turning is impractical or detrimental to the work and when specifically directed by the ENGINEER, the roller shall be of the self-propelled type.

E. In lieu of the rolling equipment specified, the CONTRACTOR may operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time, its use shall be discontinued.

F. Rollers shall be maintained in good repair and operating condition and shall be approved by the ENGINEER.

2.02 LIGHT PNEUMATIC TIRE ROLLER:

A. The light pneumatic tire roller shall consist of not less than 9 pneumatic tire wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group, mounted in

a rigid frame, and provided with a loading platform or body suitable for ballast loading.

B. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle.

C. Under working conditions the pneumatic tire roller shall have an effective rolling width of approximately 60 inches and shall be so designed that by ballast loading the total load can be varied uniformly from 9,000 pounds or less to 18,000 pounds or more.

D. The roller shall be equipped with tires that will afford ground contact pressures to 45 pounds per square inch or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart. The roller under working conditions shall provide a uniform compression under all wheels.

E. Individuals tire inflation pressures shall be within +5 psi of each other.

F. The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type and the roller, when drawn or propelled by either type of equipment, shall be considered a light pneumatic tire roller unit.

2.03 MEDIUM PNEUMATIC TIRE ROLLER (TYPE A):

A. The medium pneumatic tire roller (Type A) shall consist of not less than 7 pneumatic tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading.

B. The front axles shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The pneumatic tire roller, under working conditions, shall have an effective rolling width of approximately 84 inches and shall be so designed that, by ballast loading, the total load may be varied uniformly from 23,500 pounds or less to 50,000 pounds or more.

C. The roller shall be equipped with tires that will afford ground contact pressures to 80 pounds per square inch or more. Individual tire inflation pressures shall be within +5 psi of each other.

D. The operating load and tire air pressure shall be within the range of the

manufacturer's chart.

E. The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type.

F. The roller, when drawn or propelled by any type of equipment, shall be considered a medium pneumatic tire roller unit.

G. The power unit shall have adequate tractive effort to properly move the operating roller at variable uniform speeds up to approximately 5 miles per hour.

2.04 MEDIUM PNEUMATIC TIRE ROLLER (Type B):

A. The medium pneumatic tire roller (Type B) shall conform to the requirements for Medium Pneumatic Tire Roller (Type A) as speCified above, except that the roller shall be equipped with tires that will afford ground contact pressures to 90 psi or more.

PART 3 -EXECUTION

3.01 CONSTRUCTION METHODS:

A. The embankment layer or the base course be sprinkled if directed and rolling with a pneumatic tire roller shall start longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 112 of width of the pneumatic tire roller.

B. On super-elevated curves, rolling shall begin at the low sides and progress towards the high sides.

C. Alternative trips of the roller shall be slightly different in length.

D. The light pneumatic tire roller shall be operated at speeds between 2 and 6 miles per hour for asphalt surfacing work and all other work.

E. The medium pneumatic tire roller shall be operated at speeds which produce a satisfactory product.

F. Sufficient rollers shall be provided to compact the material in a satisfactory

manner. When operations are so isolated from one another that 1 roller unit cannot perform the required compaction satisfactorily, additional roller units shall be provided.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. No additional compensation will be made for materials, equipment or labor required by this item, but shall be considered subsidiary to the various items of the contract.

END OF SECTION

Section 02241

PROOF ROLLING

PART 1- GENERAL

1.01 GENERAL DESCRIPTION WORK:

A. This work shall consist of furnishing and operating heavy, pneumatic-tired, compaction equipment for testing the compaction of embankment, subgrade or flexible base.

B. Proof roll is to be used to locate unstable areas.

PART 2- PRODUCTS

2.01 EQUIPMENT:

A. The proof rolling equipment shall consist of not less than 4 pneumatic tired wheels, running on axles carrying not more than 2 wheels, mounted in a rigid frame, and provided with a loading platform or a body suitable for ballast loading.

B. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces.

C. Under working conditions the proof roller shall have a rolling width of 8 feet to 10 feet and shall be so designed that by ballast loading the gross load may be varied uniformly from 25 tons to 50 tons.

D. The tires shall be capable of operating under the various loads with variable air pressure up to 150 pounds per square inch. The operating load and tire pressure shall be within the range of the manufacturer's chart and as directed by the ENGINEER.

E. The proof roller may be of the self-propelled type or shall be drawn by a suitable crawler-type tractor or a rubber tired tractor of adequate tractive effort. There shall be a sufficient quantity of ballast available to load the equipment to a maximum gross weight of 50 tons.

F. Rubber tired tractive equipment shall be used on base courses.

G. Other type tractive equipment may be used on embankment subgrade.

H. The heavy pneumatic tired roller unit shall be capable of turning 180 degrees in the crown width.

I. In lieu of the rolling equipment specified, the CONTRACTOR may, upon written permission from the ENGINEER, operate other equipment that will produce equivalent results as the specified equipment. If the substituted equipment fails to produces the desired results as would be expected of the specified equipment as determined by the ENGINEER, its use shall be discontinued.

PART 3 -EXECUTION

3.01 CONSTRUCTION METHODS:

A. This work shall be done to proof all prepared subgrade and flexible base courses or as directed by the ENGINEER.

B. On embankment compaction, each layer will be placed to specified thickness at optimum moisture and compacted with conventional equipment to comply with the requirements of the governing embankment item.

C. Prior to placing the overlaying course, the layer shall be proof rolled as directed by the ENGINEER.

D. When the operation of the proof rolling unit shows an area to be unstable or nonuniform, such area shall be brought to satisfactory stability and uniformity by additional compaction or by removal of unsuitable materials and replacement with suitable materials and recompacted.

E. The surface tested shall then be checked for conformity with line and grade and any irregularities corrected.

F. Roller shall be operated at speeds between 2 and 6 miles per hour or as directed by the ENGINEER.

PART 4- MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. No additional payment will be made for the materials, equipment or labor required by this item and shall be considered subsidiary to the various items included in the contract.

END OF SECTION

SECTION 02270

SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all labor, materials, tools, equipment, and services for all soil erosion and sediment control, as indicated, in accord with provisions of Contract Documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation in order to meet the United States Environmental Protection Agency requirements.

1.2 QUALITY ASSURANCE

A. Erosion Control Standards:

1. United States Environmental Protection Agency, National Pollutant Discharge Elimination System (NPDES) - Storm Water Management for Construction Activities.

2. North Central Texas Council of Governments (NCTCOG) - Storm Water Quality Best Management Practices for Construction Activities.

1.3 EROSION CONTROL PRINCIPLES:

A. Perform demolition, construction and other soil disturbances in a manner which minimizes soil erosion.

B. Retain and protect existing vegetation as much as is feasible.

C. Keep area which is exposed and free of vegetative cover to a minimum, within practical limits.

D. Protect exposed critical areas during prolonged construction or other land disturbance by temporary seeding, mulching or other suitable stabilization measures.

1.4 JOB CONDITIONS:

A. Comply with all requirements of the EPA for implementation of the storm water pollution prevention plan, under the NPDES General Permits for Storm Water Discharges from Construction Sites.

1.5 SUBMITTALS

A. Project Information:

1. Submit copy of NPDES Storm Water Permit for Construction Activities to Owner prior to construction.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Filter Fabric: Sediment control silt fabrics, AMOCO Style #2125 or approved equal.

B. Crushed stone.

C. Metal clips or ties.

D. Steel fence posts.

E. Grass Seed: annual ryegrass or Bermuda depending on the season.

F. Concrete block.

G. Wire screen.

PART 3 - EXECUTION

3.1 BEGINNING CONSTRUCTION

A. Prior to general demolition, install temporary silt fences and stabilized construction entrance as indicated on the storm water pollution prevention plan or where directed by Owner.

B. Construct erosion control devices in accordance with the storm water pollution prevention plan and as directed by the Owner during demolition and as demolition progresses.

C. Seed disturbed areas where construction activities temporarily cease at rate necessary to achieve a full stand of grass. Reseed as required until good stand of grass is achieved.

3.2 DURING CONSTRUCTION

A. Maintain temporary silt fences.

B. Inspect regularly, especially after rainstorms.

C. Repair or replace damaged or missing items.

D. Sow temporary grass cover over disturbed areas where construction activities temporarily cease for more than 21 days and as required by NPDES permit.

E. Install inlet protection as indicated by the storm water pollution prevention plan at each inlet.

F. Provide swales and dikes as necessary to direct all water towards a protected device.

G. Do not disturb existing vegetation (grass and trees) outside limits of demolition.

H. Remove sediment from behind temporary silt fences when it reaches a depth of 6 in.

3.3 COMPLETION OF CONSTRUCTION AND STABILIZATION OF THE SITE

A. Remove from site all temporary erosion control devices.

END OF SECTION

Section 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Clearing and grubbing, excavation, backfilling, and compaction of backfill for structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for structural excavation and backfill under this Section. Include payment in unit price or lump sum for construction of structures.

2. No separate or additional payment will be made for clearing and grubbing, surface water control, ground water control, or for excavation drainage. Include in the unit price or lump sum construction of structures.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.

C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.

D. Backfill: Select material meeting specified quality requirements, placed and compacted under controlled conditions around structures.

E. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

F. Foundation Base: For foundation base material, use crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.

G. Foundation Subgrade: Foundation subgrade is the surface of the natural soil which has been excavated and prepared to support the foundation base or foundation backfill, where needed.

H. Ground Water Control Systems: Installations external to the excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower the ground water, intercepting seepage which would otherwise emerge from the side or bottom of the excavation, and depressurization to prevent failure or heaving of the excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from the excavation. Remove rain water and surface water which accidentally enters the excavation as a part of excavation drainage.

J. Excavation Drainage: Removal of surface and seepage water in the excavation by sump pumping and using French drains surrounding the foundation to intercept the water.

K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below the foundation as shown on Drawings, and backfilled with foundation backfill material.

L. Shoring System: A structure that supports the sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.04 REFERENCES

A. ASTM D 558 - Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

B. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb (2.49-kg) Rammer and 12-in. (304.88-mm) Drop.

C. ASTM D 1556 - Density of Soil in Place by the Sand-Cone Method.

D. ASTM D 2487 - Classification of Soils for Engineering Purposes.

E. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

G. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

H. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

I. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

J. Federal Regulations, 29 CFR, Part 1926, Standards - Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit a work plan for excavation and backfill for each structure with complete written description which identifies details of the proposed method of construction and the sequence of operations for construction relative to excavation and backfill activities. The descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to the Engineer that the procedures meet the requirements of the Specifications and Drawings.

C. Submit excavation safety system plan.

1. The excavation safety system plan shall be in accordance with applicable OSHA requirements for all excavations.

2. The excavation safety system plan shall be in accordance with the requirements of Section 01561 - Trench Safety System, for all excavations that fall under State and Federal trench safety laws.

D. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

E. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.06 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Contractor shall perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving the requirements of this Specification.

B. Use equipment which will produce the degree of compaction specified. Backfill within 3 feet of walls shall be compacted with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to the depth of the fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

A. Backfill materials shall conform to the classifications and product descriptions of Section 02320 - Utility Backfill Materials. The classification or product description for backfill applications shall be as shown on the Drawings and as specified.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Conduct an inspection to determine condition of existing structures and other permanent installations.

B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where affected by the Work, and is considered hazardous to traffic movements.

C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 01561 - Trench Safety Systems.

D. Project sites, rights-of-way and easements shall be made ready for construction operations in accordance with Section 02200 – Earthwork and Site Grading.

E. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

F. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.02 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings, and in accordance with requirements of City Ordinance.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.

D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.

E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to the Owner.

3.03 EXCAVATION

A. Perform excavation work so that the underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to the absolute minimum necessary. No additional payment will be made for excess excavation.

B. The use of explosives or headache balls is prohibited.

C. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Resident Project Representative and obtain instructions before proceeding in such areas.

D. Immediately notify the agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Resident Project Representative and agency for any repairs or relocations, either temporary or permanent.

E. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.

F. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.

G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed by the Engineer, replace those which are damaged or destroyed by the Work.

H. Provide sheeting, shoring, and bracing where required to safely complete the Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect the Work and adjacent structures or improvements. Sheeting, shoring, and bracing used to protect workmen and the public shall conform to requirements of Section 01561 - Trench Safety Systems.

I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, concrete fill, cement stabilized sand, or other material approved by Resident Project Representative.

J. After completion of the structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Engineer in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to the Work and adjacent structures or improvements.

K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or material approved by Resident Project Representative.

3.04 HANDLING EXCAVATED MATERIALS

A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at a sufficient distance from excavation to prevent slides or cave-ins.

3.05 DEWATERING

A. Provide ground water control per Section 01578 - Control of Ground Water and Surface Water.

B. Keep ground water surface elevation a minimum of 2 feet below the bottom of the foundation base.

C. Maintain ground water control as directed by Section 01578 - Control of Ground Water and Surface Water and until the structure is sufficiently complete to provide the required weight to resist hydrostatic uplift with a minimum safety factor of 1.2.

3.06 FOUNDATION EXCAVATION

A. Notify Resident Project Representative at least 48 hours prior to planned completion of foundation excavations. Do not place the foundation base until the excavation is accepted by the Resident Project Representative.

B. Excavate to elevations shown on Drawings, as needed to provide space for the foundation base, forming a level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or a material as directed by the Resident Project Representative. Prior to placing material over it, recompact the subgrade where indicated on the Drawings, scarifying as needed, to 98 percent of the maximum Standard Dry Density according to ASTM D 698. If the specified level of compaction cannot be achieved, moisture condition the subgrade and recompact until 98 percent is achieved, over-excavate to provide a minimum layer of 24 inches of foundation backfill material, or other means acceptable to the Resident Project Representative.

C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by the Resident Project Representative.

D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in a satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

E. Soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to the required subgrade, shall be removed and replaced with foundation backfill material, as directed by Resident Project Representative, at no additional cost to the Owner.

F. Place foundation base, or foundation backfill material where needed, over the subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with a seal slab or cement-stabilized sand.

G. Crushed aggregate, and other free draining Class I materials, shall have a filter fabric as specified in Section 02621 - Geotextile, separating it from native soils or select material backfill. The fabric shall overlap a minimum of 12 inches beyond where another material stops contact with the soil.

H. Crushed aggregate, and other Class I materials, shall be placed in uniform layers of 8-inch maximum thickness. Compaction shall be by means of at least two passes of a vibratory compactor.

3.07 FOUNDATION BASE

A. After the subgrade is properly prepared, including the placement of foundation backfill where needed, the foundation base shall be placed. The foundation base shall consist of a 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, a seal slab with a minimum thickness of 4 inches may be placed. The foundation base shall extend a minimum of 12 inches beyond the edge of the structure foundation, unless shown otherwise on the Drawings.

B. Where the foundation base and foundation backfill are of the same material, both may be placed in one operation.

3.08 BACKFILL

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Use existing material that qualifies as select material, unless indicated otherwise. Deposit backfill in uniform layers and compact each layer as specified.

B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that the concrete has reached a minimum of 90 percent of the specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until the slab or intermediate walls have been placed and concrete has attained sufficient strength.

C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.

D. Maintain fill material at no less than 2 percent below nor more than 2 percent above optimum moisture content. Place fill material in uniform 8-inch maximum loose layers. Compaction of fill shall be to at least 95 percent of the maximum Standard Dry Density according to ASTM D 698 under paved areas. Compact to at least 95 percent around structures under unpaved areas.

E. Where backfill is placed against a sloped excavation surface, run compaction equipment across the boundary of the cut slope and backfill to form a compacted slope surface for placement of the next layer of backfill.

F. Place backfill using cement stabilized sand in accordance with Section 02321 - Cement Stabilized Sand.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Tests will be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.

C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions:

1. A minimum of one test for every 100 cubic yards of compacted backfill material.

2. A minimum of three density tests for each full work shift.

3. Density tests will be performed in all placement areas.

4. The number of tests will be increased if inspection determines that soil types or moisture contents are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density.

D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.

E. If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

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Section 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in the unit price for installed underground piping, sewer, conduit, or duct work.

2. No separate or additional payment will be made for surface water control, ground water control, or for excavation drainage. Include in the unit price for the installed piping, sewer, conduit, or duct work.

3. Concrete Encasement shall be measured and paid for by cubic yard, complete in place. Measurement shall be to the neat lines shown on the plans.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at the trench subgrade after excavation to depth of bottom of the bedding as shown on the Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: The portion of trench backfill that extends vertically from top of foundation up to a level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: The material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: The portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to a level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: The portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: The portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:
1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement are considered suitable, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as a part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using a drainage layer, as defined in ASTM D 2321, placed on the foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to the stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as a result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

   a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.

   b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in the embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in the pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Subtrench: Subtrench is a special case of benched excavation. Subtrench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of a subtrench depends upon trench stability and safety as determined by the Contractor.

O. Trench Dam: A placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along the trench.

P. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 01561 - Trench Safety Systems.

1. Trench Shield (Trench Box): A portable worker safety structure moved along the trench as work proceeds, used as a protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within the trench. Trench shields may be stacked if so designed or placed in a series depending on depth and length of excavation to be protected.

2. Shoring System: A structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of the ground affecting adjacent installations or improvements.

3. Special Shoring: A shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on the Drawings.

1.04 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.8-mm) Drop.

D. ASTM D 1556 - Test Method for Density in Place by the Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

L. Code of Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SCHEDULING

A. Schedule work so that pipe embedment can be completed on the same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.06 SUBMITTALS

A. Conform to Section 01330 - Submittal Procedures.

B. Submit a written description for information only of the planned typical method of excavation, backfill placement and compaction, including:

1. Sequence of work and coordination of activities.

2. Selected trench widths.

3. Procedures for foundation and embedment placement, and compaction.

C. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

D. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

E. Submit a trench excavation safety program in accordance with requirements of Section 01561 - Trench Safety System. Include designs for special shoring meeting the requirements defined in Paragraph 1.08, Special Shoring Design Requirements.

F. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

1.07 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by the Contractor's Professional Engineer to provide support for the sides of the excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by the Contractor’s Professional Engineer to meet the project site requirements based on the manufacturer’s standard design.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving the requirements of this Section.

B. Use only hand-operated tamping equipment until a minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.09, Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials.

B. Concrete Encasement and Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

B. Install rigid pipe to conform with standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

3.02 PREPARATION

A. Establish traffic control to conform with requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by the Work, and is considered hazardous to traffic movements.

B. Perform work to conform with applicable safety standards and regulations. Employ a trench safety system as specified in Section 01561 - Trench Safety Systems.

C. Immediately notify the agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from the Resident Project Representative and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform with requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface water control measures to conform with Section 01578 - Control of Ground Water and Surface Water.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 - Field Surveying.

3.03 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings, and in accordance with requirements of City Ordinance.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to Owner.

3.04 EXCAVATION

A. Except as otherwise specified or shown on the Drawings, install underground utilities in open cut trenches with vertical sides. Open cut excavation does not include the use of explosives or headache balls. The use of explosives or headache balls is prohibited.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on the Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using the following schedule as related to pipe outside diameter (O.D.). Maximum trench width shall be the minimum trench width plus 24 inches.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
Greater than 30	O.D. + 36

D. Use sufficient trench width or benches above the embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from the surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify the Resident Project Representative and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with the trench excavation, so that the soils within the full height of the trench excavation walls will remain laterally supported at all times.

2. For all types of shoring, support trench walls in the pipe embedment zone throughout the installation. Provide trench wall supports sufficiently tight to prevent washing the trench wall soil out from behind the trench wall support.

3. Unless otherwise directed by the Engineer, leave sheeting driven into or below the pipe embedment zone in place to preclude loss of support of foundation and embedment materials. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and the trench wall in the vicinity of the pipe zone.

4. Employ special methods for maintaining the integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of the pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into the embedment zone shall be the equivalent of a 1-inch-thick steel plate. Fill voids left on removal of supports with compacted backfill material.

G. Use of Trench Shields. When a trench shield (trench box) is used as a worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to the trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor the degree of compaction reduced.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath the shield. For backfill above bedding, lift the shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in a safe manner.

3.05 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials which are suitable as defined in this Section and conforming with Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at a distance from the trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming with requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect excess stockpiles for use on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls.

3.06 GROUND WATER CONTROL

A. Implement ground water control according to Section 01578 - Control of Ground Water and Surface Water. Provide a stable trench to allow installation in accordance with the Specifications.

3.07 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Immediately prior to placement of embedment materials, the bottoms and sidewalls of trenches shall be free of loose, sloughing, caving, or otherwise unsuitable soil.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around the pipe to provide uniform bearing and side support when compacted. Do not allow materials to free-fall from heights greater than 24 inches above top of pipe. Perform placement and compaction directly against the undisturbed soils in the trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of the embedment zone unless means to maintain the density of compacted embedment material are used. If moveable supports are used in embedment zone, lift the supports incrementally to allow placement and compaction of the material against undisturbed soil.

E. Place geotextile to prevent particle migration from the in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around the pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside the pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Neither water tamping nor jetting are allowed.

J. For water line construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material.

K. Place trench dams in Class I embedments in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

L. The Contractor shall provide whatever means and materials are required to prevent pipe flotation at no separate pay.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only the minimum length of trench open as necessary for construction.

B. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave the sheeting in place. Cut off sheeting 1.5 feet or more above the crown of the pipe. Remove trench supports within 5 feet from the ground surface.

C. When shown on Drawings, a random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

D. Place trench zone backfill in lifts and compact by methods selected by the Contractor. Fully compact each lift before placement of the next lift.

1. Bank run sand.

    a. Maximum 9-inches compacted lift thickness.

    b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.

    c. Moisture content within 3 percent of optimum determined according to ASTM D 698

2. Cement-stabilized sand.

    a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but not exceeding 24 inches.

    b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 558.

    c. Moisture content on the dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Select fill.

    a. Maximum 6-inches compacted lift thickness.

    b. Compaction by equipment providing tamping or kneading impact to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.

    c. Moisture content within 2 percent of optimum determined according to ASTM D 698.

E. For trench excavations outside pavements, a random backfill of suitable material may be used in the trench zone.

1. Fat clays (CH) may be used as trench zone backfill outside paved areas at the Contractor's option. If the required density is not achieved, the Contractor, at his option and at no additional cost to the Owner, may use lime stabilization to achieve compaction requirements or use a different suitable material.

2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.

3. Compact to a minimum of 90 percent of the maximum dry density determined according to ASTM D 698.

4. Moisture content as necessary to achieve density.

F. Concrete encasement shall be placed at locations shown on the drawings and as directed by the Resident Project Representative.

G. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES, AND OTHER PIPELINE STRUCTURES

A. Meet the requirements of adjoining utility installations for backfill of pipeline structures, as shown on the Drawings.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.

C. Tests will be performed on a minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions.

1. A minimum of one test for every 100 Linear feet of trench of compacted embedment and compacted trench zone backfill material.

2. A minimum of three density tests for each full shift of Work.

3. Density tests will be distributed among the placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below the fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than the acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at the same frequency as the first test series, including verification tests.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with non-conforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal

END OF SECTION

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Section 02318

EXCAVATION (Detention)

This specification includes requirements for the construction of new ditches or widening existing ditches within the Work area, and includes the following:

1.0 General
2.0 Materials & Equipment
3.0 Construction Methods
4.0 Measurement and Payment

PART 1 - GENERAL

1.1 RELATED DOCUMENTS, CONTRACT CLAUSES, & SPECIFICATIONS

The following may not include all related documents, contract clauses, & technical specifications, and does not relieve the Contractor of the responsibility of performing work associated with this specification in accordance with all terms of the Contract herein.

1.2 GENERAL

In general, the Contractor shall excavate areas as shown on the plans or as directed, and remove materials encountered to the lines, grades, and typical sections shown on the plans and cross-sections.

PART 2 – MATERIALS & EQUIPMENT (Not Applicable To This Specification)

PART 3 – CONSTRUCTION METHODS

Excavated material shall be stockpiled in areas as identified in the plans. If otherwise noted in the plans, that the excavated material is identified as unsuitable or excess material, the Contractor shall accept ownership and dispose of material in accordance with local, state, and federal regulations at locations outside the right of way. The Contractor shall maintain drainage in the excavated area as required. The Contractor shall shape slopes to avoid loosening material below or outside the proposed grades, and remove and dispose of slides as directed by the Engineer.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

This Item will be measured by the cubic yard in its original position as computed by the method of average end areas. This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified in accordance with Contract provisions. Additional measurements

or calculations will be made if adjustments of quantities are required. Shrinkage or swelling factors will not

be considered in determining the calculated quantities.

4.2 PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Ditch Excavation". Price is full compensation for authorized excavation; drying; undercutting subgrade and reworking or replacing the undercut material in rock cuts; hauling; disposal of material not used elsewhere on the project; scarification and compaction; and equipment, labor, materials, tools, and incidentals.

Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

END OF SECTION

Section 02320

UTILITY BACKFILL MATERIALS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:
- Concrete sand
- Gem sand
- Pea gravel
- Crushed stone
- Crushed concrete
- Bank run sand
- Select backfill
- Random backfill

C. Material Handling and Quality Control Requirements.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for backfill material under this Section. Include payment in unit price for applicable utility installation.

2. Payment for backfill material, when included as a separate pay item, is on a cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, and waste; or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are the following:

1. Those meeting specification requirements.

2. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I A requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for the designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within the embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching, and initial backfill.

G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in the trench zone from top of embedment zone to base course in paved areas or to the surface grading material in unpaved areas.

H. Foundation: Either suitable soil of the trench bottom, or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: A source selected by the Contractor for supply of embedment or trench zone backfill material. A selected source may be the project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Section 02317 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

1.04 REFERENCES

A. ASTM C 33 - Specification for Concrete Aggregate.

B. ASTM C 40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Test Method for Lightweight Pieces in Aggregate.

D. ASTM C 131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

E. ASTM C 136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Test Method for Amount of Materials in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

J. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

K. ASTM D 4643 - Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

L. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

M. TxDOT Tex-104-E - Test Method for Determination of Liquid Limit of Soils (Part 1)

N. TxDOT Tex-106-E - Test Method - Methods of Calculating Plasticity Index of Soils.

O. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit a description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials to comply with Paragraph 2.03, Materials Testing.

