FEDERAL

ITB #26-182

July 24, 2026

Construction Services for Boykin Road Improvements

For

Augusta-Richmond County (herein "Augusta")
On behalf of the Augusta Recreations and Parks Department
Located at 2027 Lumpkin Road Augusta, GA 30906

ITB Due: Tuesday August,18, 2026 @ 3:00 p.m.

One Original and One Electronic Version of ITB on a USB Drive shall be submitted

Andy Penick
Procurement Director
535 Telfair Street, Room 605
Augusta, Georgia 30901

Rev. 02/03/26

Invitation to Bid

Bid Item **#26-182 Boykin Road Improvements Project** for Augusta -Richmond County Recreations and Parks Department.

Sealed bids will be received until Tuesday, August 18, 2026, at 3:00 p.m. Bid openings are open to the public in the Augusta Procurement Department located at 535 Telfair Steet, Suite 605, Augusta, GA 30901, and via Teams: Meeting ID: 276 847 943 030 504; Passcode: 2ns7Fi3y.

No submittal will be accepted by email. All submittals must be received during our normal office hours from 8:30 a.m. to 5:00 p.m., Monday through Friday. No bids may be withdrawn for a period of ninety (90) days after bids have been opened.

Bid documents may examined at the office of the Augusta, GA Procurement Department, 535 Telfair Street – Suite 605, Augusta, GA 30901 (706)821-2422. Plans and specifications for this project shall be obtained by all prime, subcontractors and suppliers exclusively from Augusta Blueprint. There is a non-refundable fee of **$255.00** for the plans and specifications for this project. Addenda will also be posted on the plan room's websites.

It is the wish of the Owner that all businesses are given the opportunity to submit on this project. To facilitate this policy the Owner is providing the opportunity to view plans online (www.augustablue.com) at no charge through Augusta Blueprint (706)722-6488 beginning Friday, July 24, 2026. Bidders are cautioned that submitting a package without Procurement of a complete set are likely to overlook issues of construction phasing, delivery of goods or services, or coordination with other work that is material to the successful completion of the project.

All Bidder's questions, request for clarifications, or interpretations must be submitted in writing by emailing procbidandcontract@augustaga.gov on or before Monday, August 17, 2026, by 5:00 P.M.

All bids must be received by mail, courier or hand delivered to the Procurement Department,
Attn: Tywanna Scott
535 Telfair Street - Suite 605
Augusta, Georgia 30901
Phone: 706-821-2422
Email: procbidandcontract@augustaga.gov

A 5% Bid bond is required to be submitted along with the bidders' qualifications. Performance and Payment Bonds are required at 100% of the Awarded Amount.

Bidders are cautioned that obtaining Bid documents through any source other than the Procurement Department is not advisable, as documents from unauthorized sources places the bidder at risk of receiving incomplete or inaccurate information.

Publish: Augusta Chronicle July 24th, 31st, and August 7th, 14th

Revised: 2/18/26

PROCUREMENT DEPARTMENT

ELECTRONIC TEAMS INFORMATION

The Augusta, Georgia Procurement Department conducts Public RFP, RFQ, and Bid Openings to award quality contracts for Augusta. Bidders may participate in our Public Openings via webcast or teleconference by following the instructions outlined below:

ELECTRONIC BID INSTRUCTIONS

ITB 26-182 Bid Opening -Boykin Road Improvements Project
openings are open to the public in the Procurement Department
located at 535 Telfair Steet, Suite 605,
Augusta, GA 30901 and via Teams

Tuesday, August 18, 2026 @ 3:00 p.m.

TEAMS Opening (optional):

1. Go to https://team.microsoft.us/join and enter meeting ID: 276 847 943 030 504;

2. Password: 2ns7Fi3y

Revised 1/29/26

INSTRUCTIONS TO SUBMIT

1.1 **Purpose:** The purpose of this document is to provide general and specific information for use by vendors in submitting a bid to supply Augusta, Georgia with equipment, supplies, and or services as listed above. All bids are governed by the Augusta, Georgia Code.