D. Before stockpiling materials, submit a copy of temporary easement or approval from landowner for stockpiling backfill material on private property.

E. For each delivery of material, provide a delivery ticket which includes source location.

1.06 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.03.

B. Verification tests of backfill materials may be performed by the Owner in accordance with Section 01454 - Testing Laboratory Services and in accordance with Paragraph 3.03.

C. Random fill obtained from the project excavation as source is exempt from pre-qualification requirements by Contractor but must be inspected by Owner’s testing lab for unacceptable materials based on ASTM D 2488.

PART 2 P R O D U C T S

2.01 MATERIAL CLASSIFICATIONS

A. Materials for backfill shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:

1. Class IA. Class IA materials shall be manufactured aggregates with an open graduation. Materials shall consist of angular, crushed stone or rock, or crushed gravel. Class IA

embedment material shall have a large void content and contain little or no fines. 100% of the material shall pass a 1 ½ " sieve, up to 10% shall pass a No. 4 sieve, and no more than 5% shall pass a No. 200 sieve. Class IA materials used for foundation, replacement of over-excavation, or in the pipe embedment zone shall be wrapped in one layer of geotextile filter cloth when groundwater is present in the excavated trench and the trench walls in the pipe embedment zone are composed of fine granular soils. Filter cloth shall be Poly-Filter GB, Nicolon 70/20, or Nicolon 40/30A.

2. Class IB. Class IB materials shall be manufactured / processed aggregates with a dense graduation. Materials shall consist of angular, crushed stone (or other Class IA materials) and stone/sand mixtures and contain little or no fines. 100% of the material shall pass a 1 ½ " sieve, up to 50% shall pass a No. 4 sieve, and no more than 5% shall pass a No. 200 sieve.

3. Class II. Class II materials shall be clean, coarse-grained soils classified as GW, GP, SW, or SP soil groups under ASTM D 2487 or coarse-grained soils which are borderline clean to with fines classified as GW-GC or SP-SM under ASTM D 2487. 100% of the GW, GP, SW, SP, GW-CC, and SP-SM soils shall pass a 1 ½ " sieve. Up to 50% of the GW and GP coarse fraction (material retained on a No. 200 sieve) shall pass a No. 4 sieve. Up to 5% of the GW, GP, SW, and SP soils shall pass a No. 200 sieve. Between 5% and 12% of the GW-CC and SP-SM soils shall pass a No. 200 sieve.

4. Class III. Class III materials shall be coarse-grained soils with fines. The soils shall be classified as GM, GC, SM, or SC soil groups under ASTM D 2487. 100% of the GM, GC, SM, and SC soils shall pass a 1 ½ " sieve. Up to 50% of the GM and GC coarse fractions (material retained on a No. 200 sieve) shall pass a No. 4 sieve. At least 50% of the SM and SC coarse fractions shall pass a No. 4 sieve. Between 12% and 50% of the GM, GC, SM, and SC soils shall pass a No. 200 sieve.

2.02 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by the Resident Project Representative. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by the applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to the following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.

2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.

3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in the product specification, and approved by Engineer, provided that the physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D 2487) meeting the following requirements:

1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140. The amount of clay lumps or balls not exceeding 2 percent.

2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318:

   a. Liquid limit: not exceeding 25 percent.

   b. Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C 33 and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to the requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2”	100
3/8”	85 to100
No. 4	10 to 30
No. 8	0 to 10
No.16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for the same construction activity from a single source.

2. Non-plastic fines.

3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.

4. Crushed aggregate shall have a minimum of 90 percent of the particles retained on the No. 4 sieve with 2 or more crushed faces as determined by Test Method Tex-460-A, Part I.

5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from a naturally occurring single source. Uncrushed gravel are not acceptable materials for embedment where crushed stone is shown on the applicable utility embedment drawing details.

6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are the same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15"	15" - 8"	<8"
1"	95 - 100	100	-
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with a plasticity index between 7 and 20.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by the applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

K. Cement Stabilized Sand: Conform to requirements of Section 02321 - Cement Stabilized Sand.

L. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

2.03 MATERIALS TESTING

A. Ensure that material selected, produced and delivered to the project meets applicable specifications and is of sufficient uniform properties to allow practical construction and quality control.

B. Source or Supplier Qualification. Perform testing, or obtain representative tests by suppliers, for selection of material sources and products. Provide test results for a minimum of three samples for each source and material type. Tests samples of processed materials from current production representing material to be delivered. Tests shall verify that the materials meet specification requirements. Repeat qualification test procedures each time the source characteristic changes or there is a planned change in source location or supplier. Qualification tests shall include, as applicable:

1. Gradation. Complete sieve analyses shall be reported regardless of the specified control sieves. The range of sieves shall be from the largest particle through the No. 200 sieve.

2. Plasticity of material passing the No. 40 sieve.

3. Los Angeles abrasion wear of material retained on the No. 4 sieve.

4. Clay lumps.

5. Lightweight pieces

6. Organic impurities

C. Production Testing. Provide reports to the Engineer from an independent testing laboratory that backfill materials to be placed in the Work meet applicable specification requirements.

D. Deliver material samples for verification testing to the site of the Work.

PART 3 E X E C U T I O N

3.01 SOURCES

A. Use of material encountered in the trench excavations is acceptable, provided applicable specification requirements are satisfied. If excavation material is not acceptable, provide from other approved source.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use and deliver samples for verification testing to the site of the Work.

C. Obtain approval for each material source by the Engineer before delivery is started. If sources previously approved do not produce uniform and satisfactory products, furnish materials from other approved sources. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet the requirements of the specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once a material is approved by the Engineer, expense for sampling and testing required to change to a different material will be credited to the Owner through a change order.

D. Bank run sand, select backfill, and random backfill, if available in the project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete the work from off-site sources.

E. The Owner does not represent or guarantee that any soil found in the excavation work will be suitable or acceptable as backfill material.

3.02 MATERIAL HANDLING

A. When backfill material is obtained from either a commercial or non-commercial borrow pit, open the pit to expose the vertical faces of the various strata for identification and selection of approved material to be used. Excavate the selected material by vertical cuts extending through the exposed strata to achieve uniformity in the product.

B. Establish temporary stockpile locations for practical material handling and control, and verification testing in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near the project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering the drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

A. Quality Control

1. The Resident Project Representative may sample and test backfill at:

   a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.

   b. On-site stockpiles.

   c. Materials placed in the Work.

2. The Resident Project Representative may resample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: The project testing laboratory will provide verification testing on backfill materials, as directed by the Resident Project Representative. Samples may be taken at the source or at the production plant, as applicable.

END OF SECTION

Section 02321

CEMENT STABILIZED SAND

1.0 G E N E R A L

1.01 SECTION INCLUDES

A Cement stabilized sand for backfill and bedding.

B References to Technical Specifications:

1. Section 01330 – Submittals
2. Section 02320 – Utility Backfill Materials
3. Section 01454 – Testing Laboratory Services

C Referenced Standards:

1. American Society for Testing and Materials (ASTM)

a. ASTM D 558, “Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures”

b. ASTM D 1632, “Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory”

c. ASTM D 1633, “Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders
”

d. ASTM C 150, “Standard Specification for Portland Cement”

e. ASTM C 33, “Standard Specification for Concrete Aggregates”

f. ASTM D 2487, “Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)”

g. ASTM C 142, “Standard Test Method for Clay Lumps and Friable Particles in Aggregates”

h. ASTM C 123, “Standard Test Method for Lightweight Particles in Aggregate”

i. ASTM C 40, “Standard Test Method for Organic Impurities in Fine Aggregates for Concrete”

j. ASTM C 4318, “Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils”

k. ASTM C 94, “Standard Specification for Ready-Mixed Concrete”

l. ASTM C 31, “Standard Practice for Making and Curing Concrete Test Specimens in the Field”

1.02 MEASUREMENT AND PAYMENT

A Unless indicated as an Extra Item, no separate payment will be made for cement stabilized sand under this Section. Include cost in Bid Items for applicable utility or structure installation.

B If use of cement stabilized sand is allowed, based on the Engineer's direction, and indicated in Section 00405 – Schedule of Unit Price work as an Extra Item, measurement will be on a per ton basis. A conversion between volumes calculated based on theoretical limits and total weight will be made based on a ratio of 1.64 tons per cubic yard.

1.03 SUBMITTALS

A Make Submittals required by this Section under the provisions of Section 01330 – Submittals.

B Submit material qualification and design mix tests to include:

1. Three series of tests of sand or fine aggregate material from the proposed source. Tests shall include procedures defined in this Section, 2.01 “Materials”.

2. Three moisture-density relationship tests prepared using the material qualified by the tests in this Section, 1.03B1. Blends of fine aggregate from crushed concrete and bank run sand shall be tested at the ratio to be used for the design mix testing.

3. Design mix report to meet the specifications of this Section, 1.04 “Design Requirements”. The design mix shall include compressive strength tests after 48-hours and 7 days curing.

1.04 DESIGN REQUIREMENTS

A Design sand-cement mixture to produce a minimum unconfined compressive strength of 100 pounds per square inch in 48 hours when compacted to a minimum 95 percent in accordance with ASTM D 558 and when cured in accordance with ASTM D 1632, and tested in accordance with ASTM D 1633. Mix shall contain a minimum of 1-1/2 sacks of cement per cubic yard. Compact mix with moisture content on the dry side of optimum.

2.0 P R O D U C T S

2.01 MATERIALS

A Cement shall be Type 1 Portland cement conforming to ASTM C 150.

B Sand shall be clean, durable, and meet grading requirements for fine aggregates of ASTM C 33 and the following requirements:

1. Classified as SW, SP or SM by the United Soil Classification System of ASTM D 2487.

2. Deleterious material content:
   a. Clay lumps shall comprise less than 0.5 percent by ASTM C 142.

b. Lightweight pieces shall comprise less than 5.0 percent by ASTM C 123.

c. Organic impurities shall produce color no darker than the standard color by ASTM C 40 ASTM.

3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C Fine aggregate, manufactured from crushed concrete meeting the quality requirements for crushed rock material in Section 02320 - Utility Backfill Materials, may be used as a complete or partial substitute for Bank Sand. The blending ratio of fine aggregate from crushed concrete and Bank Sand shall be defined in the mix design report.

D Water shall be potable, free of oils, acids, alkalies, organic matter, or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

A Thoroughly mix sand, cement and water in proportions of the mix design using a pugmill-type mixer. The plant shall be equipped with automatic weight controls to ensure correct mix proportions.

B Stamp batch ticket at plant with time of loading directly after mixing. Material not placed and compacted within 4 hours after mixing shall be rejected.

3.0 E X E C U T I O N

3.01 PLACEMENT AND COMPACTION

A Place sand-cement mixture in 8-inch-thick loose lifts and compact to a minimum of 95 percent of ASTM D 558, unless otherwise specified on Plans. The moisture content during compaction shall be on the dry side of optimum but sufficient for hydration. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at the plant.

B Do not place or compact sand-cement mixture in standing or free water.

3.02 FIELD QUALITY CONTROL

A Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B Mixing plant inspections will be performed periodically. Material samples will be obtained and tested in accordance with this Section, 2.01 “Materials”, if there is evidence of change in material characteristic.

C One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first,

middle, and last third of the truck and composite them into one sample for test purpose.

D Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

E After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

F Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

G A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

H Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

I Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number
2. Time material was batched
3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number
8. Indication of compliance / non-compliance
9. Mixture identification
10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633

16. Supplier mixture identification

17. Specimen diameter and height, in.

18. Specimen cross-sectional area, sq. in.

J The cement content will be checked on samples obtained in the field whenever there are apparent changes in the mix properties.

3.03 ACCEPTANCE

A Strength level of material will be considered satisfactory if:
1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
2. All 7-day individual strength tests (average of two specimens) are greater than or equal to100 psi.

B Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C The material will be considered unacceptable and subject to removal and replacement at Contractors expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi

D When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E Testing laboratory shall notify Contractor, Project Manager, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.

G Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

A When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2\ (100\ \text{psi} - \text{Actual psi})}{100}$$

C When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to City.

END OF SECTION

Section 02580

PAVEMENT MARKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pavement striping and handicap symbols.
2. Primer adhesive.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installations instructions including guidelines and templates as required.

B. Samples: Submit test samples when requested.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Handicap parking space marking shall comply with state of Texas and city requirements.

1.4 PROJECT CONDITIONS

A. Apply marking when surfaces are thoroughly dry and when air temperature is above 40 degrees F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Sherwin-Williams.
2. Pratt & Lambert.

2.2 MATERIALS

A. Latex Paint:

1. Colors: White, yellow, red, and blue as required.

2. Acceptable products - Sherwin-Williams:
   a. White or Yellow: Set Fast Latex Traffic Marking Paint or Acrylic Water Borne Traffic Marking Paint.
   b. Red or Blue: Metalatex Semi-Gloss Coatings.

3. Acceptable Products - Devoe:
   a. White or Yellow: #416XX Traffic-Line Water Based Traffic Marking Paint.
   b. Red or Blue: #83XX Mirrolac W.B.

B. Paint Primer: As recommended by paint manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure new concrete and asphaltic concrete paving has cured for 30 days minimum prior to application of pavement marking.

3.2 PREPARATION

A. Clean surface of scale, dirt, mud, sand gravel, oil, grease and other foreign material.

B. On portland cement concrete, apply primer for striping as recommended by paint manufacturer to act as barrier coat with curing compound.

C. Layout lines and symbols in advance of making application. Space control points at intervals to ensure accurate location of markings.

3.3 PAINT STRIPING APPLICATION

A. Lay out markings using guide line, templates and forms as required. Use white or yellow, match existing paint to distinguish parking spaces. Use red paint for fire lanes.

B. Apply 4" wide stripes at manufacturer's recommended rate.

C. Stencil "FIRE LANE - NO PARKING" in 4" high white block letters on red background 6" high and of appropriate length for lettering background at intervals not closer than 25 ft. and not farther apart than 50 ft. on curbs and pavement throughout length of fire lane.

E. Place suitable warning signs near work site to alert approaching traffic from all directions to prevent damage to newly painted surfaces.

3.4 PROTECTION

A. Protect pavement markings in accordance with manufacturer's instructions.

END OF SECTION

SECTION 02711

CHAIN LINK FENCE

PART 1 GENERAL

1.01 DESCRIPTION

A. Work under this section includes furnishing and installation of all chain link fence, grates, and accessories complete with all required accessories, as shown on the drawings and as specified herein.

B. Refer to the following Sections for related work:

1. Section 02200 - Earth Work
2. Section 03300 - Concrete

1.02 QUALITY ASSURANCE

A. Steel pipe for posts and accessories shall be hot dip galvanized conforming to provisions of ASTM A-123 for zinc coating.

B. Chain link fabric shall conform to ASTM A-392 Class 2 for wire galvanized coating.

1.03 SUBMITTALS

A. Submit complete installation shop drawings showing placement of posts, bracing and gates. Do not begin work prior to approval of submittal.

PART 2 PRODUCT

2.01 MATERIALS

A. Gate posts shall be schedule 40 pipe 2-7/8 inch outside diameter for single gates 6 feet or less in width and double gates 12 feet or less in width for fences less than 72 inches high. Rolling gates shall be supported on rolling wheels at the top of the gate. Minimum clearance shall be 1 foot.

B. End, corner and slope posts shall be schedule 0 pipe 2-3/8 inch outside diameter for fences less than 72 inches high.

C. Line posts shall be schedule 40 pipe 1-7/8 inch outside diameter for fences less than 72 inches high.

D. Top rail shall be schedule 40 pipe 1-5/8 inch outside diameter.

E. Horizontal braces shall be schedule 40 pipe 1-5/8 inch outside diameter with 3/8 inch truss rod at all gate and terminal posts.

F. Chain link fabric shall be woven from 9 gage wire with knuckled finish top and bottom edges.

G. Gate frames shall be schedule 40 pipe 1-7/8 inch outside diameter.

H. All incidental fittings, braces, post caps, gate hinges shall be manufacturer's standard metal fittings, coated as previously specified for posts.

2.02 FABRICATION

A. Fabricate all components form new ferrous galvanized materials. Chain link fabric to be galvanized after fabrication.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify location of fencing with approved shop drawings and layout of property.

3.02 INSTALLATION

A. Footings shall be concrete a minimum of 8 inches diameter. Footings for line posts shall be at least 3 feet deep, gate posts shall be at least 4 feet deep. Crown footings to shed water. Concrete shall meet Section 03300 requirements. Line posts at 10 feet o.c. maximum. The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within 7 days after the individual post footing is completed.

B. Attach fabric, bracing, gates and accessories in conformance with manufacturer's standard. Fabric to be placed on outward facing side of posts. Gates shall have provision for padlock security fastening.

C. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

D. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

E. The wire fabric shall be firmly attached to the posts and braced in the manner shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than 1 inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

3.03 CLEANUP

A. Inspect fence, touch-up any damaged finish, remove all work related debris.

END OF SECTION

SECTION 02720

STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes storm drainage systems consisting of storm sewers, inlets, culverts and other drainage structures as shown on the Drawings and specified herein from a point 5 feet outside the buildings to the point of disposal.

B. Related Sections: The following Sections contain requirements that relate to this section.

1. Division 2 Section 02200: Earthwork and Site Grading
2. Division 2 Section 02516: Cast-in-Place Concrete

1.3 SUBMITTALS

A. General: Submit the following:

1. Product data and certification of pipe quality from the manufacturer prior to installation.
2. A trench safety plan for all excavation in excess of 5 feet which meets all requirements of Texas state law and O.S.H.A.
3. Testing laboratory certification of specified materials.
4. Compaction tests for embedment and backfill.
5. Shop drawings and manufacturer's certifications for precast concrete inlets.
6. Shop drawings, product data, mix designs and materials certifications for reinforced concrete structures.
7. Shop drawings for grates and castings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Pipe: (15” and larger - public). Reinforced concrete culvert pipe conforming to ASTM C76, Class III, with tongue and groove joints. Lifting holes in pipe sections are not permissible.

B. Corrugated Polyethylene Pipe: (15” and smaller – private) Polethylene pipe with corrugated exterior and smooth interior conforming to ASTM F405. Use fittings manufactured specifically for use with this pipe.

C. PVC Pipe: (12” and smaller – private) PVC pipe per ASTM D-3034, SDR-35.

D. Aluminized Steel: (8” – private) Type 2 to meet all requirements by Contech or approved

equal.

E. Cement Mortar: One part cement and two parts clean sharp sand with lime added in an amount not exceeding twenty-five percent of volume of cement. Mix dry and then wet to proper consisting for use. Use no mortars that have stood for more than one hour.

F. Reinforced Concrete: Reinforced concrete conforming to Section 02516 for inlets, culverts and headwalls.

G. Precast Inlets: Precast inlets shall be reinforced concrete with 4500 psi concrete at 28 days and grade 60 reinforcing steel.

H. Jointing Materials:

1. Reinforced Concrete Pipe: Cold applied preformed plastic gaskets suitable for sealing joints of tongue and groove concrete pipe. Use "Ram-nek" brand or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pipe Trenches:

1. Excavate the pipe trenches to the widths necessary for the proper laying of the pipe but in no case wider than 24 inches plus the outside diameter of the pipe and keeping the banks as nearly vertical as practicable to at least 12 inches above top of pipe. In paved areas, maintain the trench walls vertical and sheeted, if required, with the clearance between the pipe and trench wall or back of sheeting not exceeding 12 inches. Excavate the bottom of the trenches to a depth as indicated on the plans and replace any over excavation with suitable compacted material.
2. Remove for the full width of the excavation soft, spongy, or otherwise unstable material encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work and replace with approved fill material.
3. Where sheeting and bracing are necessary to prevent caving of the trench sidewalls of excavation for other structures, and to safeguard the workmen, excavate the trench or excavation for other structures to such width that the proper allowance is made for the space occupied by the sheeting and bracing to provide clearance as specified above.
4. Place embedment as foundation for pipe in accordance with City standard details.

3.2 PIPE INSTALLATION

A. General

1. Pipe Handling: All pipe, fittings and specials shall be handled in such a manner as not to damage the material. All pipe and fittings handled with clamps or slings must meet with the approval of the Owner; no hooks shall be permitted. When it becomes necessary to deflect the pipe to avoid obstructions, the deflection of each joint must be within the limits provided by the manufacturer and be approved by the Owner.
2. Laying Underground Conduit Pipe: Previous to being lowered into the trench, each pipe shall be carefully inspected; and those not meeting specifications shall be

rejected and either destroyed or removed from the job. All lumps or excrescences on the ends of conduit shall be removed before it is lowered into the trench. No pipe shall be laid except in the presence of the Owner, unless otherwise specified; and the Owner may order the removal of and re-laying of any pipe not so laid. The pipe and specials shall be so laid in the trench that after the project is completed the interior surface shall conform accurately to the grade and alignment indicated on the plans. Bell holes shall be excavated and all pipe shall be carefully adjusted to fit snugly in the bedding so that the entire length bears on bedding material with no wedging or blocking to hold up the bell. All pipe shall be laid in the dry, regardless of the type of joint used. Pipes shall be laid with the bell or groove end upgrade unless otherwise approved by the Owner; and, in any event, shall be laid with the bell or collar away from the last section placed. Before laying the pipe, the interior of the joints shall be carefully bored smooth and clean and the annular space shall be kept free from dirt, stones or water. Pipe shall be installed and joints made up in complete conformance with the instructions and recommendations regarding proper installation and assembly furnished by the manufacturer. Proper facilities shall be provided for hoisting and lowering the section of the pipe into the trench without disturbing the prepared foundation and the sides of the trench. All pipe shall be so laid that the contact in the joint between two lengths of pipe shall be uniform throughout the circumference of the joint. Where curves in the alignment are indicated on the drawings, standard pipe (short sections of pipe or bevels) shall be used with the outside edge of the joint pulled away from the seat to make a smooth curve.

B. Drainage Structures

1. Construct concrete structures in conformity with City and TxDOT standard details. Design and construct forms so that they may be removed without injury to the concrete. Thoroughly compact the concrete and leave forms in place for at least 24 hours after concrete is poured. Cure the concrete for at least 5 days after removal of forms. Thoroughly clean honeycomb places, saturate with water and point up with mortar.

C. Inlets: Inlets shown on the plans may be precast or poured-in-place reinforced concrete at the Contractor's option.

3.3 BACKFILLING FOR PIPE AND STRUCTURES

A. After the pipe has been installed on specified embedment, place specified backfill at a moisture content which will facilitate compaction alongside the pipe in layers not exceeding 6 inches loose measure in depth. Thoroughly compact the fill under the haunches of the pipe and compact each layer by rolling or tamping with mechanical rammers. Continue this method of filling and compacting until the fill is 12-inches above the pipe, then place the remainder of the backfill, in lifts not exceeding 9-inches. Operate heavy equipment in a manner so that no damage to the pipe will result. Compact backfill to a point 12 inches above the pipe to not less than 95 percent of maximum dry unit weight as determined by ASTM D698. Compact backfill material 12 inches and more above the pipe to not less than 95 percent of the maximum dry unit weight as determined by ASTM D698 under pavement and 90 percent elsewhere.

B. Place and compact backfill for drainage structures in the same manner as specified above for pipe, except allow the concrete to cure for not less than five days before placing the backfill.

END OF SECTION

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Section 02740

ASPHALT OVERLAY AND BASE REPAIR

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. This item shall consist of repairing the existing pavement and base, installation of asphaltic concrete level-up course, and asphaltic concrete overlay as herein specified and in conformity with typical sections, lines and grades shown on the plans and established by the Engineer.

1.02 MEASUREMENT AND PAYMENT

A. Tack Coat will be measured at the point of application to the street in gallons at the applied temperature. Hot mixed asphalt pavement shall be measured by the number of square yards complete in-place.

B. Hot mixed asphalt will be measured by the number of square yards complete in-place.

C. The work performed and materials furnished as prescribed by this item and measured as provided under “Measurement” will be paid for at the unit price bid for:

a. “Tack Coat”

b. “Hot Mixed Asphaltic Pavement, Type “D”

D. The unit bid price shall be full compensation for furnishing all material, freight, heating, mixing, hauling, cleaning of the existing base course or pavement, pavement preparation, tack coat, placing asphaltic concrete mixture, rolling and finishing, and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

1.03 REFERENCES – Not Used

1.04 SUBMITTALS – Not Used

PART 2 P R O D U C T S

2.01 MATERIALS

E. Hot Mix Asphaltic Concrete: The hot mix asphaltic concrete shall conform to the requirements of the Texas Department of Transportation 1993 Specifications, Item 340. The paving mixture to be used shall be type designated on the plans. The Contractor shall provide appropriate documentation from the producer and a commercial laboratory that the hot mix asphaltic concrete used in the overlay meets these requirements. The asphalt to be used shall be A.C. 10.

F. Tack Coat shall be AC-5

PART 3 E X E C U T I O N

3.01 PREPARATION

A. The pavement surface shall be dry free of dirt, grease and loose material. All "pot holes" shall be cleaned, primed and repaired with hot mix asphaltic concrete. Large cracks (greater than ¼ inch) shall be filled with AC-5. Level-up course shall be applied as needed and as directed by the Engineer.

3.03 BASE REPAIR

A. The existing base and asphaltic mat to be scarified and reshaped shall first be cleaned of all dirt, vegetation or other objectionable materials, and then scarified to a minimum depth of 6 inches. In no case shall the underlying sub-grade be disturbed. The asphaltic mat may either be removed and disposed of by the Contractor or broken into particles not more than 2 inches in their greatest dimensions. Caliche base shall be added as necessary to bring the surface to finish shape and grade as shown on the plans. Such caliche added shall be subsidiary to the various pay items.

B. The reshaped surface and base shall be sprinkled as required and rolled as directed until a uniform compaction is secured. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical sections shown on plans and to the established lines and grades. In that area on which pavement is to be placed, any deviation in excess of ¼ inch in cross-section in a length of 12 feet measured longitudinally shall be corrected by loosening, adding or removing material reshaping and re-compacting by sprinkling and rolling. All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and re-compacting by sprinkling and rolling.

C. The Contractor shall "proof roll" the finish surface and directed by the Engineer to determine any weak spots. The "proof rolling" will be done with a loaded water truck (2000 gallon maximum).

D. "Base Repair" is specified based on the assumption that the underlying courses have not failed and have adequate strength to support the loads applied to them during construction. The Contractor may "proof roll" the area designated for "scarify and reshape surface and base" before beginning work. If such "proof rolling" indicates failure in the underlying courses a "change order" will be made to pay for the additional work to repair the underlying courses. Once work has begun on an area, the Contractor shall be responsible for any failures in the underlying courses. Should the areas of "scarified and reshaped surface and base", due to any reason or cause, lose the required stability, density and finish before the surfacing is complete, it shall be re-compacted and refinished at the sole expense of the Contractor. Prime coat shall be subsidiary to "Scarify and Reshape Surface and Base".

3.04 TACK COAT

A. Tack coat shall be sprayed uniformly in one pass at a spray width of the existing roadway. The tack coat shall not be placed more than 1 inch onto the lip of the "Curb and Gutter", "Valley Gutter" or edge of pavement. The tack coat shall be uniformly metered at the rate specified on the plans with a tolerance of plus or minus 0.05 gallons per square yard. Any excessive spills shall be removed and any obvious deviation from the rate specified will be rejected by the Engineer.

3.05 HOT MIX ASPHALTIC CONCRETE (HMAC)

A. The prime coat, tack coat or the asphaltic mixture when placed with a spreading and finishing machine; shall not be placed when the air temperature is below 50° F and is falling, but it may be placed when the air temperature is above 50°F and is rising.

B. The air temperature shall be taken in the shade away from artificial heat. It is further provided that the prime coat, tack coat, or asphaltic mixture shall be placed only when the humidity, general weather conditions, and temperature and moisture condition of the base, in the opinion of the Engineer, are suitable.

C. If the temperature of the asphaltic mixture of a load or any part of a load becomes less than 225°F or more than 350°F after being dumped from the mixer and prior to passing through the lay-down machine, all or any part of the load may be rejected.

a. Prime Coat: A prime coat shall be applied at the rate shown on the plans. The application temperature shall be as provided above. The tack coat or asphaltic concrete shall not be applied on a previously primed flexible base until the primed base has completely cured to the satisfaction of the Engineer.

b. Tack Coat: Before the asphaltic mixture is laid, the surface upon which the tack coat is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using asphaltic materials specified in the plans. This tack coat shall be applied, as directed by the Engineer, with an approved sprayer at a rate not to exceed 0.10 gallons per square yard or surface. All contact surfaces of curbs and structures and all joints shall be painted with a thin uniform coat of the asphaltic material meeting the requirements for tack coat. The tack coat shall be rolled with a pneumatic tire roller when directed by the Engineer.

c. Transporting Asphaltic Concrete: The asphaltic mixture, prepared as specified above, shall be hauled to the work in tight vehicles previously cleaned of all foreign material. The dispatching of the vehicles shall be arranged so that all material delivered may be placed, and all rolling shall be completed during daylight hours. In cool weather or for long hauls, canvas covers and insulating of the truck bodies may be required. The inside of the truck body may be given a light coating of oil, lime slurry or other material satisfactory to the Engineer, if necessary, to prevent mixture from adhering to the body.

d. Placing:

i. Generally, the asphaltic mixture shall be dumped and spread on the approved prepared surface with specified spreading and finishing machine, in such manner that when properly compacted the finished pavement will be smooth, of uniform density and will meet the requirement of the typical cross sections and the surface tests. During the application of asphaltic materials, care shall be taken to prevent splattering of adjacent pavement; curb and gutter and structures.

ii. In placing a level-up course with the spreading and finishing machine, binder twine or cord shall be set to line and grade established by the Engineer. If approved by the Engineer, level-up courses may be spread with a motor grader.

iii. When the asphaltic mixture is placed in a narrow strip along the edge of an existing pavement, or used to level up small areas of an existing pavement or placed in small irregular areas where the use of a finishing machine is not

practical, the finishing machine may be eliminated when authorized by the Engineer, provided a satisfactory surface can be obtained by other approved methods.

iv. Flush Structures. Adjacent to flush curbs, gutters, liners and structures, the surface shall be finished uniformly high so that when compacted it will be slightly above the edge of the curb or flush structure.

e. Compacting:

i. Rolling with the three wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheel unless otherwise directed by the Engineer. Alternate trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Engineer. Rolling with pneumatic-tire roller shall be done as needed. Rolling shall be continued until no further compression can be obtained and all roller marks are eliminated. One tandem roller, one pneumatic-tire roller and at least one three wheel roller, as specified above shall be provided for each job. If the Contractor elects, he may substitute the three axle tandem roller for the two axle tandem roller and/or the three wheel roller; but in no case shall less than three roller be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixtures where required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing.

ii. In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer, operate other compacting equipment that will produce equivalent relative compaction as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction as would be expected of the specified equipment, as determined by the Engineer, its use shall be discontinued.

iii. Hand Tamping: The edges of the pavement along curbs, headers and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction with the rollers, shall be thoroughly compacted with lightly oiled tamps.

f. Opening to Traffic:

i. The pavement shall be opened to traffic when directed by the Engineer. The Contractor's attention is directed to the fact that all construction traffic allowed on pavement open to the public will be subject to the laws governing traffic on Public Roads and Streets.

ii. If the surface ravels, it will be the Contractor's responsibility to correct this condition at this expense.

g. Density Test - Acceptance Sampling and Testing of Hot Mix Asphaltic Concrete (Compaction):

i. Hot Mix Asphaltic Concrete will be accepted for density on a lot basis. A lot will consist of one day's production or 1,200 tons, whichever is less and shall be divided into four equal sublots. One test shall be made for each sublot.

ii. Each lot of pavement will be accepted, with respect to density, when the average field density is equal to or greater than 92 percent of the average maximum theoretical density as determined in accordance with ASTM D2041, and when no individual determination is less than 91.0 percent of the average maximum theoretical density. Four field density determinations will be made for each lot. Cores or sawed samples taken from the pavement will be used to determine the field density. The density of the cored or sawed samples shall be determined in accordance with ASTM D2726.

iii. The same specimen shall be used for determining both the maximum theoretical density and field density. Specimens used for field density determination shall be carefully crumbled, using heat if necessary, and maximum theoretical density determined in accordance with ASTM D2041. If heating is necessary, the specimen shall be heated to the lowest temperature required for proper preparation of the sample.

iv. The use of nuclear field density determination shall not be used as the basis for acceptance with respect density.

Table 8
Sliding Scale Pay Factors
(Density Based on Percent of Maximum Theoretical)

Average Percent Density*	Recommended Percent Payment
92 or above	100
91.0 - 91.9	90
Below 91.0	Reject **

* Average of 4 samples.
** If the Owner agrees to accept densities below 91.0%, the pay factor for density shall be 50%.

h. Surface Tests:

i. Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after final rolling. Any variation exceeding the specified tolerances shall immediately be corrected by removing the defective work and replacing with new material, as directed by the Engineer. Any correction required shall be at the sole expense of the Contractor.

ii. For surface course, the finished surface shall not vary more than ¼ inch (6.35 mm) when tested with a 16-foot straightedge applied parallel with, or at right angles to, the centerline.

iii. The finished surfaces of hot mix asphaltic concrete shall not vary from the grade line, elevations and cross sections shown on the plans by more than ½ inch (12.7 mm). The Contractor shall correct pavement areas varying in excess of this amount

by removing and replacing the defective work. Skin patching shall not be permitted for correction of low areas nor shall planning be permitted for correction of high areas.

i. Sampling Pavement:

i. Samples for determination of thickness and density of completed pavements shall be obtained by the Contractor at no extra cost. The size, number and locations of the samples will be as directed by the Engineer. Samples shall be neatly cut with a saw, core drill or other approved equipment. The Contractor shall furnish all tools, labor and materials for cutting samples and replacing pavement.

ii. All tests necessary to determine conformance with the specified requirements will be performed without cost to the Contractor; however, any required retests shall be performed at the Contractor's cost.

END OF SECTION

Section 02741

ASPHALTIC CONCRETE PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Surface courses of compacted mixture of coarse and fine aggregates and asphaltic material.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for asphaltic concrete pavement is on square yard basis. Separate pay items reused for each different required thickness of pavement.

2. Payment for asphaltic concrete pavement includes payment for associated work performed in accordance with Section 02743 - Tack Coat.

3. Payment for asphaltic concrete in miscellaneous areas is on a square yard basis. Miscellaneous areas include tie-in to existing driveways.

4. No separate payment will be made under this section for asphaltic concrete provided for Section 02744-Pavement Repair.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

6. Refer to Paragraph 3.08 for unit price adjustments.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

D. TxDOT Tex-126-E - Molding, Testing, and Evaluation of Bituminous Black Base Material.

E. TxDOT Tex-106-E - Method of Calculating the Plasticity Index of Soils.

F. TxDOT Tex-203-F - Sand Equivalent Test.

G. TxDOT Tex-204-F - Design of Bituminous Mixtures.

H. TxDOT Tex-207-F - Determination of Density of Compacted Bituminous Mixtures.

I. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

J. TxDOT Tex-217-F - Determination of Deleterious Material and Decantation Test for Coarse Aggregates.

K. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates that asphaltic materials and aggregates meet requirements of Article 2.01, Materials, of this Section.

C. Submit proposed design mix and test data for each type and strength of surface course in Work.

D. Submit manufacturer's description and characteristics of mixing plant for approval.

D. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Coarse Aggregate: Gravel or crushed stone, or combination thereof, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic or other injurious matter occurring either free or as coating on aggregate. Aggregate shall conform to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

B. Fine Aggregate: Sand or stone screenings or combination of both passing No. 10 sieve. Aggregate shall conform to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by Tex-106-E. Sand equivalent shall have a minimum value of 45 when tested by Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with ASTM C 136.

GRADUATION OF COMPOSITE AGGREGATE	
Sieve Size	**Percent Passing**
1/2"	100
3/8”	85 to 100
#4	50 to 70
#10	32 to 42
#40	11 to 26
#80	4 to 14
#200	1 to 6*
*2 to 8 when Test Method Tex – 200 - F, Part II (Washed Sieve Analysis) is used	

D. Asphaltic Material: Moisture-free homogeneous material which will not foam when heated to 347 degrees F, meeting following requirements:

VISCOSITY GRADE				
	AC-10		AC-20	
TEST	Min.	Max.	Min.	Max.
Viscosity, 140º F stokes	1000	± 200	2000	± 400
Viscosity, 275º F stokes	1.9	-	2.5	-
Penetration, 77º F, 100g, 5 sec.	85	-	55	-
Flash Point, C.O.C., F.	450	-	450	-
Solubility in trichloroethylene, percent	99.0	-	99.0	-
Tests on residues from thin film oven tests:				
Viscosity, 140º F stokes		3000	-	6000
Ductility, 77º F, 5 cms per min., cms	100	-	70	-
Spot tests	Negative for all grades			

1. Material shall not be cracked.

2.02 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing Continuously mixtures meeting specifications. Plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device.
2. Dryer.
3. Screens.
4. Aggregate weight box and batching scales.
5. Mixer.
6. Asphalt storage and heating devices.
7. Asphalt measuring devices.
8. Truck scales.

B. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix.

2.03 MIXES

A. Employ a certified testing laboratory to prepare design mixes. Test in accordance with Tex-126-E or Tex-204-F and Tex-208-F.

B. Density and Stability Requirements:

Percent Density		Percent	HVEEM Stability Percent
Min.	Max.	Optimum	Not Less Than
94.5	97.5	96	35

C. Proportions for Asphaltic Material: Provide 4 to 8 percent of mixture by weight. Aggregate by weight shall not contain more than 1.0 percent by weight of fine dust, clay-like particles, or silt when tested in accordance with Tex-217-F, Part II.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base course is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Prime Coat: If indicated on the Drawings, apply a prime coat conforming to requirements of Section 02742 - Prime Coat. Do not apply a tack coat until primed base has cured to satisfaction of Resident Project Representative.

B. Tack Coat: Conform to requirements of Section 02743 - Tack Coat.

C. Prepare subgrade in advance of asphaltic concrete paving operation.

D. Do not use cutback asphalt during the period of April 16 to September 15.

3.03 PLACEMENT

A. Do not place asphaltic mixture when air temperature is below 50 degrees F and falling. Mixture may be placed when air temperature taken in shade and away from artificial heat is above 40 degrees F and rising.

B. Haul prepared and heated asphaltic concrete mixture to the project in tight vehicles previously cleaned of foreign material. Mixture shall be at temperature between 250 degrees F and 325 degrees F when laid.

C. Spread material into place with approved mechanical spreading and finishing machine of screening or tamping type.

D. Surface Course Material: Surface course 2 inches or less in thickness may be spread in one lift. Spread lifts in such manner that, when compacted, finished course will be smooth, of uniform density, and will be to section, line and grade as shown. Place construction joints on surface courses to coincide with lane lines or as directed by Resident Project Representative.

E. Place courses as nearly continuously as possible. Pass roller over unprotected ends of

Freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

F. When new asphalt is laid against existing or old asphalt, existing or old asphalt shall be saw cut full depth to provide straight smooth joint.

G. In restricted areas where use of paver is impractical, spread and finish asphalt by Mechanical compactor. Use wood or steel forms, rigidly supported to assure correct grade and cross section. Carefully place materials to avoid segregation of mix. Do not broadcast material. Remove any lumps that do not break down readily. Place asphalt courses in same sequence as if placed by machine.

3.04 COMPACTION

A. Begin rolling while pavement is still hot and as soon as it will bear roller without undue displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water.

B. Compress surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing from 8 to 10 tons. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mixture temperature drops below 175 degrees F.

C. Use tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.

D. Along walls, curbs, headers and similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

E. Compact binder course and surface course to density not less than 94 percent nor more than 98 percent of the maximum possible density of voidless mixture composed of same materials in like proportions.

3.05 TOLERANCES

A. Furnish templates for checking surface in finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/8 inch.

B. Completed surface, when tested with 10-foot straightedge laid parallel to center line of pavement, shall show no deviation in excess of 1/8 inch in 10 feet. Correct any surface not meeting this requirement.

3.06 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Minimum of one core will be taken at random locations per 1000 feet per lane of roadway or 500 square yards of base to determine in-place depth and density.

C. In-place density will be determined in accordance with Tex-207-F and Tex-227-F from cores or sections. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Engineer.

D. Contractor may, at his own expense, request three additional cores in vicinity of cores indicating nonconforming in-place depths. In-place depth at these locations shall be average depth of four cores.

E. Fill cores and density test sections with new compacted asphaltic concrete.

3.07 NONCONFORMING PAVEMENT

A. Remove and replace any non – conforming pavement.

B. Remove and replace areas of asphalt found deficient in thickness by more than 10 percent. Use new asphaltic base of thickness shown on Drawings.

C. Replace nonconforming pavement sections.

3.08 UNIT PRICE ADJUSTMENT

A. Unit price adjustments shall be made for in-place depth determined by cores as follows:

1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price bid.

2. Adjustment shall apply to lower limit of 90 percent and upper limit of 105 percent of unit price.

3. Average depth below 90 percent may be rejected by Engineer.

3.09 PROTECTION

A. Do not open pavement to traffic until 12 hours after completion of rolling, or as shown on Drawings.

B. Maintain asphaltic concrete pavement in good condition until completion of Work.

C. Repair defects immediately by replacing asphaltic concrete pavement to full depth.

END OF SECTION

SECTION 02742

PRIME COAT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Prime coat for asphaltic concrete paving

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for prime coat under this Section. Include payment in unit price for material being primed.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed prime coat.

C. Submit report of recent calibration of distributor.

PART 2 P R O D U C T S

A. Cutback Asphalt

B. Provide moisture-free homogeneous material which will not foam when heated to 347 degrees F and which meets following requirements:

C. Asphalt material for prime coat shall be MC-30 or MC-70 and shall meet following requirements:

PROPERTIES	TYPE - GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
Water, Percent	---	0.2	---	0.2
Flash Point, T.O.C., °F	100	---	100	---
Kinematic Viscosity at 140°F, cst	30	60	70	140

2. Distillate shall be as follows, expressed as percent by volume of total distillate to 680 degrees F:

TEMPERATURE	TYPE-GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
to 437°F	---	25	---	20
to 500°F	40	70	20	60
to 600°F	75	93	65	90
Residue from 680ºF Distillation, Volume, Percent	50	---	55	---

3. Tests on Distillation Residue:

TEST	TYPE-GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
Penetration at 77°F, 100g, 5 sec., cm	120	250	120	250
Ductility at 77°F, 5 cm/min., cm	100*	---	100*	---
Solubility in Trichloroethylene, %	99	---	99	---
Spot Test	All Negative			

*If penetration of residue is more than 200 and ductility at 77 degrees F is less than 100 cm, material will be acceptable if its ductility at 60 degrees F is more than 100 cm.

2.02 EMULSIFIED PETROLEUM RESIN

A. EPR-1 Prime: Slow curing emulsion of petroleum resin and asphalt cement conforming to the following requirements:

PROPERTIES	MIN.	MAX.
Fural Viscosity at 77°F, Sec	14	40
Residue by Evaporation, % by Weight	60	-
Sieve Test, %	-	0.1
Particle Charge Test	Positive	
Tests on the Distillation Residue:		

Flash Point, COC (F)	400	-
Kinematic Viscosity @ 140 F (cst)	190	350

B. For use, EPR-1 may be diluted with water up to a maximum three parts water to one part EPR-1 in order to achieve desired concentration of residual resin/asphalt to facilitate application.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course surface of loose material by brooming prior to application of prime coat.

B. Prepare sufficient base in advance of paving for efficient operations.

3.03 APPLICATION, BASIC

A. Apply prime coat with approved type of self-propelled pressure distributor. Distribute prime coat evenly and smoothly under pressure necessary for proper distribution.

B. Keep storage tanks, piping, retorts, booster tanks, and distributors used in handling asphaltic materials clean and in good operating condition. Conduct operations so that asphaltic material does not become contaminated.

C. If yield of asphaltic material appears to be in error, recalibrate distributor prior to continuing work.

D. Maintain the surface until Work is accepted by Owner.

3.04 APPLICATION, CUTBACK ASPHALT

A. Do not place prime coat when air temperature is below 60 degrees F and falling. Materials may be placed when air temperature taken in shade and away from artificial heat is above 50 degrees F and rising.

B. Distribute at rate of 0.25 to 0.35 gallons per square yard.

C. Equipment shall be capable of reporting temperature of asphaltic material in heating equipment and in distributor, for determining rate of application, and for obtaining uniformity at junction of two distributor loads. Maintain in accurate working order, including recording thermometer at storage heating unit at all times.

D. Temperature of application shall be based on temperature-viscosity relationship that will permit application of asphalt with viscosity of 100 to 125 centistokes. Maintain asphalt within 15 degrees F of temperature required to meet viscosity. Selected temperature shall be within following range.

Prime Coat Type	Minimum (°F)	Maximum (°F)

MC-30	70	150
MC-70	125	175

E. Do not allow temperature of MC-30 to exceed 175 degrees F at any time.

F. Do not allow temperature of MC-70 to exceed 200 degrees F at any time.

3.05 APPLICATION, EMULSIFIED PETROLEUM RESIN

A. Do not place prime coat when air temperature is below 36 degrees F and falling.

B. Distribute at rate of 0.15 to 0.25 gallons per square yard.

3.06 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied prime coat until authorized by Resident Project Representative.

END OF SECTION

Section 02743

TACK COAT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Tack coat for asphaltic concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for tack coat under this Section. Include payment in unit price for asphaltic pavements.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM D 244 - Standard Test Methods for Emulsified Asphalts.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed tack coat.

C. Submit report of recent calibration of distributor.

PART 2 P R O D U C T S

2.01 CUTBACK ASPHALT

A. Provide moisture-free homogeneous material which will not foam when heated to 347 degrees F and which meets following requirements:

1. Asphalt material for tack coat: RC-250 and meet following:

PROPERTIES	RC – 250	
	MIN.	MAX.
Water, Percent	---	0.2
Flash Point, T.O.C.,°F	80	---
Kinematic Viscosity at 140°F, cst	250	400

2. Distillate: Expressed as percent by volume of total distillate to 680 F:

TEMPERATURE	RC – 250	
	MIN.	MAX.
to 437°F	40	75
to 500°F	65	90
to 600°F	85	---
Residue from 680°F Distillation, Volume, Percent	70	---

3. Tests on Distillation Residue:

PROPERTIES	RC – 250	
	MIN.	MAX.
Penetration at 77°F, 100g, 5 sec.	100	150
Ductility at 77°F, 5 cm/min. cms	100	---
Solubility in Trichloroethylene, %	99	---
Spot Test	All Negative	

2.02 EMULSION

A. Provide homogeneous material which shall show no separation of asphalt after mixing and shall meet the viscosity requirements at any time within 30 days after delivery.

1. Emulsion material for tack coat: SS-1 and meet following:

PROPERTIES	SS – 1	
	MIN.	MAX.
Furol Viscosity at 77°F, sec.	30	100
Residue by Distillation, %	60	---
Oil Portion of Distillate, %	---	2
Sieve Test, %	---	0.1
Miscibility (Standard Test)	Passing	Passing
Cement Mixing, %	---	2.0
Storage Stability, 1 Day, %	---	1
Test on Residue: Penetration at 77°F, 100g, 5 sec. Solubility in Trichloroethylene, % Ductility at 77°F, 5 cm/min., cms	 120 97.5 100	 160 --- ---

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course or concrete surface of loose material by brooming prior to application of tack coat.

3.03 APPLICATION

A. Apply tack coat uniformly by use of approved distributor at rate not to exceed 0.05 gallons per square yard of surface.

B. Paint contact surfaces of curbs and structures, and joints with thin uniform coat of tack coat.

C. Cutback Asphalt:

1. Do not place tack coat when air temperature is below 50 degrees F and falling. Materials may be placed when air temperature taken in shade and away from artificial heat is above 40 degrees F and rising.

2. Temperature of tack coat shall be between 125 degrees F and 180 degrees F when applied.

3. Do not heat tack coat above 200 degrees F at any time.

3.04 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied tack coat until authorized by Resident Project Representative.

END OF SECTION

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SECTION 02744

PAVEMENT REPAIR

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK:

A. This item shall consist of repairing the existing pavement, scarifying, removing existing asphalt and base material, adding new base, prime coat and application of asphalt overlay as herein specified and in conformity with typical sections, lines and grades shown in the plans and established by the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All materials provided under this item shall be new and meet or exceed the requirements of the item for which they are part of.

B. Additional materials to meet the intent of this item shall be provided as required.

2.02 MATERIALS:

A. FLEXIBLE BASE

1. The flexible base shall be crushed limestone as specified in Specification CL1 based upon Texas Department of Transportation Item 247.

B. HOT MIX ASPHALTIC CONCRETE

1. H.M.A.C. surfacing shall be “Type D” (Fine graded surface course) (Modified) as described elsewhere in these specifications.

C. PRIME COAT

1. Prime coat shall be CSS-IH liquid asphalt.

PART 3 - EXECUTION

3.01 SCARIFY AND RESHAPE SURFACE AND BASE:

A. The existing base and asphaltic mat to be scarified shall first be cleansed of all dirt, vegetation or other objectionable materials, and then scarified to a minimum depth of 8 inches.

B. The asphaltic mat and base shall be removed and disposed of by the Contractor.

C. New flexible base shall be added to bring the surface to a finished shape and grade as shown on the plans.

D. The reshaped surface and base shall be sprinkled as required and rolled as directed until a uniform compaction is secured.

E. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical sections shown on plans and to the established lines and grades.

F. In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 12 feet measured longitudinally shall be corrected by loosening, adding and rolling, all irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, re-shaping and re-compacting by sprinkling and rolling.

G. The Contractor shall “proof roll” the finish surface as directed by the Engineer to determine any weak spots.

H. “Scarify and reshape surface and base” is specified based on the assumption that the underlying courses have not failed and have adequate strength to support the loads applied to them during construction.

I. The Contractor may “proof roll” the area designated for “scarify and reshape surface and base” before beginning work.

J. If such “proof rolling” indicates failure in the underlying courses, the unstable material is to be removed, and replaced with Lime Stabilized Subgrade Material.

K. The replacing of the underlying material shall be measured and paid for by the square yard of Lime Treated Subgrade (8” thick).

L. Once work has begun on an area, the Contractor shall be responsible for any failures in the underlying courses.

M. Should the areas of “scarified and reshaped surface and base”, due to any reason or cause, lose the required stability, density and finish before the surfacing is complete, it shall be re-compacted and refinished at the sole expense of the Contractor.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. No bid item is established for these items, this work shall be considered subsidiary to the contract and no direct payment will be made.

END OF SECTION

Section 02752

CONCRETE PAVEMENT JOINTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks; concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for saw-cutting existing concrete or asphalt pavement for new joints is on linear foot basis. Saw-cutting existing standard concrete curb will be measured as 1-1/2 linear feet and existing standard concrete curb and gutter will be measured as 3 linear feet.

2. No separate payment will be made for expansion joints, formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.

3. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

C. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. ASTM D 3405 - Standard Specification for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.

1.04 SUBMITTALS

A. Submit product data and samples in accordance with requirements of Section 01330 - Submittal Procedures.

B. Submit product data for joint sealing compound and proposed sealing equipment for approval.

C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Board Expansion Joint Material: Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

B. Preformed Expansion Joint Material: Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

C. Joint Sealing Compound: Hot-poured rubber-asphalt compound conforming to ASTM D 3405.

D. Load Transmission Devices:

1. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.

2. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

E. Metal Supports for Reinforcing Steel and Joint Assembly: Employ metal supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete.

PART 3 E X E C U T I O N

3.01 PLACEMENT

A. When new work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If the limit of removal of existing concrete or asphaltic pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.02 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.03 EXPANSION JOINTS

A. Place 3/4-inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission

devices of type and size shown on Drawings unless otherwise specified or shown as “No Load Transfer Device”. Seal with joint sealing compound.

3.04 CONTRACTION JOINTS

A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

3.05 LONGITUDINAL WEAKENED PLANE JOINTS

A. Place longitudinal weakened plane joints at spaces indicated on Drawings. Seal groove with joint sealing compound.

3.06 SAWED JOINTS

A. Use sawed joints as an alternate to contraction and weakened plane joints. Circular cutter shall be capable of cutting straight line groove minimum of 1/2 inch wide. Depth shall be one quarter of pavement thickness plus 1/2 inch. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, it shall be continued until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.