1.2 **Viewing the Augusta Code**: All bids are governed and awarded in accordance with the applicable federal and state regulations and the Augusta, Georgia Code. To view the Code visit Augusta's website at **www.augustaga.gov** or **http://www.augustaga.gov/index.aspx?NID=685 Guidelines & Procedures**.

1.3 **Compliance with laws:** The Bidder shall obtain and maintain all licenses, permits, liability insurance, workman's compensation insurance and comply with any and all other standards or regulations required by federal, state or Augusta, Georgia statute, ordinances, and rules during the performance of any contract between the Bidder and Augusta, Georgia. Any such requirement specifically set forth in any contract document between the Bidder and Augusta, Georgia shall be supplementary to this section and not in substitution thereof.

1.4 **Bids For All Or Part:** Unless otherwise specified, **County reserves The Right To make an award(s) for all Items, or categories, or specific line items, to one or more bidders.** Bidder may restrict their bid to consideration in the aggregate by so stating but must name a unit price on each item submitted upon.

1.5 **All protests shall be made in writing to:**

Attn: Andy Penick
Procurement Director
535 Telfair Street, Room 605
Augusta, GA 30901
Email:procbidandcontract@augustaga.gov

1.6 **Augusta, Georgia License Requirement:** For further information contact the License and Inspection Department @ 706 312-5050.

General Contractors' License Number: If applicable, in accordance with O.C.G.A. §43-41, or be subjected to penalties as may be required by law.

Utility Contractor License Number: If applicable, in accordance with O.C.G.A. §43-14, or be subjected to penalties as may be required by law.

1.7 **Terms of Contract:** (Check where applicable)
[ ] (A) Annual Contract
[**X**] (B) One time Purchase.
[ ] (C) Other

Revised 11/24/25

Augusta
GEORGIA

NOTICE TO ALL VENDORS

ADHERE TO THE BELOW INSTRUCTIONS AND DO NOT SUBSTITUTE FORMS

PLEASE READ CAREFULLY:

Exhibit A is a consolidated document consisting of:

1. Business License Number Requirement (must be provided)
2. Acknowledgement of Addenda (must be acknowledged, if any)
3. Statement of Non-Discrimination
4. Non-Collusion Affidavit of Prime Bidder/Offeror
5. Conflict of Interest
6. Contractor Affidavit and Agreement (E-Verify User ID Number must be provided)

Exhibit A Must be Notarized & Two (2) Pages Must be returned with your submittal .

Business License Requirement: Bidder must be licensed in the Governmental entity for where they do the majority of their business. Your **company's business license number must** be provided. If your Governmental entity (State or Local) does not require a business license, your company will be required to obtain an Augusta-Richmond County business license if awarded a contract. For further information contact the License and Inspection Department @ 706 312-5050.

Acknowledgement of Addenda: You Must acknowledge all Addenda. See Page 1 of Exhibit A.

E-Verify * User Identification Number (Company I.D.): Vendor must provide the E-Verify affidavit with their bid.

The city, each contractor, and each subcontractor have different roles and responsibilities in the E-Verify process. The city collects E-Verify affidavits from the contractor. The contractor collects E-Verify affidavits from its subcontractors. The subcontractors collect E-Verify affidavits from its sub-subcontractors. Independent contractors (those with no employees) do not need to supply E-Verify information. Instead, they will provide a driver's license or state identification card from states on the "compliant" list created by the Georgia Attorney General. Those contractors and subcontractors that fill out the affidavits are responsible for the accuracy of the information. The city does not need to confirm that the E-Verify information is correct. The liability for incorrect information is on the contractor or subcontractor. NOTE: The authorization date can be found within the Memorandum of Understanding (MOU).