B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Provide at least one standby saw in good working order. Maintain an ample supply of saw blades at work site at all times during sawing operations. Sawing equipment shall be on job at all times during concrete placement.

3.07 JOINTS FOR CURB, CURB AND GUTTER

A. Place 3/4-inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement; at end of radius returns at street intersections and driveways; and at curb inlets. Maximum spacing shall be 120-foot centers.

3.08 JOINTS FOR CONCRETE SIDEWALKS

A. Provide 3/4-inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 36 feet. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend the expansion joint material full depth of the slab.

3.09 JOINTS FOR CONCRETE DRIVEWAYS

A. Provide 3/4-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

3.10 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F, and weather is not foggy or rainy.

B. Joint sealing equipment shall be in like new working condition throughout the joint sealing operation, and be approved by Resident Project Representative. Use concrete grooving machine or power-

operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

A. Maintain joints in good condition until completion of Work.

B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

Section 02753

CONCRETE PAVEMENT CURING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for concrete curing under this Section. Include payment in unit price for Concrete Paving, Concrete Sidewalks, Curbs, and Curb and Gutters.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

B. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 P R O D U C T S

2.01 COVER MATERIALS FOR CURING

A. Curing materials shall conform to one of the following:

1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.

2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.

3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Mats shall be stitched so that mat will contact surface of pavement at all points when saturated with water.

2.02 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Liquid membrane-forming compounds shall conform to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m^2 of surface in 72 hours.

PART 3 E X E C U T I O N

3.01 CURING REQUIREMENT

A. Concrete pavement shall be cured by protecting it against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphaltic concrete.

B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.02 POLYETHYLENE FILM CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in the form of a fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.

B. Cover entire surface and both edges of pavement slab. Joints in film sheets shall overlap minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or by replacing.

3.03 WATERPROOFED PAPER CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Joints in blankets caused by joining paper sheets shall lap not less than 5 inches and shall be securely sealed with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure an overlap of at least 12 inches. Tears or holes appearing in paper during curing period shall be immediately repaired by cementing patches over defects.

3.04 COTTON MAT CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, in such manner that they will contact surface of pavement equally at all points.

B. Mats shall remain on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.05 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Immediately after finishing surface, and after concrete has taken its initial set, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

END OF SECTION

Section 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for curbs and for curbs and gutter is on linear foot basis measured along face of curb. Item is subsidiary to other items, if it is incidental to the project.

2. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to streets.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit details of proposed formwork for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Grout: Nonmetallic, nonshrink grout containing no chloride producing agents conforming to the following requirements.

1. Compressive strength

a. at 7 days: 3500 psi

b. at 28 days: 8000 psi

2. Initial set time: 45 minutes

3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.

F. Mortar: Mortar finish composed of one part Portland cement and 1-1/2 parts of fine aggregate. Use only when approved by Resident Project Representative.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.02 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Section 02752 - Concrete Pavement Joints. Place dummy groove joints at 6-foot centers at right angles to curb lines. Cut dummy grooves 1/4 inch deep using an approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.03 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10-foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4-inch edger. Finish edges with tool having 1/4-inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.04 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods. Use of mechanical methods shall provide specified curb design and finish.

3.05 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 - Concrete Pavement Curing.

3.06 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them.

3.07 PROTECTION

A. Maintain curbs and gutters in good condition until completion of the Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

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SECTION 02775

CONCRETE SIDEWALKS

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete sidewalks.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ASTM D698 - Standard Test Methods for Moisture - Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-Pound Rammer and 12-inch Drop.

B. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Section 01300 - Submittals.

PART 2 –PRODUCTS

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02731 - Concrete Paving.

B. Reinforcing steel: Conform to material requirements for welded wire fabric of Section 02731 - Concrete Paving.

C. Preformed expansion joint material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Paving Joints.

D. Expansion joint filler: Conform to material requirements for expansion joint material of Section 02752 – Concrete Paving Joints.

E. Sand bed: Conform to material requirements for bank run sand of Section 02320 – Utility Backfill Materials.

PART 3 –EXECUTION

3.1 REPLACEMENT

A. Replace sidewalks which are removed or damaged during construction with sidewalk of thickness and width equivalent to one removed or damaged.

B. Provide replaced and new sidewalks with wheelchair ramps if sidewalk intersects curb at street or

driveway intersection.

3.2 PREPARATION

A. Identify and protect utilities which are to remain.

B. Protect living trees, other plant growth, and features designated to remain.

C. Clear and grub area.

D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to the line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime. Compact subgrade to minimum of 90 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D698.

E. Immediately after subgrade is prepared, cover with 2-inch-thick compacted sand bed. Lay concrete when sand is moist but not saturated.

3.3 PLACEMENT

A. Forms: Straight, unwarped wood or metal forms with nominal 4-inch depth. Securely stake forms to line and grade, and maintain in true position during concrete placement.

B. Reinforcement: Install 6x6, W2.9 x W2.9 welded wire fabric or No. 3 reinforcing steel bars on 18-inch centers longitudinally and transversely. Lay longitudinal bars in walk continuously, except through expansion joints. Support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.

C. Expansion Joints: Install expansion joints in accordance with Section 02752.

D. Colored concrete: Not Applicable.

E. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.

F. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.

G. Unless otherwise indicated on Drawings, mark off joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.

H. Finish edges with tool having 1/4-inch radius.

I. After concrete has set sufficiently, refill space along sides of sidewalk to top of walk with suitable material. Tamp unit firm and solid. Dispose of excess material in accordance with Section 01564.

3.4 CURING

A. Conform to requirements of Section 03370.

3.5 PROTECTION

A. Maintain sidewalks in good condition until completion of Work.

B. Replace damaged sidewalks in accordance with the Paragraph in this Section on REPLACEMENT.

END OF SECTION

Section 02911

TOPSOIL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for topsoil under this Section. Include payment in Section 02922 - Hydromulch Seeding.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 P R O D U C T S

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics:

1. pH value of between 5.5 and 6.5

2. Liquid limit: 50 or less

3. Plasticity index: 20 or less.

4. Gradation: maximum of 10 percent passing the No. 200 sieve.

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify that excavation and embankment operations have been completed to correct lines and grades.

3.02 TOPSOIL EXCAVATION

A. Strip off topsoil from the area to be excavated to a minimum depth of 6-inches, unless indicated otherwise on the Drawings.

B. Place Topsoil in stockpile for reuse. Cover stockpile to prevent erosion.

3.03 PLACEMENT

A. For areas to be seeded or sodded, scarify or plow existing material to a minimum depth of 4 inches, or as indicated on the Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with an appropriate lawn roller to consolidate topsoil.

B. Increase depth of topsoil to 6 inches when placed over sand bedding and backfill materials specified in Section 02320 - Utility Backfill Material.

C. For areas to receive shrubs or trees, excavate existing material and place topsoil to the depth and dimensions shown on the Drawings.

D. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Section 01576 - Waste Material Disposal.

3.04 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

SECTION 02920

TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, tools, equipment, and services for all topsoiling and finished grading, as indicated, in accord with provisions of contract documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.02 LOCATION OF WORK

A. All areas within limits of construction, areas of surplus material disposal, and all areas which are disturbed in the course of the work.

1.03 RELATED SECTIONS

A. Section 02200 - Earthwork and Site Grading

B. Section 02100 – Site Clearing

1.4 QUALITY ASSURANCE

A. Finish Grading Tolerance:

1. 0.1 ft. (30 mm) plus/minus from required elevations.

1.5 JOB CONDITIONS:

A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:

1. Original fertile, friable surface soil typical of the area, capable of supporting native plant growth, reasonably free of subsoil, clay, weeds, roots, and stones larger than 1 inch.

a. Use existing topsoil stockpiled under Section 02100.

b. If amount of topsoil stockpiled is less than amount necessary for the work, furnish all additional topsoil required at no additional cost to the Owner.

c. Contractor may import topsoil to the site with prior review and approval by the Owner's Representative.

B. Surplus Material:

1. Legally dispose of surplus material offsite.

PART 3 - EXECUTION

3.1 ROUGH GRADE REVIEW

A. Rough grading shall be inspected and approved by owner's representative before site work proceeds.

3.2 PREPARATION

A. Correct, adjust and/or repair rough graded areas.

1. Cut off mounds and ridges.
2. Fill gullies and depressions.
3. Perform other necessary repairs.
4. Bring all sub-grades to specified contours, even and properly compacted.

B. Remove all stones and debris over 2 in. (50 mm) in any dimension.

3.3 PLACING TOPSOIL

A. Do not place topsoil when subgrade is either wet or frozen enough to cause clodding.

B. Spread topsoil to minimum compacted depth of 6 in. (100 mm) for all disturbed earth areas.

C. Make finished surface free of stones, sticks, dirt clods or other material 1 in. (25 mm) or more in any dimension.

D. Drag finish with harrow (or hand rake) to insure smooth finish to the lines and grades indicated.

E. Restore areas occupied by stockpiles to condition of rest of finished work.

3.4 ACCEPTANCE

A. Upon completion of topsoiling, obtain owner's representative acceptance of grade and surface.

END OF SECTION

Section 02922

HYDRO MULCH SEEDING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Seeding, fertilizing, mulching, and maintenance of areas outside of pavement (asphalt and concrete).

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hydro mulch seeding is on an acre basis. Item is subsidiary when it is incidental and should be part other main pay items.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.

C. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Topsoil: Conform to material requirements of Section 02911 - Topsoil.

B. Seed: Conform to U.S. Department of Agriculture rules and regulations of Federal Seed Act and Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.

2. Bermuda: Extra-fancy, treated, lawn type common bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.

3. Wet, moldy, or otherwise damaged seed will not be accepted.

4. Seed requirements, application rates, and planting dates are:

TYPE	APPLICATION RATE POUNDS/A	PLANTING DATE
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88	40 40	Jan 1 to Mar 31
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88 Annual Rye Grass (Gulf)	40 40 30	Oct 1 to Dec 31

C. Fertilizer: Dry and free flowing, inorganic, water-soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers, which bear manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of following elements:

1. Nitrogen: 10 Percent

2. Phosphoric Acid: 20 Percent

3. Potash: 10 Percent

D. Mulch:

1. Virgin wood cellulose fibers from whole wood chips having minimum of 20 percent fibers 0.42 inches in length and 0.01 inches in diameter.

2. Cellulose fibers manufactured from recycled newspaper and meeting same fiber content and size as for cellulose fibers from wood chips.

3. Dye mulch green for coverage verification purposes.

E. Soil Stabilizer: "Terra Tack 1" or approved equal.

F. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Place and compact topsoil in accordance with requirements of Section 02911 - Topsoil.

B. Dispose of Objectionable and Waste Materials in accordance with Section 01576 - Waste Material Disposal.

3.02 APPLICATION

A. Seed: Apply uniformly at rates given in Paragraph 2.01 B for type of seed and planting date.

B. Fertilizer: Apply uniformly at rate of 500 pounds per acre.

B. Mulch: Apply uniformly at rate of 50 pounds per 1000 square feet.

D. Soil Stabilizer: Apply uniformly at rate of 40 pounds per acre.

E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydro mulching.

F. Sod: Lay single row of sod along perimeter where topsoil and pavement intersect.

G. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Engineer approval before resuming operations.

3.03 MAINTENANCE

A. Maintain grassed areas minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in fall, continue maintenance following spring until acceptable lawn is established.

B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.

C. Repair areas damaged by erosion by regrading, rolling and replanting.

D. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydro mulch.

E. Mow grass when height reaches 32 inches or greater on average before final acceptance. Mow to height of 22 inches.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

PART 1 –GENERAL

1.1 SECTION INCLUDES

A. Design, construction, erection and removal of structural concrete formwork.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCE STANDARDS

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 347 - Recommended Practice for Concrete Formwork.

C. U.S. Product Standard PS1 Construction & Industrial Plywood.

D. U.S. Product Standard PS20 American Softwood Lumber Standard.

1.4 SUBMITTALS

A. Conform to Section 01300 - Submittals.

B. Shop Drawings: Show location, member size and loading of shoring. When reshoring is permitted, submit plans showing locations and member size of reshoring.

C. Product Data and Samples:

1. Corrugated Fiberboard Carton Forms: Submit certification of compliance with design criteria, description of forms, and one-foot-long sample.

2. Form-coating Materials: Submit trade or brand names of manufacturers and complete description of products.

3. Form ties and related accessories, including taper tie plugs, if taper ties are used.

4. Form gaskets.

D. Detailed Layout for Slip-forming: Submit detailed layout of proposed slipforming, including description of equipment, rate of progress, and other data to show suitability of method. Show provisions for ensuring attainment of required concrete surface finish.

PART 2 –PRODUCTS

2.1 MATERIAL

A. Smooth Forms: New plywood, metal, plastic, tempered concrete-form hardboard, dressed lumber faced with plywood or fiberboard lining, or metal-framed plywood-faced panel material, to provide continuous, straight, smooth surfaces. Form material shall be free of raised grain, torn surfaces, worn edges, patches, dents or other defects. Furnish material in largest practical sizes to minimize number of joints and, when indicated on Drawings, conform to joint system indicated. Form material shall have sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Rough Forms: Plywood, metal, dressed or undressed lumber free of knots, splits or other defects, or other material acceptable to Engineer of sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

C. Plywood: Conform to PS 1, Class 1.

D. Lumber: Conform to PS 20.

E. Edge Forms and Intermediate Screed Strips: Type and strength compatible with the screed equipment and methods used.

F. Plastic Forms: One-piece forms for domes, beams and pan joists. Single lengths for columns not exceeding height of 7'-6". For columns over 7'-6", use 7'-6" sections and filler sections as needed. To facilitate removal of pan joist forms, taper sides 1 inch per foot.

G. Metal Pan Joist Forms: Removable type; fabricated of minimum 14-gage steel; one piece between end closures. Adjustable forms not allowed. Taper sides 1 inch per foot to facilitate removal.

H. Earth Cuts for Forms:

1. Use earth cuts for forming unexposed sides of grade beams cast monolithically with slabs on grade.

2. Where sides of excavations are stable enough to prevent caving or sloughing, following surfaces may be cast against neat-cut excavations:

a. Sides of footings.

b. Inside face of perimeter grade beams not monolithic with slab on grade. When inside face is cast against earth, increase beam width indicated on Drawings by 1 inch.

c. Both faces of interior grade beams not monolithic with slab on grade. When grade beam is cast against earth, increase beam width indicated on Drawings by 2 inches.

I. Corrugated Fiberboard Carton Forms:

1. Corrugated fiberboard carton forms, when called for, are intended to form a void space

beneath pile-supported and pier-supported slabs and other structural elements as shown.

2. Provide products of a reputable manufacturer regularly engaged in commercial production of double-faced corrugated fiberboard carton forms, constructed of waterproof paper and laminated with waterproof adhesive.

3. Fiberboard forms: Capable of supporting required dead load plus construction loads, and designed to lose their strength upon prolonged contact with moisture and soil bacteria.

4. Seal cuts and ends of each form section by dipping in waterproof wax, unless liners and flutes are completely impregnated with waterproofing.

5. Size forms as indicated on Drawings. Assemble as recommended by manufacturer, either with steel banding at 4'-0" maximum on centers, or, where liners and flutes are impregnated with waterproofing, with adequate stapling.

J. Circular Forms:

1. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide manufacturer's seamless units to minimize spiral gaps and seams.

2. Fiberglass or steel forms may be used for round-section members.

K. Shores: Wood or adjustable metal, with bearing plates; with double wedges at lower end.

L. Form Ties:

1. Use commercially-manufactured ties, hangers and other accessories for embedding in concrete. Do not use wire not commercially fabricated for use as a form accessory.

2. Fabricate ties so ends or end fasteners can be removed without causing spalling of concrete faces. Depth from formed concrete face to the embedded portion: At least 1 inch, or twice the minimum dimension of tie, whichever is greater.

3. Provide waterstop feature for form ties used on liquid-containing structures and on concrete walls which will have earth backfill on one side.

4. Removable ties: Taper ties may be used when approved by the Owner. In the hole left by the removal of the taper tie, insert a preformed neoprene or polyurethane plug sized to seat at the center of the wall.

M. Form Coating: Commercial formulation of form oil or form-release agent having proven satisfactory performance. Coating shall not bond with, stain or otherwise adversely affect concrete surfaces, or impair their subsequent treatment, including application of bonding agents, curing compounds, paint, protective liners and membrane waterproofing.

N. Coating for Plastic Forms: Alkali-resistant gel-coat.

O. Chamfer Strips: Unless otherwise indicated on Drawings, provide 3/4 inch chamfer strips in corners of forms to produce beveled edges where required by Part 3, Execution.

P. Form Gaskets: Polyethylene rod, closed cell, 1-inch diameter.

2.2 DESIGN OF FORMWORK

A. Conform to ACI 117, ACI 347 and Owner building codes, unless more restrictive requirements are specified or shown on Drawings. Contractor shall design and engineer concrete formwork, including shoring and bracing. Design formwork for applicable gravity loads, lateral pressure, wind loads and allowable stresses. Camber formwork to compensate for anticipated deflection during placement of concrete when required to maintain specified tolerances. Design formwork to be readily removed without impact, shock or damage to concrete surfaces and adjacent materials.

B. Slip Forming: Permitted on written approval of Owner. Contractor shall demonstrate suitability of method proposed.

PART 3 –EXECUTION

3.1 INSTALLATION

A. Formwork Construction

1. Construct and maintain formwork so that it will maintain correct sizes of members, shape, alinement, elevation and position during concrete placement and until concrete has gained sufficient strength. Provide for required openings, offsets, sinkages, keyways, recesses, moldings, anchorages and inserts.

2. Construct forms for easy removal without damage to concrete surfaces.

3. Make formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins. Provide gaskets for wall forms to prevent concrete paste leakage at their base.

4. Place chamfer strips in forms to bevel edges and corners permanently exposed to view, except top edges of walls, and slabs which are indicated on Drawings to be tooled. Do not bevel edges of formed joints and interior corners unless indicated on Drawings. Form beveled edges for vertical and horizontal corners of equipment bases. Unless otherwise indicated on Drawings, make bevels 3/4 inch wide.

5. Provide temporary openings at bases of column and wall forms and other points as required for observation and cleaning immediately before concrete is placed.

6. Where runways are required for moving equipment, support runways directly on the formwork or structural members. Do not allow runways or supports to rest on reinforcing steel.

7. Use smooth forms on formed concrete surfaces required to have smooth form finish or rubbed finish as specified in Section 03345 - Concrete Finishing.

8. Rough forms may be used on formed concrete surfaces indicated to have rough form finish as specified in Section 03345 - Concrete Finishing.

B. Forms for Surfaces Requiring Smooth Form Finish:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Uniformly space form ties and align in horizontal and vertical rows. Install taper ties, if used, with the large end on the wet face of the wall.

2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back up joints with extra studs or girts to maintain true, square intersections.

3. Form molding shapes, recesses and projections with smooth-finish materials and install in forms with sealed joints to prevent displacement.

4. Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines.

5. Provide exterior exposed edges with 3/4-inch chamfer or 3/4-inch radius.

6. Arrange facing material in orderly and symmetrical fashion. Keep number of joints to practical minimum. Support facing material adequately to prevent deflection in excess of allowable tolerances.

7. For flush surfaces exposed to view in completed structure, overlap previously- placed hardened concrete with form sheathing by approximately 1 inch. Hold forms against hardened concrete to maintain true surfaces, preventing offsets or loss of mortar.

C. Forms for Surfaces Requiring Rubbed Finish: Provide forms as specified in paragraph 3.01B, Smooth Form Finish. Use smooth plywood or fiberboard linings or forms, in as large sheets as practicable, and with smooth, even edges and close joints.

D. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure supports for types of screeds required.

E. Circular Forms: Set forms in one piece for full height of member.

F. Surfaces to Receive Membrane Waterproofing: Coordinate surface finish, anchors, reglets and similar requirements with membrane waterproofing applicator.

G. Fireproofing Steel Member: Construct forms to provide not less than the concrete thickness necessary, measured from face of steel member, to provide the required fire rating. Forms for concealed surfaces may be unlined.

H. Tolerances:

1. Unless noted otherwise on Drawings, construct formwork so concrete surfaces will conform to tolerance limits listed in Tables 03100A and 03100B at end of this Section.

2. Establish sufficient control points and bench marks as references for tolerance checks. Maintain these references in undisturbed condition until final completion and acceptance of the Work.

I. Adjustment of Formwork:

1. Use wedges or jacks to provide positive adjustment of shores and struts. After final inspection and before concrete placement, fasten in position wedges used for final adjustment of forms.

2. Brace forms securely against lateral deflections. Prepare to compensate for settling during concrete placement.

3. For wall openings, construct wood forms that facilitate necessary loosening to counteract swelling of forms.

J. Corrugated Fiberboard Carton Forms:

1. Place on smooth firm bed of suitable material to prevent vertical displacement; set tight to prevent horizontal displacement. Exercise care to avoid buckling of forms. Install in accordance with manufacturer's directions and recommendations.

2. Fit carton forms tightly around piles and piers; completely fill the space between subgrade and concrete placement with carton forms to form a void space.

3. Protect carton forms from moisture and maintain in a dry condition until concrete is placed on them. If they become wet before placement of concrete, allow them to dry and carefully inspect for strength before concrete is placed.

4. Before concrete placement, replace damaged or deteriorated forms which are incapable of supporting concrete dead load plus construction live loads.

3.2 PREPARATION OF FORM SURFACES

A. Clean surfaces of forms and embedded materials before placing concrete. Remove accumulated mortar, grout, rust and other foreign matter.

B. Coat forms for exposed or painted concrete surfaces with form oil or form-release agent before placing reinforcement. Cover form surfaces with coating material in accordance with manufacturer's printed instructions. Do not allow excess coating material to accumulate in forms or to contact hardened concrete against which fresh concrete will be placed. Remove coating material from reinforcement before placing concrete.

C. Forms for unexposed surfaces, other than retained-in-place metal forms, may be wet with water immediately before concrete placement in lieu of coating. When possibility of freezing temperatures exists, however, the use of coating is mandatory.

3.3 REMOVAL OF FORMS

A. Time Limits:

1. When repair of surface defects or finishing is required before concrete is aged, forms on vertical surfaces may be removed as soon as concrete has hardened sufficiently to resist damage from removal operations.

2. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete. Leave formwork for water-retaining structures in place for at least 2 days. Formwork for non-water-retaining columns, walls, sides of beams and other formwork components not supporting weight of

concrete may be removed after 12 hours, provided concrete has hardened sufficiently to resist damage from removal operations, and provided removal of forms will not disturb members supporting weight of concrete.

3. Forms and shoring supporting weight of concrete or construction loads: Leave in place until concrete has reached minimum strength specified for removal of forms and shoring. Do not remove such forms in less than 4 days.

B. Circular Paper or Spiral Tube Forms: Follow manufacturer's directions for form removal. Take necessary precautions to prevent damage to concrete surface. When removal is done before completion of curing time, replace form, tie in place and seal to retard escape of moisture.

C. Removal Strength:

1. Control Tests: Suitable strength-control tests will be required as evidence that concrete has attained specified strength for removal of formwork or shoring supporting weight of concrete in beams, slabs and other structural members. Furnish test cylinders and data to verify strength for early form removal.

a. Field-cured Test Cylinders: When field-cured test cylinders reach specified removal strength, formwork or shoring may be removed from respective concrete placements.

b. Laboratory-cured Test Cylinders: When concrete has been cured as specified for structural concrete for same time period required by laboratory-cured cylinders to reach specified strength, formwork or shoring may be removed from respective concrete placements. Determine length of time that concrete has been cured by totaling the days or fractions of days, not necessarily consecutive, during which air temperature surrounding concrete is above 50 degrees F and concrete has been damp or thoroughly sealed against evaporation and loss of moisture.

2. Compressive Strengths: The minimum concrete compressive strength for removal of formwork supporting weight of concrete is 75 percent of specified minimum 28-day strength for class of concrete involved.

3.4 RESHORING

A. When reshoring is permitted, plan operations in advance and obtain Owner approval of such operations. While reshoring is under way, keep live load off new construction. Do not permit concrete in any beam, slab, column or other structural member to be subjected to combined dead and construction loads in excess of loads permitted for developed concrete strength at time of reshoring.

B. Place reshores as soon as practicable after form-stripping operations are complete but in no case later than end of day on which stripping occurs. Tighten reshores to carry required loads without overstressing construction. Leave reshores in place until tests representative of concrete being supported have reached specified strength at time of removal of formwork supporting weight of concrete.

C. Floors supporting shores under newly-placed concrete: Leave original supporting shores in place, or re-shore. Locate reshores directly under shore position above. Extend reshoring over a sufficient number of stories to distribute weight of newly-placed concrete, forms and construction live loads in such manner that design superimposed loads of floors supporting

shores are not exceeded.

3.5 FORM REUSE

A. Do not reuse forms that are worn or damaged beyond repair. Thoroughly clean and recoat forms before reuse. For wood and plywood forms to be used for exposed smooth finish, sand or otherwise dress concrete contact surface to original condition or provide form liner facing material. For metal forms, straighten, remove dents and clean to return forms to original condition.

[Tables 03100A and 03100B: See following pages.]

TABLE 03100A
TOLERANCES FOR FORMED SURFACES
CONCRETE IN BUILDINGS**

VARIATION FROM	VARIATION IN	FOR ANY 10-FOOT LENGTH	FOR ANY 20-FOOT LENGTH OR ANY BAY	MAXIMUM FOR ENTIRE DIMENSION
PLUMB OR SPECIFIED BATTER	LINES AND SURFACES OF COLUMNS, PIERS, WALLS AND ARRISES	1/4"	---	1"
	EXPOSED CORNER COLUMNS, CONTROL JOINT GROOVES, AND OTHER CONSPICUOUS LINES	---	1/4"	1/2"
LEVEL OR SPECIFIED GRADE	SLAB SOFFITS, CEILINGS, BEAM SOFFITS, AND ARRISES (MEASURED BEFORE REMOVAL OF SHORES)	1/4"	3/8"	3/4"
	EXPOSED LINTELS, SILLS, PARAPETS, HORIZONTAL GROOVES AND OTHER CONSPICUOUS LINES	---	1/4"	1/2"
DRAWING DIMENSIONS	POSITION OF LINEAR BUILDING LINES, COLUMNS, WALLS, AND PARTITIONS	---	1/2"	1"
	SIZE AND LOCATION OF SLEEVES, FLOOR OPENINGS AND WALL OPENINGS	---	---	±1/4"
	CROSS SECTION OF COLUMNS, BEAMS, SLABS, AND WALLS	---	---	+1/2", -1/4"
	FOOTINGS* IN PLAN	---	---	+2", -1/2"
	FOOTING MISPLACEMENT OR ECCENTRIOWNER IN DIRECTION OF ERROR (THE LESSER OF)	---	---	2% OF WIDTH OR 2"
	FOOTING THICKNESS DECREASE	---	---	5%
	FOOTING THICKNESS INCREASE	---	---	NO LIMIT
	STEP RISE IN FLIGHT OF STAIRS	---	---	±1/8"
	STEP TREAD IN FLIGHT OF STAIRS	---	---	±1/4"
	CONSECUTIVE STEP RISE	---	---	±1/16"
	CONSECUTIVE STEP TREAD	---	---	±1/8"

* Footing tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

** Includes water and wastewater process structures.

TABLE 03100B
TOLERANCES FOR FORMED SURFACES
CONCRETE IN BRIDGES, WHARVES AND MARINE STRUCTURES

VARIATION FROM	VARIATION IN	MAXIMUM
PLUMB OR SPECIFIED BATTER	SURFACES OF COLUMNS, PIERS AND WALLS	1/2" in 10'
LEVEL OR SPECIFIED GRADE	TOP SURFACES OF SLABS	See Section 03345
	TOP SURFACES OF CURBS AND RAILINGS	3/16" in 10'
DRAWING DIMENSIONS	CROSS SECTION OF COLUMNS, CAPS, WALLS, BEAMS AND SIMILAR MEMBERS	+1/2", -1/4"
	THICKNESS OF DECK SLABS	+1/4", - 1/8"
	SIZE AND LOCATION OF SLAB AND WALL OPENINGS	± 1/2"
	FOOTINGS IN PLAN	+2", -1/2"
	FOOTING MISPLACEMENT OR ECCENTRIOWNER IN DIRECTION OF ERROR (THE LESSER OF)	2% of WIDTH OR 2"
	FOOTING THICKNESS DECREASE	5%
	FOOTING THICKNESS INCREASE	NO LIMIT
	STEP RISE IN FLIGHT OF STAIRS	±1/8"
	STEP TREAD IN FLIGHT OF STAIRS	±1/4"
	CONSECUTIVE STEP RISE	±1/16"
	CONSECUTIVE STEP TREAD	±1/8"

END OF SECTION

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SECTION 03210

REINFORCING STEEL

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Structural concrete reinforcement and grouting of reinforcement dowel bars into hardened concrete.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ACI 315 - Details and Detailing of Concrete Reinforcement.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ASTM A36 - Standard Specification for Structural Steel.

D. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

E. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

F. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

G. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

H. ASTM A675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

I. ASTM A775/A775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

J. ASTM C881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

K. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

L. WRI - Manual of Standard Practice for Welded Wire Fabric.

M. CRSI MSP-1 - Manual of Standard Practice.

1.4 SUBMITTALS

A. Conform to Section 01300 - Submittals.

B. Shop Drawings:

1. Submit shop drawings detailing reinforcement fabrication, bar placement location, splices, spacing, bar designation, bar type, length, size, bending, number of bars, bar support type and other pertinent information, including dimensions. Provide sufficient detail for placement of reinforcement without use of Contract Drawings. Information shall correspond directly to data listed on bill of materials.

2. Use of reproductions of Contract Drawings by Contractor, Subcontractor, erector, fabricator or material supplier in preparation of shop drawings (or in lieu of preparation of shop drawings) signifies acceptance by that party of information shown thereon as correct, and acceptance of obligation to pay for any job expense, real or implied, arising due to errors that may occur thereon. Remove references to Design Engineer, including seals, when reproductions of Contract Drawings are used as shop drawings.

3. Detail shop drawings in accordance with ACI 315, Figure 6.

4. Submit shop drawings showing location of proposed additional construction joints as required under Section 03250 - Joints in Concrete Structures, and obtain approval of Owner, prior to submitting reinforcing steel shop drawings.

C. Bill of Materials: Submit with shop drawings.

D. Product Data:

1. Mechanical Bar Splices: Submit manufacturer's technical literature, including specifications and installation instructions.

2. Epoxy grout proposed for anchoring reinforcing dowels to hardened concrete: Submit manufacturer's technical literature including recommended installation procedures.

E. Certificates:

1. Submit steel manufacturer's certificates of mill tests giving properties of steel proposed for use. List manufacturer's test number, heat number, chemical analysis, yield point, tensile strength and percentage of elongation. Identify proposed location of steel in work.

2. Foreign-manufactured reinforcing bars shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Submit test reports for review. Do not begin fabrication of reinforcement until material has been approved.

1.5 HANDLING AND STORAGE

A. Store steel reinforcement above ground on platforms, skids or other supports. Protect reinforcing from mechanical injury, surface deterioration and formation of excessive, loose or flaky rust caused by exposure to weather. Protect epoxy-coated reinforcing from formation of any amount of rust.

1.6 QUALITY CONTROL

A. Notify Owner at least 24 hours before concrete placement so that reinforcement may be inspected, and errors corrected, without delaying Work.

PART 2 –PRODUCTS

2.1 MATERIAL

A. Reinforcing Bars: Deformed bars conforming to ASTM A615, grade as indicated on Drawings, except column spirals and those shown on Drawings to be smooth bars. Where grade is not shown on Drawings, use Grade 60.

B. Smooth Bars: Where indicated on Drawings, use smooth bars conforming to ASTM A36; ASTM A615, Grade 60; or ASTM A675, Grade 70.

C. Column Spirals: Bars conforming to ASTM A615, Grade 60, or wire conforming to ASTM A82.

D. Epoxy-Coated Deformed Bars, Column Spirals and Smooth Bars: Conform to ASTM A775/A775M.

E. Welded Wire Fabric:

1. Welded Smooth Wire Fabric: Conform to ASTM A185.

2. Welded Deformed Wire Fabric: Conform to ASTM A497.

3. Provide wire size, type and spacing as shown. Where type is not shown on Drawings, use welded smooth wire fabric.

4. Furnish welded wire fabric in flat sheets only.

F. Tie Wire: 16-1/2 gage or heavier annealed steel wire. Use plastic-coated tie wire with epoxy-coated reinforcing steel.

G. Bar Supports: Provide chairs, riser bars, ties and other accessories made of plastic or metal, except as otherwise specified. Use bar supports and accessories of sizes required to provide required concrete cover. Where concrete surfaces are exposed to weather, water or wastewater, provide plastic accessories only; do not use galvanized or plastic-tipped metal in such locations. Provide metal bar supports and accessories rated Class 1 or 2 conforming to CRSI MSP-1 Manual of Standard Practice. Use epoxy-coated bar supports with epoxy-coated reinforcing bars.

H. Slabs on Grade: Provide chairs with sheet metal bases or provide precast concrete bar supports 3 inches wide, 6 inches long, and thick enough to allow required cover. Embed tie wires in 3-inch by 6-inch side.

I. Mechanical Bar Splices:

1. Conform to ACI 318; use where indicated on Drawings.

a. Compression splices shall develop ultimate stress of reinforcing bar.

b. Tension splices shall develop 125 percent of minimum yield point stress of reinforcing bar.

2. Regardless of chemical composition of steel, any heat effect shall not adversely affect performance of reinforcing bar.

J. Welded Splices:

1. Provide welded splices where shown and where approved by the Owner. Welded splices of reinforcing steel shall develop a tensile strength exceeding 125 percent of the yield strength of the reinforcing bars connected.

2. Provide materials for welded splices conforming to AWS D1.4.

K. Epoxy Grout: High-strength rigid epoxy adhesive, conforming to ASTM C881, Type IV, manufactured for purpose of anchoring dowels into hardened concrete and the moisture condition, application temperature and orientation of the hole to be filled. Unless otherwise shown, depth of embedment shall be as required to develop the full tensile strength (125 percent of yield strength) of dowel, but not less than 12 diameters.

2.2 FABRICATION

A. Bending: Fabricate bars to shapes indicated on Drawings by cold bending. Bends shall conform to minimum bend diameters specified in ACI 318. Do not straighten or rebend bars. Fabricate epoxy-coated reinforcing steel to required shapes in a manner that will not damage epoxy coating. Repair any damaged epoxy coating with patching material conforming to Item 4.4 of ASTM A775/A775M.

B. Splices:

1. Locate splices as indicated on Drawings. Do not locate splices at other locations without approval of Engineer. Use minimum number of splices located at points of minimum stress. Stagger splices in adjacent bars.

2. Length of lap splices: As shown on Drawings.

3. Prepare ends of bars at mechanical splices in accordance with splice manufacturer's requirements.

C. Construction Joints: Unless otherwise shown, continue reinforcing through construction joints.

D. Bar Fabrication Tolerances: Conform to tolerances listed in ACI 315, Figures 4 and 5.

E. Standard Hooks: Conform to the requirements of ACI 318.

F. Marking: Clearly mark bars with waterproof tags showing number of bars, size, mark, length and yield strength. Mark steel with same designation as member in which it occurs.

PART 3 –EXECUTION

3.1 PREPARATION

A. Clean reinforcement of scale, loose or flaky rust and other foreign material, including oil, mud or coating that will reduce bond to concrete.

3.2 INSTALLATION

A. Placement Tolerances: Place reinforcement within tolerances of Table 03210A at the end of this Section. Bend tie wire away from forms to maintain the specified concrete coverage.

B. Interferences: Maintain 2-inch clearance from embedded items. Where reinforcing interferes with location of other reinforcing steel, conduit or embedded items, bars may be moved within specified tolerances or one bar diameter, whichever is greater. Where greater movement of bars is required to avoid interference, notify Owner. Do not cut reinforcement to install inserts, conduit, mechanical openings or other items without approval of Owner.

C. Concrete Cover: Provide clear cover measured from reinforcement to face of concrete as listed in Table 03210B at the end of this Section, unless otherwise indicated on Drawings.

D. Placement in Forms: Use spacers, chairs, wire ties and other accessory items necessary to assemble, space and support reinforcing properly. Provide accessories of sufficient number, size and strength to prevent deflection or displacement of reinforcement due to construction loads or concrete placement. Use appropriate accessories to position and support bolts, anchors and other embedded items. Tie reinforcing bars at each intersection, and to accessories. Blocking reinforcement with concrete or masonry is prohibited.

E. Placement for Concrete on Ground: Support bar and wire reinforcement on chairs with sheet metal bases or precast concrete blocks spaced at approximately 3 feet on centers each way. Use minimum of one support for each 9 square feet. Tie supports to reinforcing bars and wires.

F. Vertical Reinforcement in Columns: Offset vertical bars by at least one bar diameter at splices. Provide accurate templates for column dowels to ensure proper placement.

G. Splices:

1. Do not splice bars, except at locations indicated on Drawings or reviewed shop drawings, without approval of Owner.

2. Lap Splices: Unless otherwise shown or noted, Class B, conforming to ACI 318-89, Section 12.15.1. Tie securely with wire prior to concrete placement, to prevent displacement of splices during concrete placement.

3. Mechanical Bar Splices: Use only where indicated on Drawings. Install in accordance with manufacturer's instructions.

   a. Couplers located at a joint face shall be of a type which can be set either flush or recessed from the face as shown. Seal couplers prior to concrete placement to completely eliminate concrete or cement paste from entering.

   b. Couplers intended for future connections: Recess 1/2inch minimum from concrete surface. After concrete is placed, plug coupler and fill recess with sealant to prevent contact with water or other corrosive materials.

   c. Unless noted otherwise, match mechanical coupler spacing and capacity to that shown for the adjacent reinforcing.

H. Construction Joints: Place reinforcing continuous through construction joints, unless noted otherwise.

I. Welded Wire Fabric: Install wire fabric in as long lengths as practicable. Unless otherwise indicated on Drawings, lap adjoining pieces at least 6 inches or one full mesh plus 2 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps. Conform to WRI - Manual of Standard Practice for Welded Wire Fabric.

J. Field Bending: Shape reinforcing bent during construction operations to conform to Drawings. Bars shall be cold-bent; do not heat bars. Closely inspect reinforcing for breaks. When reinforcing is damaged, replace, Cadweld, or otherwise repair, as directed by Owner. Do not bend reinforcement after it is embedded in concrete.

K. Epoxy-coated Reinforcing Steel: Install in accordance with Paragraph 3.02 J, Field Bending, and in a manner that will not damage epoxy coating. Repair damaged epoxy coating with patching material as specified in Paragraph 2.02 A, Bending.

L. Field Cutting: Cut reinforcing bars by shearing or sawing. Do not cut bars with cutting torch.

M. Welding of reinforcing bars is prohibited, except where shown on Drawings.

3.3 GROUTING OF REINFORCING AND DOWEL BARS

A. Use epoxy grout for anchoring reinforcing and dowel steel to existing concrete in accordance with epoxy manufacturer's instructions. Drill hole not more than 1/4 inch larger than steel bar diameter (including height of deformations for deformed bars) in existing concrete. Just before installation of steel, blow hole clean of all debris using compressed air. Partially fill hole with epoxy, using enough epoxy so when steel bar is inserted, epoxy grout will completely fill hole around bar. Dip end of steel bar in epoxy and twist bar while inserting into partially-filled hole.

[Tables 03210A and 03210B: See following pages]

TABLE 03210A
REINFORCEMENT PLACEMENT TOLERANCES

PLACEMENT	TOLERANCE IN INCHES
Clear Distance -	
To formed soffit:	-1/4
To other formed surfaces:	□1/4
Minimum spacing between bars:	-1/4
Clear distance from unformed surface to top reinforcement -	
Members 8 inches deep or less:	□1/4
Members more than 8 inches deep but less than 24 inches deep:	-1/4, +1/2
Members 24 inches deep or greater:	-1/4, +1
Uniform spacing of bars (but the required number of bars shall not be reduced):	□2
Uniform spacing of stirrups and ties (but the required number of stirrups and ties shall not be reduced):	□1
Longitudinal locations of bends and ends of reinforcement -	
General:	□2
Discontinuous ends of members:	□1/2
Length of bar laps:	-1-1/2
Embedded length -	
For bar sizes No. 3 through 11:	-1
For bar sizes No. 14 and 18:	-2

TABLE 03210B
MINIMUM CONCRETE COVER FOR REINFORCEMENT

SURFACE	MINIMUM COVER IN INCHES
Slabs and Joists -	

Top and bottom bars for dry conditions - No. 14 and No. 18 bars: No. 11 bars and smaller:	 1-1/2 1
Formed concrete surfaces exposed to earth, water or weather; over, or in contact with, sewage; and for bottoms bearing on work mat, or slabs supporting earth cover - No. 5 bars and smaller: No. 6 through No. 18 bars:	 1-1/2 2
Beams and Columns - For dry conditions - Stirrups, spirals and ties: Principal reinforcement: Exposed to earth, water, sewage or weather - Stirrups and ties: Principal reinforcement:	 1-1/2 2 2 2-1/2
Walls - For dry conditions - No. 11 bars and smaller: No. 14 and No. 18 bars: Formed concrete surfaces exposed to earth, water, sewage or weather, or in contact with ground - Circular tanks with ring tension: All others:	 1 1-1/2 2 2
Footings and Base Slabs - At formed surfaces and bottoms bearing on concrete work mat: At unformed surfaces and bottoms in contact with earth: Over top of piles: Top of footings -- same as slabs	 2 3 2

END OF SECTION

SECTION 03250

JOINTS IN CONCRETE STRUCTURES

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Waterstops and similar joints in concrete structures intended to retain water or withstand hydrostatic pressure.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.
   1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. Federal Specification TT-S-0227E(3) Sealing Compound, Elastomeric Type, Multi-Component, for Caulking, Sealing and Glazing Buildings and Other Structures.

B. U.S. Army Corps of Engineers Specification CRD-C572 PVC Waterstop.

C. ASTM A775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

D. ASTM C920 - Specification for Elastomeric Joint Sealants.

E. ASTM D412 - Test Methods for Rubber Properties in Tension.

F. ASTM D624 - Test Method for Rubber Property -- Tear Resistance.

G. ASTM D638 - Test Method for Tensile Properties of Plastics.

H. ASTM D746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

I. ASTM D747 - Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.

J. ASTM D1056 - Specification for Flexible Cellular Materials -- Sponge or Expanded Rubber.

K. ASTM D1752 - Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

L. ASTM D2000 - Specification for Rubber Products in Automotive Applications.

M. ASTM D2240 - Test Method for Rubber Property -- Durometer Hardness.

N. ASTM D2241 - Specification for PVC Tubing.

1.4 DEFINITIONS

A. The following definitions refer to concrete joints in water-retaining structures. Unless otherwise indicated, all such joints shall have a waterstop or sealant groove to prevent water penetration at the joint.

B. Construction Joint: The joint or surface between two concrete pours, produced by placing fresh concrete in contact with a hardened concrete surface.

1. A bond breaker may or may not be used, as indicated.

2. Reinforcing steel is continuous through the joint, unless otherwise indicated.

C. Contraction Joint: A joint similar to a construction joint, but intended to accommodate concrete shrinkage and similar movement.

1. A bond breaker is always used.

2. Reinforcing steel is held back 4-1/2 inches from the joint surface, and sleeved dowels are used so pours can move apart, unless otherwise indicated.

D. Expansion Joint: A joint similar to a construction or contraction joint, but intended to accommodate both expansion and contraction.

1. Compressible joint filler is placed against the hardened concrete, to form and separate the second pour so pours can move together or apart.

2. A centerbulb waterstop and joint sealant are used to fill the gap, unless otherwise indicated.

3. Reinforcing steel is held back, and sleeved dowels are used to allow and control movement, unless otherwise indicated.

E. Control Joint: A groove cut or formed in the face of a single pour, producing a weaker plane more likely to crack; used in an attempt to control locations of normal shrinkage cracks.

1. Joint sealant is used to fill the groove.

2. Reinforcing steel is continuous, since the pour is monolithic.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300 - Submittals.

B. Product Data: Information sufficient to indicate compliance with Contract Documents, including manufacturer's descriptive literature and specifications.

C. Shop Drawings: Indicate type, size and location of each joint in each structure, and installation details.

D. Samples: For extrusions, submit 6-inch lengths. For molded or fabricated items, submit whole items. Submit 6-inch beads for sealants and 6-inch square samples for coatings, on appropriate substrates.

E. Quality Control Submittals: Submit manufacturer's instructions and recommendations for storage, handling and installation including material safety data sheets, and, where specified,

test reports certified by an independent testing laboratory or the manufacturer, and manufacturer's certification that products furnished comply with Contract Documents.

1.6 QUALITY CONTROL

A. Waterstop Inspection: Notify Engineer to schedule inspection at least 24 hours prior to work involving waterstop installation or fabrication of waterstop field joints.

B. Defects include but are not limited to the following:

1. Offsets at joints greater at any point than 1/16 inch or 15 percent of material thickness, whichever is less.

2. Exterior cracks at joints due to incomplete bond, which are deeper at any point than 1/16 inch or 15 percent of material thickness, whichever is less.

3. At any point, any combination of offsets or exterior cracks resulting in a net reduction in the cross-sectional area of the waterstop greater than 1/16 inch or 15 percent of material thickness at any point, whichever is less.

4. Misalignment of joint resulting in misalignment of the waterstop in excess of 1/2 inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bond which can be detected with a pen knife. If, while probing the joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint is defective.

C. Field Joint Samples: Prior to use of the waterstop material in the field, fabricate and submit for review a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used. Fabricate samples so material and workmanship represent fittings to be furnished. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the Owner for testing by a laboratory at Owner's expense; they shall have a tensile strength across the joints equal to at least 600 psi when tested in accordance with ASTM D638. Contractor shall pay cost of failed tests and retesting required by failures.

D. Construction Joint Sealant: Prepare adhesion and cohesion test specimens, as specified, at intervals of 5 working days while sealants are being installed.

E. Sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:

1. Prepare sealant specimen between 2 concrete blocks (1 inch by 2 inches by 3 inches); spacing between the blocks shall be 1 inch. Use coated spacers (2 inches by 1-1/2 inches by 1/2 inch) to ensure sealant cross-sections of 1/2 inch by 2 inches with a width of 1 inch.

2. Cast and cure sealant according to manufacturer's recommendations except that curing period shall be not less than 24 hours.

3. Following curing period, widen the gap between blocks to 1-1/2 inches. Use spacers to maintain this gap for 24 hours prior to inspection for failure.

F. Sealant Installer: A competent waterproofing specialty contractor, approved by sealant manufacturer, having a record of successful performance in similar installations. Before

beginning work, sealant manufacturer's representative shall instruct installer's crew in proper method of application.

1.7 WARRANTY

A. Provide a written warranty covering entire sealant installation against faulty and incompatible materials and workmanship, and agreeing to repair or replace defective work at no additional cost to the Owner, for a period of 5 years.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with manufacturer's printed instructions.

B. Store waterstops to permit free circulation of air around waterstop material.

PART 2 –PRODUCTS

2.1 EPA POTABLE CLASSIFICATION

A. All joint materials shall be materials that reach acceptability for use in potable water systems no later than 30 days after installation, as classified by the Environmental Protection Agency.

2.2 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops: As detailed, and as manufactured by: Kirkhill Rubber Co., Brea, California; Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal acceptable to the Engineer, provided that at no place shall waterstop thickness be less than 3/8 inch.

C. Multi-Rib Waterstops: As detailed, and as manufactured by Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal acceptable to the Engineer. Use prefabricated joint fittings at intersections of ribbed-type waterstops.

D. Other Waterstops: When types of waterstops not listed above are indicated on the Drawings, they are subject to these specifications.

E. Waterstop Properties: When tested in accordance with specified standards, waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Standard
Tensile Strength-min (psi):		1750 D638, Type IV
Ultimate Elongation-min (percent):	350	D638, Type IV
Low Temp Brittleness-max (degrees F):	-35	D746
Stiffness in Flexure-min (psi):		400 D747
Accelerated Extraction (CRD-C572) -		
Tensile Strength-min (psi):		1500 D638, Type IV
Ultimate Elongation-min (percent):	300	D638, Type IV

Effect of Alkalies (CRD-C572) -			
Change in Weight (percent):		+0.25/-0.10	------
Change in Durometer, Shore A:		+5	D2240
Finished Waterstop -			
Tensile Strength-min (psi):		1400	D638, Type IV
Ultimate Elongation-min (percent):	280		D638, Type IV

2.3 JOINT SEALANT

A. Material: Polyurethane polymer designed for bonding to concrete which is continuously submerged in water. Use no material with an unsatisfactory history of bond or durability when used in joints of liquid-retaining structures.

B. Sealant Properties at 73 degrees F, 50 percent relative humidity:

1. Work Life: 45 - 180 minutes

2. Time to Reach 20 Shore A Hardness (at 77 degrees F, 200 gr quantity): 24 hours, maximum

3. Ultimate Hardness (ASTM D2240): 20 - 45 Shore A

4. Tensile Strength (ASTM D412): 200 psi, minimum

5. Ultimate Elongation (ASTM D412): 400 percent, minimum

6. Tear Resistance (Die C ASTM D624): 75 pounds per inch of thickness, minimum

7. Color: Light Gray

C. Polyurethane Sealants for Waterstop Joints in Concrete:

1. Sealant: 2-part polyurethane; when cured, sealant shall meet or exceed ANSI/ASTM C920 or Federal Specification TT-S-0227 E(3) for 2-part material.

2. Vertical and overhead horizontal joints: Use only "non-sag" compounds meeting ANSI/ASTM C920, Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.

3. Plane horizontal joints: Self-leveling compounds meeting ANSI/ASTM C920, Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I. For joints subject to either pedestrian or vehicular traffic, use a compound providing non-tracking characteristics and having a Shore A hardness range of 35 to 45.

4. Primer: Use only compatible materials manufactured or recommended for the application by the sealant manufacturer, in accordance with the printed instructions and recommendations of the sealant manufacturer.

D. Acceptable Products: Polymeric Systems Inc. "PSI-270"; Pacific Polymers "Elastothane 227R"; Sika Corporation "Sikaflex 2C", or equal acceptable to the Engineer.

2.4 MISCELLANEOUS MATERIALS

A. Bearing Pad: ASTM D2000 neoprene, Grade 2 or 3, Type BC, tensile strength 1450 psi, 60 durometer hardness, unless otherwise indicated.

B. Neoprene Sponge: ASTM D1056, Type 2C3-E1 closed-cell expanded neoprene.

C. Preformed Joint Filler: ASTM D1752 Type I non-extruding type; neoprene sponge or polyurethane of firm texture, except as otherwise specified. Bituminous fiber type will not be permitted.

D. Control Joint Former: Continuous plastic insert strips with anchorage ribs located at the bottom and an enlarged upper portion that is readily removable without damage to the concrete, and is sized to form sealant groove. Size to extend to at least 1/4 slab depth.

E. Backing Rod: Extruded closed-cell polyethylene foam rod, compatible with joint sealant materials used, with a tensile strength not less than 40 psi, and compression deflection approximately 25 percent at 8 psi. Size: 1/8-inch larger in diameter than joint width, except use one-inch diameter rod for 3/4-inch wide joints.

F. Bond Breaker: "Super Bond Breaker" manufactured by Burke Company, San Mateo, California; "Select Cure CRB", manufactured by Select Products Co., Upland, California, or equal acceptable to the Engineer. Bond breaker shall contain a fugitive dye so areas of application will be readily distinguishable.

G. Slip Dowels: Smooth epoxy-coated bars conforming to ASTM A775.

H. PVC Tubing: ASTM D2241, Schedule SDR 13.5.

2.5 BENTONITE WATERSTOP

A. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.

B. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.

C. Cross-sectional dimensions, unexpanded waterstop: One inch by 3/4 inch.

D. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

PART 3 –EXECUTION

3.1 INSTALLATION

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

A. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.