Affidavit Verifying Status for Augusta Benefit Application (Systematic Alien Verification for Entitlements Program)
(Must Be Returned With Your Submittal)

The successful vendor will submit the following forms to the Procurement Department no later than five (5) days after receiving the "Letter of Recommendation" (Vendor's letter will denote the date forms are to be received)

1. Georgia Security and Immigration Subcontractor Affidavit
2. Non-Collusion Affidavit of Sub-Contractor
3. E-Verify MOU (Memorandum of Understanding)

Rev. 02/10/26

Exhibit A

Augusta, Georgia Procurement Department
ATTN: Procurement Director
535 Telfair Street, Suite 605
Augusta, Georgia 30901

Name of Bidder: _____

Street Address: _____

City, State, Zip Code: _____

Phone: _____ Email: _____

Where/How did you hear about this solicitation? _____

Attach a copy of your Business License, W-9, and your General Contractor License.

If applicable, provide a copy of the following:

Utility Contractors License - MUST BE LISTED ON FRONT OF ENVELOPE

Acknowledgement of Addenda: (#1) ____: (#2) ____: (#3) ____: (#4) ____: (#5) ____: (#6) ____: (#7) ____: (#8) ____:
NOTE: CHECK APPROPRIATE BOX (ES) - ADD ADDITIONAL NUMBERS AS APPLICABLE

Statement of Non-Discrimination

The undersigned understands that it is the policy of Augusta, Georgia to promote full and equal business opportunity for all persons doing business with Augusta, Georgia. The undersigned covenants that we have not discriminated, on the basis of race, religion, gender, national origin, or ethnicity, with regard to prime contracting, subcontracting, or partnering opportunities.
The undersigned covenants and agrees to make good faith efforts to ensure maximum practicable participation of local small businesses on the proposal or contract awarded by Augusta, Georgia. The undersigned further covenants that we have completed truthfully and fully the required forms regarding good faith efforts and local small business subcontractor/supplier utilization.

The undersigned further covenants and agrees not to engage in discriminatory conduct of any type against local small businesses, in conformity with Augusta, Georgia's Local Small Business Opportunity Program. Set forth below is the signature of an officer of the proposer/contracting entity with the authority to bind the entity.

The undersigned acknowledge and warrant that this Company has been made aware of understands and agrees to take affirmative action to provide such companies with the maximum practicable opportunities to do business with this Company;
That this promise of non-discrimination as made and set forth herein shall be continuing in nature and shall remain in full force and effect without interruption;

That the promises of non-discrimination as made and set forth herein shall be and are hereby deemed to be made as part of and incorporated by reference into any contract or portion thereof which this Company may hereafter obtain and;
That the failure of this Company to satisfactorily discharge any of the promises of nondiscrimination as made and set forth herein shall constitute a material breach of contract entitling Augusta, Georgia to declare the contract in default and to exercise any and all applicable rights remedies including but not limited to cancellation of the contract, termination of the contract, suspension and debarment from future contracting opportunities, and withholding and or forfeiture of compensation due and owing on a contract.

Non-Collusion of Prime Bidder

By submission of a proposal, the vendor certifies, under penalty of perjury, that to the best of its knowledge and belief:

(a) The prices in the proposal have been arrived at independently without collusion, consultation, communications, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other vendor or with any competitor.

(b) Unless otherwise required by law, the prices which have been quoted in the proposal have not been knowingly disclosed by the vendor prior to opening, directly or indirectly, to any other vendor or to any competitor.

(c) No attempt has been made, or will be made, by the vendor to induce any other person, partnership, or corporation to submit or not to submit a proposal for the purpose of restricting competition. Collusions and fraud in proposal preparation shall be reported to the State of Georgia Attorney General and the United States Justice Department.

Conflict of Interest

1. By submission of a bid, the responding firm certifies, under penalty of perjury, that to the best of its knowledge and belief1. No circumstances exist which cause a Conflict of Interest in performing the services required by this BID, and
2. That no employee of the County, nor any member thereof, not any public agency or official affected by this BID, has any pecuniary interest in the business of the responding firm or his sub-consultant(s) has any interest that would conflict in any manner or degree with the performance related to this BID. By submission of a bid, the vendor certifies under penalty of perjury, that to the best of its knowledge and belief:
(a) The prices in the bid have arrived independently without collusion, consultation, communications, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other vendor or with any competitor.
(b) Unless otherwise required by law, the prices which have been quoted in the bid have not knowingly been disclosed by the vendor prior to opening, directly or indirectly, to any other vendor or competitor.
c) No attempt has been made, or will be made, by the vendor to induce any other person, partnership, or cooperation to submit or not to submit a bid for the purpose of restricting competition. For any breach or violation of this provision, the County shall have the right to terminate any related contract or agreement without liability and at its discretion to deduct from the price, or otherwise recover, the full amount of such fee, commission, percentage, gift, payment, or consideration.

Contractor Affidavit and Agreement: Contractor Affidavit under O.C.G.A. § 13-10-91(b) (I)

Georgia E-Verify and Public Contracts: The Georgia E-Verify law requires contractors and all sub-contractors on Georgia public contract (contracts with a government agency) for the physical performance of services over $2,499 in value to enroll in E-Verify, regardless of the number of employees. They may be exempt from this requirement if they have no employees and do not plan to hire employees for the purpose of completing any part of the public contract. Certain professions are also exempt. All requests for proposals issued by a city must include the contractor affidavit as part of the requirement for their bid to be considered.

The undersigned contractor ("Contractor") executes this Affidavit to comply with O.C.G.A § 13-10-91 related to any contract to which Contractor is a party that is subject to O.C.G.A. § 13-10-91 and hereby verifies its compliance with O.C.G.A. § 13-10-91, attesting as follows:

a) The Contractor has registered with, is authorized to use, and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program;
b) The Contractor will continue to use the federal work authorization program throughout the contract period, including any renewal or extension thereof;
c) The Contractor will notify the public employer in the event the Contractor ceases to utilize the federal work authorization program during the contract period, including renewals or extensions thereof;
d) The Contractor understands that ceasing to utilize the federal work authorization program constitutes a material breach of Contract;
e) The Contractor will contract for the performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the Contractor with the information required by O.C.G.A. § 13-10-91(a), (b), and (c);
f) The Contractor acknowledges and agrees that this Affidavit shall be incorporated into any contract(s) subject to the provisions of O.C.G.A. § 13-10- 91 for the project listed below to which Contractor is a party after the date hereof without further action or consent by Contractor; and
g) Contractor acknowledges its responsibility to submit copies of any affidavits, drivers' licenses, and identification cards required pursuant to O.C.G.A. § 13-10-91 to the public employer within five business days of receipt.

Georgia Law requires your company to have an E-Verify*User Identification Number (Company I.D.) on or after July 1, 2009.

For additional information or to enroll your company, visit the State of Georgia website:
https://www.e-verify.gov/employers/enrolling-in-e-verify

Federal Work Authorization User Identification Number: E-VERIFY REQUIRED FOR ALL CONTRACTS OVER $2,499.00

**** (E-Verify Number)** _____

_____ _____

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, 20_____ in _____ (City), _____ (State).

_____

Signature of Authorized Officer or Agent **Printed Name and Title of Authorized Officer or Agent**

NOTARY COMMISSIONING

Subscribed and sworn before me on this _____ day of _____, 20_____

_____ _____

Notary Public **My Commission Expires:** **NOTARY SEAL**

The undersigned further agrees to submit a notarized copy of Exhibit A, and any required documentation noted as part of the Augusta, Georgia Board of Commissions specifications which govern this process. *In addition, the undersigned agrees to submit all required forms for any subcontractor(s) as requested and or required.* ***I further understand that my submittal will be deemed non-compliant if any part of this process is violated.*** You Must Complete and Return the two (2) pages of Exhibit A with Your Submittal. Document Must Be Notarized.