1. Do not damage material by heat sealing.

2. Splice tensile strength: At least 60 percent of unspliced material tensile strength.

3. Maintain continuity of waterstop ribs and tubular center axis.

B. Butt end-to-end joints of 2 identical waterstop sections may be made in the forms during placement of waterstop material.

C. Prior to placement in formwork, prefabricate all waterstop joints involving more than 2 ends to be joined together, an angle cut, an alignment change, or the joining of 2 dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Engineer, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of waterstop in the forms.

D. Where a centerbulb waterstop intersects and is joined to a non-centerbulb waterstop, take care to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

A. Setting Waterstops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Flat-strip waterstop: Prevent folding over by concrete during placement. Unless otherwise shown, hold waterstops in place with wire ties on 12-inch centers passed through the waterstop edge and tied to reinforcing steel.

a. Horizontal waterstops (with flat face in vertical plane): Hold in place by fastening upper waterstop edge to continuous supports.

b. Horizontal waterstops (with flat face in horizontal plane): Work concrete under waterstops by hand to eliminate air and rock pockets.

3. Place centerbulb waterstops in expansion joints centered on joint filler material.

4. Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.

B. Joint Location: Unless specifically noted otherwise, provide construction joints at 25-foot maximum spacing for concrete construction. Where joints are shown spaced greater than 40 feet apart, provide additional joints to maintain the 25-foot maximum spacing. Submit joint locations for review by the Engineer.

C. Joint Preparation: Prepare surfaces in accordance with Section 03310 - Structural Concrete.

Unless otherwise indicated, bonding is required at horizontal concrete joints in walls. Except on horizontal wall construction joints, wall-to-slab joints, or where otherwise shown or specified, at joints where waterstops are required, coat the joint face of the first pour with bond breaker as specified.

D. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Contract Documents.

E. Construction Joint Sealant:

1. In water-bearing floor slabs and elsewhere where indicated, provide construction joints with tapered grooves filled with construction joint sealant. Leave groove- forming material in place until time grooves are cleaned and filled with joint sealant. After removing groove forms, remove laitance and fins and sand-blast the grooves. Allow grooves to dry thoroughly, then blow out, immediately prime surfaces, place bond-breaker tape in bottom of groove and fill with construction joint sealant. Use no sealant without a primer. Completely fill sealant grooves. Thoroughly clean areas designated to receive sealant, as specified for tapered grooves, prior to sealant application.

2. Mix and install primer and sealant in accordance with manufacturer's printed instructions and recommendations. Do not coat sides of sealant groove with bond breaker, curing compound or other substance which would interfere with proper sealant bond. Allow at least 7 days for sealant to achieve final cure before filling structure with water.

3. Thoroughly and uniformly mix 2-part catalyst-cured material.

4. Remove and replace improperly cured sealants after the manufacturer's recommended curing time; thoroughly sandblast the groove to remove all traces of uncured or partially-cured sealant and primer, then re-prime and re-seal with specified sealant.

F. Bentonite Waterstop:

1. Install bentonite waterstop in accordance with manufacturer's instructions and recommendations except as otherwise indicated and specified.

2. When requested by the Owner, provide technical assistance by manufacturer's representative in the field at no additional cost to the Owner.

3. Use bentonite waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

5. Where thickness of the concrete member to be placed on the bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1-1/4 inches wide formed or ground into the concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.

6. Where bentonite waterstop is used in combination with PVC waterstop, lap bentonite waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop.

7. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.

8. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

9. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.

G. Control Joints:

1. Where indicated, form in slabs by sawcutting, preformed plastic inserts or other means acceptable to Owner. Minimum insert or sawcut: 1/4 slab depth.

2. Perform sawcutting during the curing period as soon as possible after concrete has reached its final set, has attained sufficient strength to support sawcutting operations without damage, and while it remains fully saturated.

3. Leave the removable portion of plastic inserts in place and protect sawcuts against damage and intrusion of foreign material until the end of the curing period and until concrete has dried sufficiently to allow sealant installation.

4. Sealant Installation: Blow foreign material from formed or sawcut space. Insert a foam backer rod to form a sealant depth equal to the width of the space but not less than 3/8 inch. Install sealant as specified elsewhere in the Contract Documents.

END OF SECTION

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SECTION 03300

CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.

2. Obtain services of and pay for certified testing laboratory to prepare design mixes.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

AB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

AC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

AD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

AE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

AF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

AG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

AH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AI. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

AJ. CRSI MSP-1 - Manual of Standard Practice.

AK. CRSI - Placing Reinforcing Bars.

AL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

AM. NRMCA - Concrete Plant Standards.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed mix design and test data for each type and strength of concrete in Work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for

testing when required by Engineer.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. Submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.05 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 P R O D U C T S

2.01 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Engineer; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na2O + 0.658K20.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.

2. Fine Aggregate: ASTM C 33.

3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:

1. Water Reducers: ASTM C 494, Type A.

2. Water Reducing Retarders: ASTM 494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:

1. Fibrillated Polypropylene Fiber:

a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.

b. Physical Properties:

1. Material: Polypropylene

2. Length: 1/2 inch or graded

3. Specific Gravity: 0.9l

c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.

2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.

a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.

b. Physical Properties

1. Material: Steel

2. Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1

3. Specific Gravity: 7.8

4. Tensile Strength: 40-400 ksi.

5. Young's Modulus: 29,000 ksi

6. Minimum Average Tensile Strength: 50,000 psi

7. Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.02 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.04 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Engineer for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Engineer.

D. Classification:

Class	Cement Sks Per CY	Minimum Strength, psi (MPa)		Maximum W/C Ratio[1]	Air Entrain.
		28 Days	7 Days		
A	5.0 (280 kg/m^3)	3000 (20.6)	2100 (14.5)	0.6	Yes
B	4.0 (225 kg/m^3)	2000 (13.8)	1400 (9.7)	0.6	No
C	6.0 (335 kg/m^3)	3600(24.8)	2520 (17.4)	0.45	Yes
D	4.5 (252 kg/m^3)	2500 (17.2)	1750 (12.1)	0.6	No
H	6.0 (335 kg/m^3)	As indicated	As Indicated	0.45	Yes
I	5.5 (308 kg/m^3)	3500 (24.1)	2450 (16.9)	0.45	Yes
J	2.0 (112 kg/m^3)	800 (5.5)	560 (3.9)	N/A	No
S	6.0 (335 kg/m^3)	4000 (27.6)	2800 (19.3)	0.45	Yes

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:

1. Thickness: not less than 3/8 inch

2. Acceptable Manufacturers:

a. Kirkhill Rubber Co., Brea, California

b. Water Seals, Inc., Chicago, Illinois

c. Progress Unlimited, Inc., New York, New York

d. Greenstreak Plastic Products Co., St. Louis, Missouri

e. Approved equal.

PART 3 E X E C U T I O N

3.01 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Engineer, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars."

Request inspection of reinforcing steel by Engineer and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Engineer. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Engineer before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Engineer.

3.05 PLACING CONCRETE

A. Give sufficient advance notice to Engineer (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Engineer's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely

supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

3.07 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Engineer. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until

concrete has reached specified 28 day strength, unless directed otherwise by Engineer.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.

2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Engineer. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.

2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day

strength, unless directed otherwise by Engineer.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Unless otherwise directed by Engineer, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.

2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test

specimens in accordance with ASTM C 31 and ASTM C 39.

3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C231, and for unit weight according to ASTM C 138.

4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15,and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Engineer, at no additional cost to Owner.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Engineer.

END OF SECTION

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SECTION 03310

STRUCTURAL CONCRETE

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Cast-in-place normal-weight structural concrete and mass concrete.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304.2R - Placing Concrete by Pumping Methods

C. ACI 305R - Hot Weather Concreting.

D. ACI 306.1 - Standard Specification for Cold Weather Concreting.

E. ACI 309R - Guide for Consolidation of Concrete.

F. ACI 318 - Building Code Requirements for Reinforced Concrete.

G. ACI 350R - Environmental Engineering Concrete Structures.

H. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

I. ASTM C33 - Standard Specification for Concrete Aggregates.

J. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

K. ASTM C42 - Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

L. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

M. ASTM C94 - Standard Specifications for Ready-Mixed Concrete.

N. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.

O. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

P. ASTM C136 - Sieve Analyses of Fine and Coarse Aggregates.

Q. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

R. ASTM C150 - Standard Specification for Portland Cement.

S. ASTM C157 - Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

T. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.

U. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

V. ASTM C192 - Method of Making and Curing Concrete Test Specimens in the Laboratory.

W. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

X. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

Y. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

Z. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

AA. ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

AB. ASTM C567 - Standard Test Method for Unit Weight of Structural Lightweight Concrete.

AC. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AD. Concrete Plant Manufacturer's Bureau (CPMB), Plant Mixer Manufacturers Division: Concrete Plant Mixer Standards.

AE. National Ready-Mixed Concrete Association (NRMCA): Certification of Ready-Mixed Concrete Production Facilities (checklist with instructions).

AF. John Wiley and Sons, Interscience Publishers Division, "Encyclopedia of Industrial Chemical Analysis," Vol. 15, Page 230 (alkalinity test procedure).

1.4 DEFINITIONS

A. Mass Concrete: Concrete sections 4 feet or more in least dimension.

B. Hot Weather: Any combination of high air temperature, low relative humidity and wind velocity tending to impair quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

C. Cold Weather: Period when, for more than 2 successive days, mean daily temperature is below 40 degrees F.

1.5 SUBMITTALS

A. Conform to Section 01300 - Submittals.

B. Mill Certificates: Required for bulk cement.

C. Design Mixes:

1. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and shrinkage tests for Class C and D concrete at 21 or 28 days of drying.

2. Submit abrasion loss and soundness test results for limestone aggregate.

3. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Notice to Proceed.

4. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.

5. Review and acceptance of mix design does not relieve Contractor of responsibility to provide concrete of quality and strength required by these Specifications.

D. Admixtures: Submit manufacturer's technical information, including following:

1. Air-Entraining Admixture: Give requirements to control air content under all conditions, including temperature variations and presence of other admixtures.

2. Chemical Admixtures: Give requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.

E. High-Range Water Reducer (Superplasticizer): When proposed for use, submit manufacturer's technical information and instructions for use of superplasticizer. State whether superplasticizer will be added at ready-mix plant or job site. When superplasticizer will be added at job site, submit proposed plan for measuring and adding superplasticizer to concrete mix at job site, and establish dosing area on site with holding tanks and metering devices. When superplasticizer is to be added at ready-mix plant, submit contingency plans for adding additional superplasticizer at job site when required due to delay in placing concrete. Identify portions of Work on which superplasticizer is proposed for use.

F. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product.

G. Project Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.

1.6 QUALITY CONTROL

A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record dates, locations, quantities, air temperatures, and test samples taken.

B. Code Requirements: Concrete construction for buildings shall conform to ACI 318. Concrete construction for water and wastewater treatment and conveying structures shall conform to ACI 318 with modifications by ACI 350R, Item 2.6. Where this Specification conflicts with ACI 318 or ACI 350R, this Specification governs.

C. Testing and Other Quality Control Services:

1. Concrete testing required in this section, except concrete mix design, limestone aggregate test data, and testing of deficient concrete, will be performed by an independent commercial testing laboratory employed and paid by the Owner in accordance with Section 01454 - Testing Laboratory Services.

2. Provide material for and cooperate fully with Owner's testing laboratory technician in obtaining samples for required tests.

3. Standard Services: The following testing and quality control services will be provided by Owner in accordance with Section 01454, Testing Laboratory Services:

a. Verification that plant equipment and facilities conform to NRMCA "Certification of Ready-Mix Concrete Production Facilities".

b. Testing of proposed materials for compliance with this Specification.

c. Review of proposed mix design submitted by Contractor.

d. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Specification.

e. Strength testing of concrete according to following procedures:

(1) Obtaining samples for field test cylinders from every 100 cubic yards and any portion less than 100 cubic yards for each mix design placed each day, according to ASTM C172, with each sample obtained from a different batch of concrete on a representative, random basis. Selecting test batches by any means other than random numbers chosen before concrete placement begins is not allowed.

(2) Molding four specimens from each sample according to ASTM C31, and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C31.

(3) Testing two specimens at 7 days and two specimens at 28 days according to ASTM C39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days.

f. Air content: For each strength test, determination of air content of normal weight concrete according to ASTM C231.

g. Slump: For each strength test, and whenever consistency of concrete appears to vary, conducting slump test in accordance with ASTM C143.

h. Temperature: For each strength test, checking concrete temperature in accordance with ASTM C1064.

i. Lightweight concrete: For each strength test, or more frequently when requested by Engineer, determination of air content by ASTM C567 and unit weight by ASTM C567.

j. Monitoring of current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise Contractor to use hot weather precautions when such conditions will exist during concrete placement, and note on concrete test reports when Contractor has been advised that hot weather conditions will exist.

k. Class A and D Concrete Shrinkage Tests: Performance of drying shrinkage tests for trial batches as follows:

(1) Preparation and Testing of Specimens: Compression and drying shrinkage test specimens will be taken in each case from the same concrete sample; shrinkage tests will be considered a part of the normal compression tests for the project. 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C157, modified as follows:

(a) Wet curing: Remove specimens from molds at an age of 23 hours □1 hour after trial batching and immediately immerse in water at 70 degrees F □3 degrees F for at least 30 minutes;

(b) Measure within 30 minutes after first 30 minutes of immersion to determine original length (not to be confused with "base length");

(c) Then submerge in saturated limewater, at 73 degrees F □3 degrees F, for 7 days;

(d) Then measure at age 7 days to establish "base length" for drying shrinkage calculations ("zero" days drying age);

(e) Calculate expansion (base length expressed as a percentage of original length);

(f) Immediately store specimens in a temperature- and humidity-controlled room maintained at 73 degrees F, ±3 degrees F and 50 percent ±4 percent relative humidity, for the remainder of the test.

(g) Measure to determine shrinkage, expressed as percentage of base length. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at zero (0) days drying age) and the length after drying at each test age. Compute the average

drying shrinkage deformation of the specimens to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen. Report results of shrinkage tests to the nearest 0.001 percent of shrinkage.

(h) Report shrinkage separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

4. Additional Testing and Quality Control Services: The following will be performed by an independent commercial testing laboratory employed and paid by the Owner in accordance with Section 01410, Testing Laboratory Services, when requested by Owner.

   a. Checking of batching and mixing operations.

   b. Review of manufacturer's report of each cement shipment and conducting laboratory tests of cement.

   c. Molding and testing reserve 7-day cylinders or field cylinders.

   d. Conducting additional field tests for slump, concrete temperature and ambient temperature.

   e. Alkalinity Tests: For concrete used in sanitary structures, one test for each structure. Perform alkalinity tests on concrete covering reinforcing steel on the inside of the pipe or structure in accordance with "Encyclopedia of Industrial Chemical Analysis," Vol. 15, page 230.

5. Contractor shall provide the following testing and quality control services:

   a. Employ an independent commercial testing laboratory, acceptable to Owner, to prepare and test design mix for each class of concrete for which material source has been changed.

   b. Notify commercial testing laboratory employed by Owner 24 hours prior to placing concrete.

6. Testing of deficient concrete in place:

   a. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required by Owner.

   b. When concrete in place proves to be deficient, Contractor shall pay costs, including costs due to delays, incurred in providing additional testing and analysis services provided by the Owner, or the independent commercial testing laboratory selected by the Owner.

   c. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to the Owner.

d. Core Tests:

(1) Obtain and test cores in accordance with ASTM C42. Where concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before test; test dry. Where concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning in accordance with ASTM C42.

(2) Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Location of cores shall be determined by Owner so as to least impair strength of structure. When, before testing, one or more cores shows evidence of having been damaged during or after removal from structure, replace the damaged cores.

(3) Concrete in area represented by core test will be considered adequate when average strength of cores is equal to at least 85 percent of specified strength, and when no single core is less than 75 percent of specified strength.

(4) Patch core holes in accordance with Section 03345 - Concrete Finishing.

e. Structural Analysis: When core tests are inconclusive or impractical to obtain, Owner may perform additional structural analysis at Contractor's expense to confirm safety of structure.

f. Load Tests: When core tests and structural analysis do not confirm safety of structure, load tests may be required, and their results evaluated, in accordance with ACI 318.

g. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe), or other nondestructive device may be permitted by Owner to determine relative strengths at various locations in structure, to evaluate concrete strength in place, or for selecting areas to be cored. However, such tests, unless properly calibrated and correlated with other test data, shall not be used as basis for acceptance or rejection of structure's safety.

1.7 STORAGE AND HANDLING OF MATERIALS

A. Cement: Store cement in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set. When there is any doubt as to expansive potential of shrinkage-compensating cements because of method or length of storage and exposure, laboratory test cement before use.

B. Aggregate: Arrange and use aggregate stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before next is started.

C. Fine Aggregate: Before using, allow fine aggregate to drain until uniform moisture content is reached.

D. Admixtures: Store admixtures to avoid contamination, evaporation or damage. For those used in form of suspensions or nonstable solutions, provide suitable agitating equipment to assure uniform distribution of ingredients. Protect liquid admixtures from freezing and other temperature changes which would adversely affect their characteristics.

E. Lightweight Aggregates: Uniformly predampen lightweight aggregates as necessary to prevent excessive variations in moisture content. Allow predampened aggregates to remain in stockpiles, under continuous fog spray, for minimum of 24 hours before use. Provide adequate drainage in stockpile areas to eliminate excess water and accumulation of contaminated fines.

PART 2 –PRODUCTS

2.1 MATERIALS

A. Cement:

1. Use same brand of cement used in concrete mix design. Use only one brand of each type in each structure, unless otherwise indicated on Drawings.

2. Portland Cement: ASTM C150, Type I or Type II, gray in color. Use Type III only when specifically authorized by Owner in writing. Use Type II, including the requirements of Table 2, in construction of liquid-containing structures and cooling towers, unless shown otherwise on Drawings.

B. Admixtures:

1. Do not use calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions.

2. Air-Entraining Admixtures: ASTM C260, compatible with other admixtures used.

3. Chemical Admixtures: Polymer type, nonstaining, chloride-free admixtures conforming to ASTM C494, Type A, C, D or E.

4. High-Range Water Reducer (Superplasticizer): ASTM C494, Type F or G, compatible with and by the same manufacturer as other admixtures.

C. Mixing Water: Use clean, potable water, free from harmful amounts of oils, acids, alkalis or other deleterious substances, meeting requirements of ASTM C94.

D. Aggregates: Use coarse aggregate from only one source, and fine aggregate from only one source, for exposed concrete in any single structure.

1. Coarse Aggregate: Gravel, crushed gravel or crushed limestone conforming to ASTM C33. For wastewater treatment and conveying structures, provide only crushed limestone.

2. Fine Aggregate: Natural sand complying with ASTM C33, except provide only crushed limestone for wastewater treatment and conveying structures.

3. Limestone aggregate shall conform to ASTM C33 and the following additional requirements: Clean, hard, strong and durable particles free of chemicals and coatings of silt, clay, or other fine materials that may affect hydration and bond of cement paste. Select crushed limestone: High-calcium limestone (minimum 95 percent $CaCO_3$ and maximum 3.5 percent $MgCO_3$) with maximum Los Angeles Abrasion loss of 38 percent, when tested in accordance with ASTM C131 or ASTM C535. Test aggregate for soundness in accordance with ASTM C88; maximum loss shall not exceed 18 percent after 5 cycles of magnesium sulfate test.

4. Maximum size of coarse aggregate:

   a. Normal weight concrete, except as noted below: 1-1/2 inches.

   b. Formed members 6 inches or less in least dimension: 1/5 least dimension.

   c. Slabs: 1/3 depth of slab.

   d. Drilled shafts: 1/3 clearance between reinforcing steel, but not greater than 3/4 inch.

   e. Concrete fill, seal slabs and bonded concrete topping in clarifiers: 3/8 inch.

5. Coarse aggregate for lightweight concrete: ASTM C330. Grading limits: 3/4 inch to No. 4.

6. Abrasive Aggregate: Conform to requirements of Section 03345 - Concrete Finishing.

E. Calcium Chloride: Not permitted.

F. Evaporation Retardant: Masterbuilders "Confilm", Euclid "Eucobar", or equal.

G. Miscellaneous Materials:

1. Bonding Agent: Two-component modified epoxy resin.
2. Vapor barrier: 6 mil clear polyethylene film of type recommended for below-grade aplication.
3. Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement and water-reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.2 CONCRETE MIX

A. Objective: Select proportions of ingredients to produce concrete having proper placability, durability, strength, appearance and other specified properties.

B. Mix Design: Employ and pay an independent commercial testing laboratory, acceptable to Owner, to prepare and test mix designs for each type of concrete specified. Proportion mix design ingredients by weight. Submit mix designs and test results for approval.

1. During the trial batches, aggregate proportions may be adjusted by the testing laboratory using two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor. Concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractor's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. Prepare trial batches using the aggregates, cement and admixtures proposed for the project. Make trial batches large enough to obtain 3 drying shrinkage test specimens and 6 compression test specimens from each batch. Shrinkage testing is required only for Class C and D concrete.

2. Determine compressive strength by testing 6-inch diameter by 12-inch high cylinders, made, cured and tested in accordance with ASTM C192 and ASTM C39. Test 3 compression test cylinders at 7 days and 3 at 28 days. Average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall be not less than 125 percent of the specified compressive strength.

3. Perform sieve analysis of the combined aggregate for each trial batch according to of ASTM C136. Report percentage passing each sieve.

4. In mix designs for Class C and D concrete, fine aggregate shall not exceed 41 percent of total aggregate by weight.

C. Shrinkage Limitations, Class A and D Concrete

1. Maximum concrete shrinkage for specimens cast in the laboratory from the trial batch: 0.036 percent as measured at 21-day drying age, or 0.042 percent at 28-day drying age. Use for construction only mix designs that meet trial batch shrinkage requirements. Shrinkage limitations apply only to Class A and D concrete.

2. Maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.

3. If the required shrinkage limitation is not met during construction, take any or all of the following actions, at no additional cost to the Owner, for securing the specified shrinkage requirements: Changing the source or aggregates, cement or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or its effects.

D. Selecting Ingredient Proportions for Concrete:

1. Proportion concrete mix according to ACI 301, Chapter 3.

2. Establish concrete mix design by laboratory trial batches prepared by independent testing laboratory, or on basis of previous field experience in accordance with provisions of ACI 318, Item 5.3; however, minimum cement content for each class of concrete shall not be less than specified.

3. Concrete mix design data submitted for review shall have average 28-day compressive strength calculated in accordance with ACI 318, Item 5.3.2.1. When data is not available to determine standard deviation in accordance with ACI 318, Item 5.3.1, average 28-day strength of mix design shall conform to ACI 318, Table 5.3.2.2.

E. Water-Cement Ratios:

1. Maximum allowable water-cement ratios shall be as follows:

a. Concrete for liquid-containing structures: 0.45.

b. Concrete subjected to brackish water, salt spray or deicers: 0.40.

c. All other concrete: 0.55.

2. Superplasticizer may be added to maintain specified maximum water-cement ratios. Include free water in aggregate in water-cement ratio computations.

F. Adjustment of Mix Proportions: After sufficient data becomes available during construction, mix may be adjusted upon approval of Engineer, in accordance with ACI 318, Item 5.5; however, minimum cement content for each class of concrete shall not be less than specified.

G. Entrained Air: Air-entrain all concrete except drilled shafts. Total air content in accordance with ASTM C173: 4 to 6 percent.

H. Consistency, Workability, and Slump:

1. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce concrete which can be worked properly into place without segregation, and which can be compacted by vibratory methods as specified, to give the desired strength, density, impermeability and smoothness of surface. Change the quantity of water as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. Determine the consistency of the concrete in successive batches by slump tests in accordance with ASTM C 143. Slumps shall be as follows:

Concrete Type	Minimum Slump	Maximum Slump
Portland Cement Concrete:	2"	4"
Concrete to be dosed with superplasticizer:	1"	3"
Normal Weight Concrete after dosing with superplasticizer:	4"	9"
Lightweight Concrete after dosing with superplasticizer:	4"	7"
Drilled Shaft Concrete:	4"*	8"

* Minimum slump where drilled shafts are cast in temporary casings: 5 inches.

2. Specified slump shall apply at time when concrete is discharged at job site. Perform slump tests to monitor uniformity and consistency of concrete delivered to job site; however, do not use as basis for mix design. Do not exceed water-cement ratios specified.

I. Admixtures: Proportion admixtures according to manufacturer's recommendations. Use of accelerator is permitted when air temperature is less than 40 degrees F. Use of retarder is permitted when temperature of placed concrete exceeds 65 degrees F.

J. High-Range Water Reducers (Superplasticizers): Use superplasticizer to improve workability of concrete or delay hydration of cement, in accordance with requirements and recommendations of product manufacturer and approved submittals.

K. Concrete Classification and Strength:

1. Strength: Conform to values for class of concrete indicated on Drawings for each portion of Work. Requirements are based on 28-day compressive strength. If high early-strength concrete is allowed, requirements are based on 7-day compressive strength.

2. Classification:

Class (Normal-weight)	Minimum 28-Day Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
Concrete for Structures Containing Water or Wastewater		

A	4000	564 (6 Sacks)
B	1500	423 (3-1/2 Sacks)
C	3000	470 (5 Sacks)
D	5000	658 (7 Sacks)
H	3000	610 (6-1/2 Sacks)

Concrete for Buildings, Slabs on Grade and Miscellaneous Structures

Class (Light-weight)	Minimum 28-Day Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
AB	4000	Not Applicable
BB	1500	Not Applicable
CB	3000	Not Applicable
DB	5000	Not Applicable
E	3000	Not Applicable
F	4000	Not Applicable
G	5000	Not Applicable

3. Maximum size aggregate for Class H concrete: 3/8 inch. Maximum size aggregate for all other normal-weight concrete: 1-1/2 inches, except as specified in Paragraph 2.1D.4.

4. When required strength is not obtained with minimum cement content as specified, add cement, lower water-cement ratio or provide other aggregates as necessary.

5. In addition to conforming to specified strength, lightweight concrete must be within specified unit weight limits. Maximum air-dry unit weight is 118 pounds per cubic foot; minimum is 110 pounds per cubic foot unless shown otherwise on Drawings. Determine air-dry unit weight in accordance with ASTM C567. Correlate air-dry unit weight with fresh unit weight of the same concrete as a basis for acceptance during construction.