Systematic Alien Verification for Entitlements (SAVE) Program

Affidavit Verifying Status for Augusta, Georgia Benefit Application By executing this affidavit under oath, as an applicant for an Augusta, Georgia Business License or Occupation Tax Certificate, Alcohol License, Taxi Permit, Contract, or other public benefit as reference in O.C.G.A. Section 50-36-1, I am stating the following with respect to my bid for an Augusta, Georgia contract for

_____

[ITB Project Number and Project Name]

_____

[Print/Type: Name of natural person applying on behalf of individual, business, corporation, partnership, or other private entity]

_____

[Print/Type: Name of business, corporation, partnership, or other private entity]

1.) _____ I am a citizen of the United States.

2.) _____ I am a legal permanent resident 18 years of age or older.

3.) _____ I am an otherwise qualified alien (8 § USC 1641) or nonimmigrant under the Federal Immigration and Nationality Act (8 USC 1101 et seq.) 18 years of age or older and lawfully present in the United States. *

In making the above representation under oath, I understand that any person who knowingly and willfully makes a false, fictitious, or fraudulent statement or representation in an affidavit shall be guilty of a violation of Code Section 16-10-20 of the Official Code of Georgia.

_____

Signature of Applicant

_____

Printed Name

_____

***Alien Registration Number for Non-Citizens**

NOTARY COMMISSIONING

SUBSCRIBED AND SWORN BEFORE ME ON THIS THE _____ DAY OF _____, 20____

_____

Notary Public

My Commission Expires: _____ **NOTARY SEAL**

Note: THIS FORM MUST BE COMPLETED AND RETURNED WITH YOUR SUBMITTAL

Augusta
GEORGIA

TRADE SECRET STATUS AFFIDAVIT
Augusta, Georgia

All documents, data, letters and generated information received by Augusta, Georgia constitutes a "public record" and is subject to disclosure under the Georgia Open Records Act ("GORA"). O.C.G.A. § 50-18-70 et seq. However, pursuant to O.C.G.A. § 50-18-72(a)(34), "[an] entity submitting records containing trade secrets that wishes to keep such records confidential under this paragraph shall submit and attach to the records an affidavit affirmatively declaring that specific information in the records constitute trade secrets pursuant to Article 27 of Chapter 1 of Title 10 [O.C.G.A. § 10-1-760 et seq.].

O.C.G.A. § 10-1-761(4) defines "Trade secret" as "...information, without regard to form, including, but not limited to, technical or nontechnical data, a formula, a pattern, a compilation, a program, a device, a method, a technique, a drawing, a process, financial data, financial plans, product plans, or a list of actual or potential customers or suppliers which is not commonly known by or available to the public and which information:

A. Derives economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use; and
B. Is the subject of efforts that are reasonable under the circumstances to maintain its secrecy."

Therefore, the records listed below and attached hereto, that were submitted with _____response to Augusta, Georgia Request for Proposal, Request for Quote, or Request for Qualified Contractor _____are marked confidential pursuant to O.C.G.A. § 10-1-761(4):

- (List specific information that the supplier wishes to withhold and how that information constitutes a trade secret)
- Additional trade secret information requested to be withheld
- **Your company is requested to send a redacted copy of your submittal.**

Under penalty of perjury, acknowledging that O.C.G.A. §16-10-71 provides a penalty of a fine of up to $1,000 and potential imprisonment of one to five years, I attest that the specific information in the records listed above constitutes trade secrets pursuant to O.C.G.A. § 10-1-761(4), and request that Augusta, Georgia not disclose this protected information under the Georgia Open Records Act ("GORA").

Signature:

_____

[Signatory Name in Print] **[Signatory's Title] [Company Name]**

_____ **Date:** _____

[Signatory's Title]

NOTARY COMMISSIONING

Subscribed and sworn before me on this _____ day of _____, 20_____

_____

Notary Public

My Commission Expires: _____ **NOTARY SEAL**

RETURN FORM ONLY IF APPLICABLE.

Revised 11/24/2025

Minority and Women Owned Business Enterprise Program Ordinance Requirements

Notice To All Bidders (PLEASE READ CAREFULLY)

The following shall apply to All Bids regardless of the dollar amount

In accordance with the Commission Action on 7/25/24 and the adoption of Ordinance No. 7945 Chapter 10C of the AUGUSTA, GA, CODE, Contractors agree to collect and maintain all records necessary to Augusta, Georgia to evaluate the effectiveness of its Minority and Women Owned Business Enterprise Program and to make such records available to Augusta, Georgia upon request. The requirements of the Minority and Women Owned Business Enterprise Program can be found at www.augustaga.gov. In accordance with AUGUSTA, GA. CODE, Contractors shall report to Augusta, Georgia the total dollars paid to each subcontractor, vendor, or other business on each contract, and shall provide such payment affidavits, regarding payment to subcontractors, if any as required by Augusta, Georgia. Such utilization reports shall be in the format specified by the Director of Compliance and shall be submitted at such times as required by Augusta, Georgia. Required forms can be found at www.augustaga.gov. If you need assistance completing a form or filing information, please contact the M/WBE Program office at (706) 821-2406. Failure to provide such reports withing the time period specified by Augusta, Georgia shall entitle Augusta, Georgia to exercise any of the remedies set forth, including, but not limited to, withholding payment from the Contractor and/or collecting liquidated damages.

SHALL APPLY TO PROJECTS IN EXCESS OF $300,000

Minority and Women Owned Business Enterprise Program (Continued)

Sec. 1-10-138. Race and Gender-Conscious Efforts

Contract-by-Contract Subcontractor Goals The City, through the Goal Setting Committee (GSC), will set specific, separate percentage-based MBE and WBE subcontracting goals on a contract-by contract basis for Prime contracts in Construction, Architecture & Engineering, Professional Services, and Other Services valued in excess of $300,000. The City shall establish such goals based upon the type of contract, the type of subcontracting work that will be required, and the availability of M/WBE firms to perform the work for that specific contract.

The GSC shall not establish subcontracting goals on contracts where (a) there are no subcontracting opportunities identified for the contract; or (b) there are not at least three (3) MBE and/or WBE firms that are available and capable to perform a CUF for the overall subcontracting opportunities on the contract.

Good Faith Efforts (GFE) Requirements and Guidance

1. Achievement of subcontracting goals or documentation of Good Faith Efforts applies to every Contract for which such goals are established. **The Bidder shall submit a compliance plan detailing its achievement of the goals or its Good Faith Efforts to meet the goals. The compliance plan shall be due at the time set out in the solicitation documents.**
2. When a Bidder cannot achieve the goals, its compliance plan shall document its GFE to achieve the goals. The Director of Compliance will determine whether the Bidder has made such GFE.

Bid Documents

All bid documents shall require bidders or proponents to submit with their bid the following written documents, statements, or forms, which shall be made available by the Procurement Department.

- Proposed Letter of Intent MBE/WBE.
- Proposed MBE/WBE Utilization Plan.
- Documentation of Good Faith Efforts Form (*in the event the bidder **will not** meet the MBE and WBE goals*).

Failure to submit the above documentation shall result in the bid being declared non-responsive.

Sec. 1-10-154.Exceptions

In accordance with § 1-10-8, on federally funded projects or contracts, the M/WBE Program shall only be utilized when authorized by the applicable federal (and/or Georgia) laws, regulations, and conditions relating to that project or contract. To the extent that there are any conflicts between any such laws, regulations, or conditions and the provisions of the M/WBE Program, the federal (and/or Georgia) guidance shall control.

NOTE: All forms should be submitted in a separate, sealed envelope, labeled M/WBE Forms, Company's Name & Bud number

For questions and or additional information, please contact:

Minority-Owned and Women-Owned Business Enterprise Program
535 Telfair Street, Suite 530
Augusta, Georgia 30901
(706) 821-2406, mwbe@augustaga.gov
Website: https://www.augustaga.gov/83/Disadvantaged-Business-Enterprise

INSTRUCTIONS TO SUBMIT

Augusta is seeking to secure a vendor to provide Construction Services for Boykin Road Improvements for the Augusta Recreation and Parks Department. Your submittal should respond to, and be based on, the information included in this Invitation to Bid.