L. Use of Classes of Concrete:

1. Use classes of concrete as indicated on the Drawings and in other specifications.

2. Liquid-containing structures: If not otherwise indicated, use the following classes for structures containing water or wastewater and for utility applications in the locations described:

   a. Class A: All reinforced concrete and where not otherwise defined.

   b. Class B: Unreinforced concrete used for plugging pipes, seal slabs, thrust blocks and trench dams, unless indicated otherwise.

   c. Class H: Fill and topping. Where concrete fill thickness exceeds 3 inches in the majority of a placement and is not less than 1.5 inches thick, Class A concrete may be used.

3. All other structures: If not otherwise indicated, use the following classes in the locations described:

   a. Class AB: All reinforced concrete and where not otherwise defined.

b. Class CB: Duct banks;

c. Class BB: Unreinforced concrete fill under structures.

2.3 MIXING NORMAL WEIGHT CONCRETE

A. Conform to ACI 301, Chapter 7.
B. Ready-Mixed Concrete:

1. Measure, batch, mix and transport ready-mixed concrete according to ASTM C94. Plant equipment and facilities shall conform to NRMCA "Certification of Ready Mixed Concrete Production Facilities".

2. Provide batch tickets with information specified in ASTM C94. Deliver batch ticket with concrete and give to Owner's on-site testing laboratory representative.

C. Batch Mixing at Site:

1. Mix concrete in batch mixer conforming to requirements of CPMB "Concrete Plant Mixer Standards". Use mixer equipped with suitable charging hopper, water storage tank and water measuring device. Batch mixer shall be capable of mixing aggregates, cement and water into uniform mass within specified mixing time, and of discharging mix without segregation. Operate mixer according to rated capacity and recommended revolutions per minute printed on manufacturer's rating plate.

2. Charge batch into mixer so some water will enter before cement and aggregates. Keep water running until one-fourth of specified mixing time has elapsed. Provide controls to prevent discharging until required mixing time has elapsed. When concrete of normal weight is specified, provide controls to prevent addition of water during mixing. Discharge entire batch before mixer is recharged.

3. Mix each batch of 2 cubic yards or less for not less than 1 minute and 30 seconds. Increase minimum mixing time 15 seconds for each additional cubic yard or fraction of cubic yard.

4. Keep mixer clean. Replace pick-up and throw-over blades in drum when they have lost 10 percent of original depth.

D. Admixtures:

1. Charge air-entraining and chemical admixtures into mixer as solution using automatic dispenser or similar metering device. Measure admixture to accuracy within $\pm$ 3 percent. Do not use admixtures in powdered form.

2. Two or more admixtures may be used in same concrete, provided that admixtures in combination retain full efficiency and have no deleterious effect on concrete or on properties of each other. Inject admixtures separately during batching sequence.

3. Add retarding admixtures as soon as practicable after addition of cement.

E. Temperature Control:

1. When ambient temperature falls below 40 degrees F, keep as-mixed temperature above 55 degrees F to maintain concrete above minimum placing temperature.

2. When water or aggregate has been heated, combine water with aggregate in mixer before cement is added. Do not add cement to mixtures of water and aggregate when temperature of mixture is greater than 100 degrees F.

3. In hot weather, maintain temperature of concrete below maximum placing temperature. When necessary, temperature may be lowered by cooling ingredients, cooling mixer drum by fog spray, using chilled water or well-crushed ice in whole or part for added water, or arranging delivery sequence so that time of transport and placement does not generate unacceptable temperatures.

4. Submit hot weather and cold weather concreting plans for approval.

2.4 MIXING LIGHTWEIGHT CONCRETE

A. Determining Absorption of Aggregates: Mixing procedures vary according to total absorption by weight of lightweight aggregates. Determine total absorption by weight before predamping in accordance with ASTM C127.

B. Ten Percent or Less Absorption: Follow same requirements as for mixing normal-weight concrete when preparing concrete made with low-absorptive lightweight aggregates having 10 percent or less total absorption by weight. To be low-absorptive, aggregates must absorb less than 2 percent additional water in first hour after mixing.

C. More Than 10 Percent Absorption: Batch and mix concrete made with lightweight aggregates having more than 10 percent total absorption by weight, as follows:

1. Place approximately 80 percent of mixing water in mixer.

2. If aggregates are pre-dampened, add air-entraining admixture and all aggregates. Mix for minimum of 30 seconds, or 5 to 10 revolutions of truck mixer.

3. When aggregates have not been predampened, mix aggregates and water for minimum of 1 minute and 30 seconds, or 15 to 30 revolutions of truck mixer. Then add air-entraining admixture and mix for additional 30 seconds.

4. Then, in the following sequence, add specified or permitted admixtures (other than air-entraining agent), all cement, and mixing water previously withheld.

5. Complete mixing using procedures for normal-weight concrete.

2.5 MASS CONCRETE

A. Do not use high early-strength cement (Type III) or accelerating admixtures.

B. Use high-range water-reducing admixture (superplasticizer) to minimize water content and cement content.

C. Specified water-reducing retarding admixture may be required to prevent cold joints when placing large quantities of concrete, to permit revibration of concrete, to offset effects of high temperature in concrete or weather, and to reduce maximum temperature or rapid temperature rise.

2.6 EQUIPMENT

A. Select equipment of size and design to ensure continuous flow of concrete at delivery end. Conform to following equipment and operations requirements.

B. Truck mixers, agitators and manner of operation: Conform to ASTM C94. Use of non-agitating equipment for transporting concrete is not permitted.

C. Belt conveyors: Configure horizontally, or at a slope causing no segregation or loss. Use approved arrangement at discharge end to prevent separation. Discharge long runs without separation into hopper.

D. Chutes: Metal or metal-lined (other than aluminum). Arrange for vertical-to-horizontal slopes not more than 1 to 2 nor less than 1 to 3. Chutes longer than 20 feet or not meeting slope requirements may be used if concrete is discharged into hopper before distribution.

E. Do not use aluminum or aluminum-alloy pipe or chutes for conveying concrete.

PART 3 –EXECUTION

3.1 SPECIAL CONSIDERATIONS

A. Concreting Under Water: Not permitted except where shown otherwise on Drawings or approved by Owner. When shown or permitted, deposit concrete under water by methods acceptable to the Owner so fresh concrete enters mass of previously-placed concrete from within, causing water to be displaced with minimum disturbance at surface of concrete.

B. Protection from Adverse Weather: Unless adequate protection is provided or Owner's approval is obtained, do not place concrete during rain, sleet, snow or freezing weather. Do not permit rainwater to increase mixing water or to damage surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect Work.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. Earth Surfaces:

1. Under interior slabs on grade, install vapor barrier. Lap joints at least 6 inches and seal watertight with tape, or sealant applied between overlapping edges and ends. repair vapor barrier damaged during placement of reinforcing and inserts with vapor barrier material; lap over damaged areas at least 6 inches and seal watertight.

2. Other Earth Surfaces: Thoroughly wet by sprinkling prior to placing concrete, and keep moist by frequent sprinkling up to time of placing concrete thereon. Remove standing water. Surfaces shall be free from standing water, mud and debris at the time of placing concrete.

B. Construction Joints:

1. Definition: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been interrupted so that, in the judgement of the Owner, new concrete cannot be incorporated integrally with that previously placed.

2. Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, use forms or other means to shape the working face to secure proper union with subsequent work. Make construction joints only where acceptable to the Owner.

3. Preparation: Give horizontal joint surfaces a compacted, roughened surface for good

bond. Except where the Drawings call for joint surfaces to be coated, clean joint surfaces of laitance, loose or defective concrete and foreign material by hydroblasting or sandblasting (exposing aggregate), roughen surface to expose aggregate to a depth of at least 1/4 inch and wash thoroughly. Remove standing water from the construction joint surface before new concrete is placed.

4. After surfaces have been prepared cover approximately horizontal construction joints with a 3-inch lift of a grout mix consisting of Class C concrete batched without coarse aggregate; place and spread grout uniformly. Place wall concrete on the grout mix immediately thereafter.

C. Set and secure reinforcement, anchor bolts, sleeves, inserts and similar embedded items in the forms where indicated on Contract Drawings, shop drawings and as otherwise required. Obtain Owner's acceptance before concrete is placed. Accuracy of placement is the sole responsibility of the Contractor.

D. Place no concrete until at least 4 hours after formwork, inserts, embedded items, reinforcement and surface preparation have been completed and accepted by the Owner. Clean surfaces of forms and embedded items that have become encrusted with grout or previously-placed concrete before placing adjacent concrete.

E. Casting New Concrete Against Old**:** Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), thoroughly clean and roughen the surface of the old concrete by hydro-blasting or sandblasting (exposing aggregate). Coat joint surface with epoxy bonding agent following manufacturer's written instructions, unless indicated otherwise. Unless noted otherwise, this provision does not apply to vertical wall joints where waterstop is installed.

F. Protection from Water: Place no concrete in any structure until water entering the space to be filled with concrete has been properly cut off or diverted and carried out of the forms, clear of the work. Deposit no concrete underwater. Do not allow still water to rise on any concrete until concrete has attained its initial set. Do not allow water to flow over the surface of any concrete in a manner and at a velocity that will damage the surface finish of the concrete. Pumping, dewatering and other necessary operations for removing ground water, if required, are subject to Owner's review.

G. Corrosion Protection**:** Position and support pipe, conduit, dowels and other ferrous items to be embedded in concrete construction prior to placement of concrete so there is at least a 2 inch clearance between them and any part of the concrete reinforcement. Do not secure such items in position by wiring or welding them to the reinforcement.

H. Where practicable, provide for openings for pipes, inserts for pipe hangers and brackets, and setting of anchors during placing of concrete.

I. Accurately set anchor bolts and maintain in position with templates while they are being embedded in concrete.

J. Cleaning**:** Immediately before concrete is placed, thoroughly clean dirt, grease, grout, mortar, loose scale, rust and other foreign substances from surfaces of metalwork to be in contact with concrete.

3.3 HANDLING, TRANSPORTING AND PLACING CONCRETE

A. Conform to applicable requirements of Chapter 8 of ACI 301 and this Section. Use no aluminum materials in conveying concrete.

B. Rejected Work**:** Remove concrete found to be defective or non-conforming in materials or workmanship. Replace rejected concrete with concrete meeting requirements of Contract Documents, at no additional cost to the Owner.

C. Unauthorized Placement**:** Place no concrete except in the presence of the Owner. Notify the Owner in writing at least 24 hours before placement of concrete.

D. Placement in Wall Forms**:**

1. Do not drop concrete through reinforcing steel or into any deep form.

2. Do not place concrete in any form so as to leave an accumulation of mortar on form surfaces above the concrete.

3. Use hoppers and, if necessary, vertical ducts of canvas, rubber or metal (other than aluminum) for placing concrete in forms so it reaches the place of final deposit without separation. Free fall of concrete shall not exceed 4 feet below the ends of ducts, chutes or buggies. Uniformly distribute concrete during depositing.

4. Do not displace concrete in forms more than 6 feet in horizontal direction from place where it was originally deposited.

5. Deposit in uniform horizontal layers not deeper than 2 feet; take care to avoid inclined layers or inclined construction joints except where required for sloping members.

6. Place each layer while the previous layer is still soft. Rate of placement shall not exceed 5 feet of vertical rise per hour.

7. Provide sufficient illumination in form interior so concrete at places of deposit is visible from the deck or runway.

E. Conveyors and Chutes**:** Design and arrange ends of chutes, hopper gates and other points of concrete discharge in the conveying, hoisting and placing system so concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyors, if used, shall be of a type acceptable to the Owner. Do not use chutes longer than 50 feet. Slope chutes so concrete of specified consistency will readily flow. If a conveyor is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyors and chutes shall be covered.

F. Placement of Slabs**:** In hot or windy weather, conducive to plastic shrinkage cracks, apply evaporation retardant to slab after screeding in accordance with manufacturer's instructions and recommendations. Do not use evaporation retardant to increase water content of the surface cement paste. Place concrete for sloping slabs uniformly from the bottom of the slab to the top, for the full width of the placement. As work progresses, vibrate and carefully work concrete around slab reinforcement. Screed the slab surface in an up-slope direction.

G. Concrete Temperature**:** When placed, not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick, nor less than 50 degrees for all other sections. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When concrete temperature is 85 degrees F or above, do not exceed 60 minutes between introduction of cement to the aggregates and discharge. When the weather is such that the concrete temperature would exceed 90 degrees F, employ effective means, such as pre-cooling of aggregates and mixing water, using ice or placing at night, as necessary to maintain concrete

temperature, as placed, below 90 degrees F.

H. Cold Weather Placement: Conform to ACI 306.1 - Standard Specification for Cold Weather Concreting, and the following.

1. Remove snow, ice and frost from surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. Warm reinforcement and embedded items to above 32 degrees F prior to concrete placement.

2. Maintain concrete temperature above 50 degrees F for at least 3 days after placement.

3.4 PUMPING OF CONCRETE

A. If pumped concrete does not produce satisfactory results, in the judgement of the Owner, discontinue pumping operations and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: Use a 2-cylinder pump designed to operate with only one cylinder if one is not functioning, or have a standby pump on site during pumping.

C. The minimum hose (conduit) diameter: Comply with ACI 304.2R.

D. Replace pumping equipment and hoses (conduits) that do not function properly.

E. Do not use aluminum conduits for conveying concrete.

F. Field Control: Take samples for slump, air content and test cylinders at the placement (discharge) end of the line.

3.5 CONCRETE PLACEMENT SEQUENCE

A. Place concrete in a sequence acceptable to the Owner. To minimize effects of shrinkage, place concrete in units bounded by construction joints shown. Place alternate units so each unit placed has cured at least 7 days for hydraulic structures, or 3 days for other structures, before contiguous unit or units are placed, except do not place corner sections of vertical walls until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for other structures.

B. Level the concrete surface whenever a run of concrete is stopped. To ensure straight and level joints on the exposed surface of walls, tack a wood strip at least 3/4-inch thick to the forms on these surfaces. Carry concrete about 1/2 inch above the underside of the strip. About one hour after concrete is placed, remove the strip, level irregularities in the edge formed by the strip with a trowel and remove laitance.

3.6 TAMPING AND VIBRATING

A. Thoroughly settle and compact concrete throughout the entire depth of the layer being consolidated, into a dense, homogeneous mass; fill corners and angles, thoroughly embed reinforcement, eliminate rock pockets and bring only a slight excess of water to the exposed surface of concrete during placement. Use ACI 309R Group 3 immersion-type high-speed power vibrators (8,000 to 12,000 rpm) in sufficient number and with sufficient (at least one) standby units. Use Group 2 vibrators only when accepted by the Owner for specific locations.

B. Use care in placing concrete around waterstops. Carefully work concrete by rodding and

vibrating to make sure air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, work concrete under waterstops by hand, making sure air and rock pockets have been eliminated. Give concrete surrounding the waterstops additional vibration beyond that used for adjacent concrete placement to assure complete embedment of waterstops in concrete.

C. Concrete in Walls: Internally vibrate, ram, stir, or work with suitable appliances, tamping bars, shovels or forked tools until concrete completely fills forms or excavations and closes snugly against all surfaces. Do not place subsequent layers of concrete until previously-placed layers have been so worked. Provide vibrators in sufficient numbers, with standby units as required, to accomplish the results specified within 15 minutes after concrete of specified consistency is placed in the forms. Keep vibrating heads from contact with form surfaces. Take care not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 PLACING MASS CONCRETE

A. Observe the following additional restrictions when placing mass concrete.

1. Use specified superplasticizer.

2. Maximum temperature of concrete when deposited: 70 degrees F.

3. Place in lifts approximately 18 inches thick. Extend vibrator heads into previously-placed layer.

3.8 REPAIRING SURFACE DEFECTS AND FINISHING

A. Conform to Section 03345 - Concrete Finishing.

3.9 CURING

A. Conform to Section 03370 - Concrete Curing.

3.10 PROTECTION

A. Protect concrete against damage until final acceptance by the Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet or snow. Provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until all components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Owner.

END OF SECTION

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Section 03315

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.

2. Obtain services of and pay for certified testing laboratory to prepare design mixes.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

AB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

AC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

AD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

AE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

AF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

AG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

AH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AI. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

AJ. CRSI MSP-1 - Manual of Standard Practice.

AK. CRSI - Placing Reinforcing Bars.

AL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

AM. NRMCA - Concrete Plant Standards.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed mix design and test data for each type and strength of concrete in Work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Engineer.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. Submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.05 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 P R O D U C T S

2.01 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Engineer; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na2O + 0.658K20.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.

2. Fine Aggregate: ASTM C 33.

3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:

1. Water Reducers: ASTM C 494, Type A.

2. Water Reducing Retarders: ASTM 494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:

1. Fibrillated Polypropylene Fiber:

a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.

b. Physical Properties:

1. Material: Polypropylene

2. Length: 1/2 inch or graded

3. Specific Gravity: 0.9l

c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.

2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.

a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.

b. Physical Properties

1. Material: Steel

2. Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1

3. Specific Gravity: 7.8

4. Tensile Strength: 40-400 ksi.

5. Young's Modulus: 29,000 ksi

6. Minimum Average Tensile Strength: 50,000 psi

7. Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.02 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.04 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Engineer for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Engineer.

D. Classification:

Class	Cement Sks Per CY	Minimum Strength, psi (MPa)		Maximum W/C Ratio[1]	Air Entrain.
		28 Days	7 Days		
A	5.0 (280 kg/m^3)	3000 (20.6)	2100 (14.5)	0.6	Yes
B	4.0 (225 kg/m^3)	2000 (13.8)	1400 (9.7)	0.6	No
C	6.0 (335 kg/m^3)	3600(24.8)	2520 (17.4)	0.45	Yes
D	4.5 (252 kg/m^3)	2500 (17.2)	1750 (12.1)	0.6	No
H	6.0 (335 kg/m^3)	As indicated	As Indicated	0.45	Yes
I	5.5 (308 kg/m^3)	3500 (24.1)	2450 (16.9)	0.45	Yes
J	2.0 (112 kg/m^3)	800 (5.5)	560 (3.9)	N/A	No
S	6.0 (335 kg/m^3)	4000 (27.6)	2800 (19.3)	0.45	Yes

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:

1. Thickness: not less than 3/8 inch

2. Acceptable Manufacturers:

a. Kirkhill Rubber Co., Brea, California

b. Water Seals, Inc., Chicago, Illinois

c. Progress Unlimited, Inc., New York, New York

d. Greenstreak Plastic Products Co., St. Louis, Missouri

e. Approved equal.

PART 3 E X E C U T I O N

3.01 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of

allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Engineer, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Engineer and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Engineer. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit,

piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Engineer before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Engineer.

3.05 PLACING CONCRETE

A. Give sufficient advance notice to Engineer (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Engineer's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from

coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

3.07 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Engineer. Where so approved, make additional construction joints with details equivalent to

those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Engineer.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.

2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Engineer. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.

2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Engineer.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Unless otherwise directed by Engineer, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.

2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.

3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.

4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15,and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Engineer, at no additional cost to Owner.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Engineer.

END OF SECTION

SECTION 03345

CONCRETE FINISHING

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Repairing surface defects.

B. Finishing concrete surfaces including both formed and unformed surfaces.

C. Sealing concrete surfaces.

D. Installation of concrete fill and installation of concrete topping in bottoms of clarifiers and thickeners.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

B. ASTM C881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

C. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

D. ASTM D4587 - Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light-and Water-Exposure Apparatus.

E. ASTM E1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System.

1.4 SUBMITTALS

A. Conform to Section 01300 - Submittals.

B. Submit manufacturer's technical literature on the following products proposed for use. Include manufacturer's installation and application instructions and, where specified, manufacturer's certification of conformance to requirements and suitability for use in the applications indicated.

1. Floor hardener.
2. Sealer.

3. Epoxy floor topping.
4. Epoxy penetrating sealer.
5. Latex bonding agent.
6. Epoxy adhesive.
7. Abrasive aggregate.
8. Evaporation retardant.

PART 2 –PRODUCTS

2.1 MATERIALS

A. Sealer/Dustproofer (VOC Compliant): Water-based acrylic sealer; non-yellowing under ultraviolet light after 200-hour test in accordance with ASTM D4587. Conform to local, state and federal solvent emission requirements.

B. Epoxy Floor Topping: Two-component epoxy resin meeting ASTM C881 Type III, resistant to wear, staining and chemical attack, blended with granite, sand, trap rock or quartz aggregate, trowel-applied over concrete floor. Topping thickness, 1/8 inch; color, gray.

C. Abrasive Aggregate for Non-slip Finish: Fused aluminum oxide grit, or crushed emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Material shall be factory graded, packaged, rustproof and non-glazing, and unaffected by freezing, moisture and cleaning materials.

D. Epoxy Penetrating Sealer: Low-viscosity, two-component epoxy system designed to give maximum penetration into concrete surfaces. Sealer shall completely seal concrete surfaces from penetration of water, oil and chemicals; prevent dusting and deterioration of concrete surfaces caused by heavy traffic; and be capable of adhering to floor surfaces subject to hydrostatic pressure from below. Color, transparent amber or gray; surface, non-slip.

E. Latex Bonding Agent: Non-redispersable latex base liquid conforming to ASTM C1059. When used in water and wastewater treatment structures, bonding agent shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required.

F. Bonding Grout: Prepare bonding grout by mixing approximately one part cement to one part fine sand meeting ASTM C144 but with 100 percent passing No. 30 mesh sieve. Mix with water to consistency of thick cream. At Contractor's option, a commercially prepared bonding agent used in accordance with manufacturer's recommendations and instructions may be used. When used in water and wastewater treatment structures, bonding agent shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required. Submit manufacturer's technical information on proposed bonding agent.

G. Patching Mortar:

1. Make patching mortar of same materials and of approximately same proportions as concrete, except omit coarse aggregate. Substitute white Portland cement for part of gray Portland cement on exposed concrete in order to match color of surrounding concrete. Determine color by making trial patch. Use minimum amount of mixing water required for handling and placing. Mix patching mortar in advance and allow to stand. Mix frequently with trowel until it has reached stiffest consistency that will permit placing. Do not add water.

2. Proprietary compounds for adhesion or specially formulated cementitious repair mortars may be used in lieu of or in addition to foregoing patching materials provided that properties of bond and compressive strength meet or exceed the foregoing and color of surrounding concrete can be matched where required. Use such compounds according to manufacturer's recommendations. When used in water and wastewater treatment structures, material shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required.

H. Epoxy Adhesive: Two-component, 100 percent solids, 100 percent reactive compound developing 100 percent of strength of concrete, suitable for use on dry or damp surfaces. Epoxy used to inject cracks and as a binder in epoxy mortar shall meet ASTM C881, Type VI. Epoxy used as a bonding agent for fresh concrete shall meet ASTM C881, Type V.

I. Non-shrink Grout: See Section 03600 - Structural Grout.

J. Spray-Applied Coating: Acceptable products are Thoro System Products "Thoroseal Plaster Mix" or equal. Color: Gray.

K. Concrete Topping: Class H concrete with 3/8-inch maximum coarse aggregate size, as specified in Section 03310 - Structural Concrete.

L. Concrete Fill: Class H concrete with 3/8-inch maximum coarse aggregate size, (Class C where fill thickness exceeds 3 inches throughout a placement), as specified in Section 03310 - Structural Concrete.

M. Evaporation Retardant: Confilm, manufactured by Master Builders; Eucobar, manufactured by Euclid Chemical Company; or equal.

PART 3 –EXECUTION

3.1 AGGREGATE CONCEALMENT

A. Unless indicated otherwise on Drawings or approved by Owner, all surfaces to be finished shall be free of exposed aggregate.

3.2 REPAIRING SURFACE DEFECTS

A. Defective Areas: Repair immediately after removal of forms. Remove honeycombed and other defective concrete down to sound concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to concrete surface. Thoroughly work bonding grout into the surface with a brush as that the entire surface is covered. Alternatively, a proprietary bonding agent may be used. Use bonding agent in accordance with manufacturer's instructions. While bonding coat is still tacky, apply premixed patching mortar. Thoroughly consolidate mortar into place and strike off to leave patch slightly higher than surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finishing. Keep patched area damp for 7 days. Alternatively, a proprietary cementitious repair mortar may be used and placed in accordance with manufacturer's instructions. Do not use metal tools in finishing patches in formed walls which will be exposed.

B. Tie Holes: Patch holes immediately after removal of forms. After cleaning and roughening with a wire brush on a rotary drill, thoroughly dampen tie hole and fill solid with patching mortar. Taper tie holes shall have the plug, specified in 03100 - Concrete Formwork, driven into the hole to the center of the wall before grouting. Completely fill taper tie holes with patching mortar except that non-shrink grout shall be used for all walls in contact with soil or liquid. On wall

faces exposed to view, fill the outer 2 inches of the taper tie hole with patching mortar blended to match adjacent concrete.

C. Cracks: Repair cracks in excess of 0.01 inch by pressure injection of moisture-insensitive epoxy-resin system. Submit proposed material and method of repair for approval prior to making repairs.

D. Structural Repair: When required, make structural repairs after prior approval of Owner as to method and procedure, using specified epoxy adhesive or approved epoxy mortar.

3.3 FINISHING OF FORMED SURFACES

A. Unfinished Surfaces: Finish is not required on surfaces concealed from view in completed structure by earth, ceilings or similar cover, unless indicated otherwise on Drawings.

B. Rough Form Finish:

1. No form facing material is required on rough form finish surfaces.

2. Patch tie holes and defects. Chip off fins exceeding 1/4 inch in height.

3. Rough form finish may be used on concrete surfaces which will be concealed from view by earth in completed structure, except concealed surfaces required to have smooth form finish, as shown on Drawings.

C. Smooth Form Finish:

1. Form facing shall produce smooth, hard, uniform texture on concrete. Use plywood or fiberboard linings or forms in as large sheets as practicable, and with smooth, even edges and close joints.

2. Patch tie holes and defects. Rub fins and joint marks with wooden blocks to leave smooth, unmarred finished surface.

3. Provide smooth form finish on the wet face of formed surfaces of water-holding structures, and of other formed surfaces not concealed from view by earth in completed structure, except where otherwise indicated on Drawings. Walls that will be exposed after future construction, at locations indicated on Drawings, shall have smooth form finish. Smooth form finish on exterior face of exterior walls shall extend 2 feet below final top of ground elevation. Exterior face of all perimeter grade beams shall have smooth form finish for full depth of grade beam.

D. Rubbed Finish:

1. Use plywood or fiberboard linings or forms in as large sheets as practicable, and with smooth, even edges and close joints.

2. Remove forms as soon as practicable, repair defects, wet surfaces, and rub with No. 16 carborundum stone or similar abrasive. Continue rubbing sufficiently to bring surface paste, remove form marks and fins, and produce smooth, dense surface of uniform color and texture. Do not use cement paste other than that drawn from concrete itself. Spread paste uniformly over surface with brush. Allow paste to reset, then wash surface with clean water.

3. Use rubbed finish at locations indicated on Drawings, except where rubbed finish is indicated for a wall which will be containing a liquid, use spray-applied coating.

E. Spray-applied Coating: At Contractor's option, in lieu of rubbed finish, spray-applied coating may be applied after defects have been repaired and fins removed. Remove form oil, curing compound and other foreign matter that would prevent bonding of coating. Apply coating in uniform texture and color in accordance with coating manufacturer's instructions.

F. Related Unformed Surfaces: Tops of piers, walls, bent caps, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to texture reasonably consistent with that of formed surfaces. Continue final treatment on formed surfaces uniformly across unformed surfaces.

3.4 HOT WEATHER FINISHING

A. When hot weather conditions exist, as defined by Section 03310 - Structural Concrete and as judged by the Owner, apply evaporation retardant to the surfaces of slabs, topping and concrete fill placements immediately after each step in the finishing process has been completed.

3.5 FINISHING SLABS AND SIMILAR FLAT SURFACES TO CLASS A, B AND C TOLERANCES

A. Apply Class A, B and C finishes at locations indicated on Drawings.

B. Shaping to Contour: Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to proper contour. See Section 03100 - Concrete Formwork for edge forms and screeds.

C. Consolidation and Leveling: Concrete to be consolidated shall be as stiff as practicable Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Consolidate and level slabs and floors with vibrating bridge screeds, roller pipe screeds or other approved means. After consolidation and leveling, do not permit manipulation of surfaces prior to finishing operations.

D. Tolerances for Finished Surfaces: Check tolerances by placing straightedge of specified length anywhere on slab. Gap between slab and straightedge shall not exceed tolerance listed for specified class.

Straightedge Class	Length in Feet	Tolerance in Inches
A	10	1/8
B	10	1/4
C	2	1/4

E. Raked Finish: After concrete has been placed, struck off, consolidated and leveled to Class C tolerance, roughen surface before final set. Roughen with stiff brushes or rakes to depth of approximately 1/4 inch. Notify Engineer prior to placing concrete requiring initial raked surface finish so that acceptable raked finish standard may be established for project. Protect raked, base-slab finish from contamination until time of topping. Provide raked finish for following:

1. Surfaces to receive bonded concrete topping or fill.

2. Steep ramps, as noted on Drawings.

3. Additional locations as noted on Drawings.

F. Float Finish:

1. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when mix has stiffened sufficiently to permit proper operation of power-driven float. Consolidate surface with power-driven floats. Use hand floating with wood or cork-faced floats in locations inaccessible to power-driven machine and on small, isolated slabs.

2. After initial floating, re-check tolerance of surface with 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots to Class B tolerance. Immediately re-float slab to a uniform, smooth, granular texture.

3. Provide float finish at locations not otherwise specified and not otherwise indicated on Drawings.

G. Trowel Finish:

1. Apply float finish as previously specified. After power floating, use power trowel to produce smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional trowelings by hand after surface has hardened sufficiently. Do final troweling when ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling operations.

2. Produce finished surface free of trowel marks, uniform in texture and appearance and conforming to Class A tolerance. On surfaces intended to support floor coverings, remove defects which might show through covering by grinding.

3. Provide trowel finish for floors which will receive floor covering and additional locations indicated on Drawings.

H. Broom or Belt Finish:

1. Apply float finish as previously specified. Immediately after completing floated finish, draw broom or burlap belt across surface to give coarse transverse scored texture.

2. Provide broom or belt finish at locations indicated on Drawings.

3.6 FINISHING SLABS AND SIMILAR FLAT SURFACES TO "F-NUMBER SYSTEM" FINISH

A. Shaping to Contour: Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to proper contour. Edge forms and screeds: Conform to Section 03100 - Concrete Formwork.

B. Consolidation and Leveling: Concrete to be consolidated shall be as dry as practicable. Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Consolidate and level slabs and floors with vibrating bridge screeds, roller pipe screeds or other approved means. After consolidation and leveling, do not manipulate surfaces prior to finishing operations.

C. Tolerances for Finished Surfaces: Independent testing laboratory will check floor flatness and levelness in accordance with Paragraph 3.12, Field Quality Control.

D. Float Finish:

1. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when mix has stiffened sufficiently to permit proper operation of power-driven float. Consolidate surface with power-driven floats. Use hand floating with wood or cork-faced floats in locations inaccessible to power-driven machine and on small, isolated slabs.

2. Check tolerance of surface after initial floating with a 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots. Immediately re-float slab to uniform, smooth, granular texture to F_F20/F_L17 tolerance, unless shown otherwise on Drawings.

3. Provide "F-Number System" float finish at locations indicated on Drawings.

E. Trowel Finish:

1. Apply float finish as previously specified. After power floating, use power trowel to produce smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional trowelings by hand after surface has hardened sufficiently. Do final troweling when ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling operations.

2. Produce finished surface free of trowel marks, uniform in texture and appearance and conforming to an F_F25/F_L20 tolerance for slabs on grade and F_F25/F_L17 for elevated slabs, unless shown otherwise on Drawings. On surfaces intended to support floor coverings, remove defects, which might show through covering, by grinding.

3. Provide "F-Number System" trowel finish at locations indicated on Drawings.

3.7 BONDED CONCRETE TOPPING AND FILL

A. Surface Preparation:

1. Protect raked, base-slab finish from contamination until time of topping. Mechanically remove oil, grease, asphalt, paint, clay stains or other contaminants, leaving clean surface.

2. Prior to placement of topping or fill, thoroughly dampen roughened slab surface and leave free of standing water. Immediately before topping or fill is placed, scrub coat of bonding grout into surface. Do not allow grout to set or dry before topping or fill is placed.

B. Concrete Fill:

1. Where concrete fill intersects a wall surface at an angle steeper than 45 degrees from vertical, provide a 1.5-inch deep keyway in the wall at the point of intersection; size keyway so that no portion of the concrete fill is less than 1.5 inches thick. Form keyway in new walls; create by sawcutting the top and bottom lines and chipping in existing walls.

2. Apply wood float finish to surfaces of concrete fill.

3. Provide concrete fill at locations shown on Drawings.

C. Bonded Concrete Topping in Bottom of Clarifiers and Thickeners:

1. Minimum thickness of concrete topping: 1 inch. Maximum thickness when swept in by clarifier and thickener equipment: 3 inches.

2. Compact topping and fill by rolling or tamping, bring to established grade, and float. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. Coat surface with evaporation retardant as needed between finishing operations to prevent plastic shrinkage cracks.

3. Screed topping to true surface using installed equipment. Protect equipment from damage during sweeping-in process. Perform sweeping-in process under supervision of equipment manufacturer's factory representative. After topping has been screeded, apply wood float finish. During finishing, do not apply water, dry cement or mixture of dry cement and sand to the surface.

4. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the Owner, fill the tank with sufficient water to cover the entire floor for 14 days.

5. Provide bonded concrete topping in bottom of all clarifiers and thickeners.

3.8 EPOXY PENETRATING SEALER

A. Surfaces to receive epoxy penetrating sealer: Apply wood float finish. Clean surface and apply sealer in compliance with manufacturer's instructions.

B. Rooms with concrete curbs or bases: Continue application of floor coating on curb or base to its juncture with masonry wall. Rooms with solid concrete walls or wainscots: Apply minimum 2-inch-high coverage of floor coating on vertical surface.

C. Mask walls, doors, frames and similar surface to prevent floor coating contact.

D. When coving floor coating up vertical concrete walls, curbs, bases or wainscots, use masking tape or other suitable material to keep a neat level edge at top of cove.

E. Provide epoxy penetrating sealer at locations indicated on Drawings.

3.9 EPOXY FLOOR TOPPING

A. Surfaces to receive epoxy floor topping: Apply wood float finish unless recommended otherwise by epoxy floor topping manufacturer. Clean surface and apply epoxy floor topping in compliance with manufacturer's recommendations and instructions. Thickness of topping: 1/8 inch.

B. Rooms with concrete curbs or bases: Continue application of floor coating on curb or base to its juncture with masonry wall. Rooms with solid concrete walls or wainscots: apply 2-inch-high coverage of floor coating on vertical surface.

C. Mask walls, doors, frames and similar surfaces to prevent floor coating contact.

D. When coving floor coating up vertical concrete walls, curbs, bases or wainscots, use masking tape or other suitable material to keep a neat level edge at top of cove.

E. Finished surface shall be free of trowel marks and dimples.

F. Provide epoxy floor topping at locations indicated on Drawings.

3.10 SEALER/DUSTPROOFER

A. Where sealer or sealer/dustproofer is indicated on Drawings, just prior to completion of construction, apply coat of specified clear sealer/dustproofing compound to exposed interior concrete floors in accordance with manufacturer's instructions.

3.11 NONSLIP FINISH

A. Apply float finish as specified. Apply two-thirds of required abrasive aggregate by method that ensures even coverage without segregation and re-float. Apply remainder of abrasive aggregate at right angles to first application, using heavier application of aggregate in areas not sufficiently covered by first application. Re-float after second application of aggregate and complete operations with troweled finish. Perform finishing operations in a manner that will allow the abrasive aggregate to be exposed and not covered with cement paste.

B. Provide non-slip finish at locations indicated on Drawings.

3.12 FIELD QUALITY CONTROL

A. Flatness and levelness of slabs and similar flat surfaces that are indicated on Drawings to receive "F-Number System" finish will be checked by independent testing laboratory employed by Owner in accordance with Section 01454 - Testing Laboratory Services.

B. Tolerances for "F-Number System" finished surfaces:

1. Floor tolerance shall be determined in accordance with ASTM E1155.

2. Floor flatness and levelness tolerances:

a. F_F defines maximum floor curvature allowed over 24 inches. Computed on the basis of successive 12-inch elevation differentials, F_F is commonly referred to as the "flatness F-Number."

$F_F = 4.57$
Maximum difference in elevation, in decimal inches, between successive 12" elevation differences.

b. F_L defines relative conformity of floor surface to horizontal plane as measured over 10-foot distance. F_L is commonly referred to as "levelness F-number."

$F_L = 12.5$
Maximum difference in elevation, in inches,
between two points separated by 10 feet.

3. Achieve specified overall slab tolerance. Minimum local tolerance (1/2 bay, unless otherwise designated by Engineer): 2/3 of specified tolerance.

4. Tolerance for floated finish: F_F20/F_L17, unless otherwise shown on Drawings.

5. Tolerance for troweled finish: F_F25/F_L20 for slabs on grade, and F_F25/F_L17 for elevated slabs, unless otherwise shown on Drawings.

3.13 CURING

A. Conform to requirements of Section 03370 - Curing Concrete.

END OF SECTION

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SECTION 03370

CONCRETE CURING

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Curing of structural concrete.

1.2 MEASURMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ACI 308 - Standard Practice for Curing Concrete.

B. ASTM C171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

D. ASTM D44587 - Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light-and Water-Exposure Apparatus.

1.4 DEFINITIONS

A. Mass Concrete: Concrete sections 4 feet or more in least dimension.

1.5 SUBMITTALS

A. Conform to Section 01300 - Submittals.

B. Product Data: Submit description of proposed curing method for concrete. When use of membrane-forming compound is proposed, submit manufacturer's technical information including material specifications, installation instructions and recommendations, and evidence that compound is satisfactory for intended application. State locations where curing compound will be used.

C. When membrane-forming compounds are to be used, submit certification by the manufacturer of compliance with specified requirements and compatibility with toppings, coatings, finishes, and adhesives to be applied.

PART 2 –PRODUCTS

2.1 MATERIALS

A. Membrane-forming Curing Compound: Conform to ASTM C309, Type 1D, and following requirements.

1. Minimum solids content: 30 percent.

2. Compound shall not permanently discolor concrete. When used for liquid- containing structures, curing compound shall be white-pigmented.

3. When used in areas that are to be coated, or that will receive topping or floor covering, material shall not reduce bond of coating, topping, or floor covering to concrete. Curing compound manufacturer's technical information shall state conditions under which compound will not prevent bond.

4. Conform to local, state and federal solvent emission requirements.

B. Clear Curing and Sealing Compound (VOC Compliant): Conform to ASTM C309, Type 1, Class B, and the following requirements: 30 percent solids content minimum; non-yellowing under ultraviolet light after 500-hour test in accordance with ASTM D4587. Sodium silicate compounds are not permitted. Conform to local, state and federal solvent emission requirements.

C. Sheet Material for Curing Concrete: ASTM C171; waterproof paper, polyethylene film or white burlap-polyethylene sheeting.

D. Curing Mats (for use in Curing Method 2): Heavy shag rugs or carpets, or cotton mats quilted at 4 inches on center; 12 ounce per square yard minimum weight when dry.

E. Water for curing: Clean and potable.

PART 3 –EXECUTION

3.1 CURING PROCEDURES

A. Comply with ACI 308 and the requirements specified herein. Protect freshly-deposited concrete from premature drying and excessively hot or cold temperatures. Maintain minimal moisture loss and relatively constant temperature during time necessary for hydration of cement and proper hardening of concrete.

B. Unformed Surfaces: For concrete surfaces not in contact with forms, use one of following procedures immediately after completion of placement and finishing.

1. Ponding or continuous sprinkling.

2. Absorptive mat or fabric kept continuously wet.

3. Sand or other covering kept continuously wet.

4. Continuous steam bath (not exceeding 150 degrees F at surface of concrete).

5. Vapor mist bath.

6. Membrane-forming curing compound applied according to manufacturer's recommendations. After the curing compound has dried, wet slab surfaces and cover with waterproof paper, polyethylene film, or white burlap-polyethylene sheeting after the

application of the curing compound. Tape sheet seams together and provide sufficient weights to keep the sheeting in place. Rewet the slab surface if the sheeting becomes dislodged, and replace the sheeting.

7. Other moisture-retaining coverings as approved by Owner.

C. Restrictions on Use of Curing Compounds: Unless curing compound manufacturer certifies that curing compound will not prevent bond to cured surface, do not use curing compound on surfaces that will be rubbed or receive additional concrete, mortar, topping, terrazzo or other cementitious finishing materials, on slabs under resilient floors or built-up roofing, or on surfaces to be waterproofed, sealed, hardened or painted.

D. Curing and Sealing Compounds: At locations indicated, cure exposed interior slabs and troweled slabs receiving mastic-applied adhesives with specified clear curing and sealing compound in accordance with manufacturer's recommendations. Do not store materials directly on curing membranes. Use plywood to protect curing membrane from damage. Immediately repair membranes damaged by foot traffic or other operations.

E. Duration of Curing: Continue curing until cumulative number of days or fractions of days during which ambient temperature is above 50 degrees F has totaled 7. Continue curing of water-retaining structures for a total of 14 days. When high-early-strength concrete has been used, continue curing for total of 3 days. Prevent rapid drying at end of curing period.

F. Formed Surfaces: During the curing period keep wet steel forms heated by sun and wood forms in contact with concrete. When forms are to be removed during curing period, employ curing materials or methods immediately. Continue such curing for remainder of curing period.

G. Temperature:

1. Cold Weather: When mean daily temperature of atmosphere is less than 40 degrees F, maintain temperature of concrete between 50 and 70 degrees F for required curing period. When necessary, make arrangements for heating, covering, insulating or housing concrete work in advance of placement to maintain required temperature and moisture conditions. Prevent damage or injury due to concentration of heat. When combustion heaters are necessary in enclosed or protected area where concrete slabs are being placed, vent heaters.

2. Hot Weather: In advance of placement make arrangements for shading, fog spraying, sprinkling, ponding or installation of windbreaks or wet covering of light color. Take such protective measures as quickly as concrete hardening and finishing operations will allow.

3. Temperature Changes: Control so rate of change in temperature of concrete is as uniform as possible. Do not permit temperature change to exceed 5 degrees F in any one hour or 50 degrees F in any 24-hour period.

H. Protection from Mechanical Injury: During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods, and by rain or running water. Do not load self-supporting structures in a way that overstresses concrete.

3.2 CURING MASS CONCRETE

A. Observe the following additional restrictions when curing mass concrete.

1. Minimum curing period: 2 weeks.

2. When ambient air temperature falls below 32 degrees F, protect surface of concrete against freezing.

3. Do not use steam or other curing methods that will add heat to concrete.

4. Keep forms and exposed concrete continuously wet for at least the first 48 hours after placing, and whenever surrounding air temperature is above 90 degrees F during final curing period.

5. During 2-week curing period, provide necessary controls to prevent ambient air temperature immediately adjacent to concrete from falling more than 30 degrees F in 24 hours.

END OF SECTION

SECTION 03600

STRUCTURAL GROUT

PART 1 – G E N E R A L

1.1 SECTION INCLUDES

A. Non-shrink grout used wherever grout is shown in the Documents, unless another type is specifically referenced. Two classes of non-shrink grout (Class I and II) and areas of application are specified.

1.2 MEASUREMENT AND PAYMENT

A. Unit prices.

1. Refer to Section 01270 – Measurement and Payment, for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. CRD-C621 - Corps of Engineers Specification for Non-shrink Grout

B. ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)

C. ASTM C230 - Specifications for Flow Table for use in Tests of Hydraulic Cement

D. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.4 SUBMITTALS

A. Conform to Section 01300 - Submittals.

B. Quality Control:

1. The Contractor shall submit manufacturer's literature certifying compliance with the specified properties for Class I and II grouts.

2. The Contractor shall submit manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the work.

C. The Contractor shall submit manufacturer's written warranty as specified.

1.5 QUALITY CONTROL

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Owner to ensure

continued compliance with these Specifications. The specimens will be made by the Owner or its representative.

2. Compression tests and fabrication of specimens for non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Owner. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.

3. Grout already placed which fails to meet the requirements of these Specifications is subject to removal and replacement no additional cost to the Owner.

4. The cost of laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Owner in obtaining specimens for testing. However, the Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. The Contractor shall supply materials necessary for fabricating the test specimens.

B. Warranty:

1. Provide 1-year warranty for work provided under this Section.

2. Manufacturer's warranty shall not contain a disclaimer limiting responsibility to only the purchase price of products or materials furnished.

3. Manufacturer shall warrant participation with Contractor in replacing or repairing grout found to be defective due to faulty materials, as determined by industry standard test methods.

PART 2 –PRODUCTS

2.1 APPLICATION

The following is a listing of typical applications and the corresponding type of grout which is to be used. Unless indicated otherwise, grouts shall be provided as listed below whether or not called for on the Drawings.

Application:	Type of Grout
Structural member base plates	Non-shrink Class II
Storage tanks and other equipment	Non-shrink Class I
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-shrink Class II (Class I where placement time exceeds 15 minutes)
Under precast concrete elements	Non-shrink Class I
Toppings and concrete fill less than 3 inches thick	Concrete Topping per Section 03310 and Section 03345
Application:	Type of Grout
Toppings and concrete fill greater than 3 inches thick	Concrete Fill per Section 03310 and Section 03345

Any application not listed above, where grout is called for on the Drawings	Non-shrink Class I, unless noted otherwise

2.2 PREPACKAGED GROUTS

A. Basic Requirements for Cementitious Non-Shrink Grout

1. Provide prepackaged non-shrink grout that is inorganic, flowable, non-gas-liberating, non-metallic, and cement-based, requiring only the addition of water.

2. Deliver grout in original packaging with manufacturer's instructions printed on each container.

3. Select the specific formulation for each class of non-shrink grout specified to conform to that recommended by the manufacturer for the particular application.

4. Compressive strength at 28 days: 7000 psi minimum.

5. Do not use a grout for which the non-shrink property is based on a chemically generated gas or gypsum expansion.

B. Class I Non-Shrink Grout:

1. Supply Class I Grout conforming to these specifications and to CRD-C621 and ASTM C1107 Grade C and B (as modified below) when tested using the amount of water needed to achieve the following properties:

   a. Fluid consistency (20 to 30 seconds) per CRD-C611 at initial testing.

   b. Fluid consistency (45 seconds) per CRD-C611 at 30 minutes after mixing.

   c. At temperatures of 45, 73.4, and 95 degrees F.

2. To satisfy non-shrink requirements, the length change from placement to time of final set shall not have a shrinkage greater than the amount of expansion measured after final set at 3 and 14 days. The expansion at 3 and 14 days shall not exceed the 28-day expansion.

3. Fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.

4. Demonstrate in tests that grout maintains contact with the baseplate to provide an minimum effective bearing area of 95 percent of the gross contact area after final set.

5. The grout packaging shall list weight, maximum amount of mixing water to be used, maximum usable working time (pot life) at flowable consistency, and temperature restrictions for preparation and placement within which grout will meet specified requirements.

C. Class II Non-Shrink Grout:

1. Supply Class II Grout confirming to ASTM C1107 and the following requirements when tested using the amount of water needed to achieve the following properties:

a. Flowable consistency: 140 percent flow on ASTM C 230, five drops in 30 seconds.

b. Fluid working time: 15 minutes, minimum.

c. Flowable duration: 30 minutes, minimum.

2. When tested, the grout shall not bleed at maximum allowed water.

2.3 CURING MATERIALS

A. Curing materials: As specified in Section 03370 - Concrete Curing and as recommended by the manufacturer of prepackaged grouts.

2.4 CONSISTENCY

A. Mix grouts to the consistency necessary to completely fill the space to be grouted. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

PART 3 –EXECUTION

3.1 PREPARATION

A. Verify that base concrete or masonry has attained design strength before grout is placed.

B. When cementitious grouts are used on concrete surfaces, saturate the concrete surface with water for 24 hours prior to placement of cement-based grout. Upon completion of saturation period remove excess water prior to grouting.

3.2 GROUTING PROCEDURES

A. Prepackaged Grouts: Perform mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts according to the written instructions of the manufacturer. Use prepackaged materials in the quantities and proportions as directed by the manufacturer unless there is certified test data verifying that the specified properties are attained by modified mix.

3.3 CONSOLIDATION

A. Place grout in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

END OF SECTION

SPECIAL SPECIFICATION

3758

CONCRETE BLOCK WALL STRUCTURE

PART 1 GENERAL

1. **DESCRIPTION.** This Item shall govern for the construction of a concrete block wall structure of the design shown on the plans and details.

PART 2 MATERIALS

(1) **Concrete Masonry Unit.** Concrete Masonry Unit shall be of the types and sizes shown on the plans.

(2) **Concrete.** Concrete shall be of the class specified in the plans and comply with Item 421, “Portland Cement Concrete”.

(3) **Cement.** Cement shall conform to ASTM C150 and shall be Type I or Type II Portland Cement. Masonry cement, when used, shall conform to ASTM C91 Type N.

(4) **Grout.** Coarse grout shall conform to ASTM C476, with a maximum aggregate size of 1/2 in. and a minimum compressive strength of 2000 psi.

(5) **Sand.** Sand shall be free of organic matter and shall conform to the grading requirements of Item 421, “Portland Cement Concrete”, for Grade 1 fine Aggregate, Subarticle 421.2.(5) or the gradation referenced by ASTM C270.

(6) **Water.** Mixing water shall conform to the requirements of Item 421, “Portland Cement Concrete”, Subarticle 421.2.(3).

(7) **Lime.** Hydrated lime shall conform to ASTM C207, Type S.

(8) **Excavation and Backfill for Structures.** Excavation and backfill shall comply with Item 400, “Excavation and Backfill for Structures”, except for Measurement and Payment, as noted or as shown on plans.

(9) **Reinforcing Steel.** Reinforcing steel shall comply with Item 440, “Reinforcing Steel”, as noted or shown on plans.

PART 3 CONSTRUCTION METHODS

(1) **General.** The Contractor shall submit samples of the Concrete Masonry Units which show the complete color range to the Engineer for approval.

The Contractor shall be responsible for verifying all dimensions incidental to this work and shall promptly report any discrepancies to the Engineer.

(2) **Footing.** A reinforced concrete footing shall be constructed to the dimensions shown on the plans. The footing shall be given a wood float finish and shall be in place a minimum of 24 hours before any masonry is placed on it. No curing of the footing will be required.

(3) **Mortar.** Mortar shall meet the requirements of ASTM C270, Type N. Mortar shall be mixed in the proportions by volume of 1 part Portland cement, 1 part hydrated lime, and 6 parts of sand; or, 1 part of Type N masonry cement and 3 parts of sand.

Water content in the mortar mix shall be the amount required to obtain a workable plastic mortar. Mixture shall be mixed for a minimum period of 3 min. in a drum type batch mixer and used within 1 hour after mixing. Mortar not used within that time shall be discarded (retempering will not be permitted). The mortar boxes will be cleaned at the end of each day's work.

(4) **Workmanship.** Concrete masonry units must be set by competent, experienced masons. Each unit shall be cleaned, sponged, and drenched with clean water just before setting. Each unit shall be set in a full bed of plastic mortar.

Joints shall be uniform and raked out 1/2 in. deep for face pointing. The mortar shall be well driven into the joints and finished with an approved pointing tool. The wall shall be kept clean wet while the pointing is being done.

After the pointing is completed and the mortar set, all showing surfaces shall be cleaned of loose mortar and cement stains. Just prior to the completion of the contract, the showing surfaces shall again be cleaned in a manner satisfactory to the Engineer.

4. **Measurement.** This Item will be measured by the square foot of surface area. The concrete footing, wall caps and wall inserts are not included for measurement under this Item. Only accepted work will be included, and the dimensions used for measurement will be those shown on the plans or ordered in writing by the Engineer.

5. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Block Wall Structure". This price shall be full compensation for furnishing and hauling all materials; for all freight involved; for excavation and backfill; for preparing and placing all materials; for grout and reinforcement of cells; and for all labor, tools, equipment and incidentals necessary to complete the work.

END OF SECTION