Bids will be received by the Augusta Commission, (hereinafter called the "Owner"), at the office of the Procurement Director, 535 Telfair Street, Room 605, Augusta, GA until **Tuesday, August 18, 2026 @ 3:00 p.m.,** and then, at said office, publicly opened and read aloud. Your submittal must be submitted in a sealed package and labeled with vendor's name and the name of the project for "Bid Item #26-182 Construction Services for Boykin Improvements" for Augusta, GA. You are required to submit one (1) marked unbound original, one (1) electronic copy of your bid. No bid will be accepted by email; all must be received by mail or hand delivered.

The opening will be opened publicly. Opening can be viewed via TEAMS Meeting ID: 276 847 943 030 504; Passcode: 2ns7Fi3y.

If the bid is forwarded by mail, or other second party delivery service, the sealed envelope containing the bid must be enclosed in another envelope addressed to:

Andy Penick, Procurement Director
Augusta Procurement Department
535 Telfair Street - Room 605
Augusta, Georgia 30901

Bid Packages may be obtained at the Augusta Procurement Department, at the address listed above.

The Bid Package contains provisions required for the specifications. All firms responding are cautioned to read this information carefully for understanding and request clarification from Augusta on any questions pertaining to this request.

All questions must be submitted in writing by email to procbidandcontract@augustaga.gov to the office of the Procurement Department by Friday, Monday, August 17, 2026 @ 5:00 P.M. No bid will be accepted by email; all must be received by mail or hand delivered. All submittals must be received during our normal office hours from 8:30 a.m. to 5:00 p.m., Monday through Friday.

All bids must be made on the required Bid Form. All blank spaces for bid prices must be filled in with ink or typewritten, and the form must be fully completed and executed when submitted. Failure to provide all of the requested information may cause the bid to be rejected as non-responsive. An official authorized to bind the firm to the terms and provisions of the bid must sign the bid form.

All interested firms are required to meet Federal, State and Local laws and regulations.

The Owner may waive any informalities or minor defects or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered.

No bids may be withdrawn for a period of **ninety (90) days** after bids have been opened, pending the execution of contract with the successful bidder. Should there be reasons why the Contract cannot be awarded within the specified period; the time may be extended by mutual agreement between the Owner and the bidder.
After bids have been submitted, the bidder shall not assert that there was a misunderstanding concerning the nature of the work to be done.

The party to whom the contract is awarded will be issued a Notice of Award. Should there be reasons why the Notice to Award cannot be issued the time may be extended by mutual agreement between the Owner and the Contractor.

The Owner may make such investigations as he deems necessary to determine the ability of the bidder to perform the work and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by or investigation of such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the Agreement and complete the work contemplated therein.

A conditional bid will not be accepted. Award will be made as a whole to one bidder.

The Owner reserves the right to consider bids or modification thereof received at any time before the award is made if such action is in the interest of the Owner.

Each bidder is responsible for reading and being thoroughly familiar with the specifications. The failure or omission of any bidder to do any of the foregoing shall in no way relieve any bidder from any obligation in respect to his bid.

The Owner will not be liable for any costs incurred by any firm prior to receiving the Notice of Award.

The Owner is not obligated to request clarifications or additional information but may do so at its discretion. The Owner reserves the right to extend the deadline for submittals.

Upon receipt of a proposal by the Owner, the proposal shall become the property of the Owner without compensation to the Proposer, for disposition or usage by the Owner at its discretion. The details of the proposal documents will remain confidential until final award. See Trade Secret Affidavit (Page 9).

INTRODUCTION AND CLARIFICATION TO SCOPE OF SERVICES

The Boykin Road Park Improvements Project consists of site and park infrastructure enhancements at Boykin Road Park in Augusta, Georgia. Work generally includes grading and earthwork, installation of new park amenities and site improvements, drainage improvements, utility coordination as required, and associated site restoration. The project is intended to enhance accessibility, functionality, and overall public use of the park in accordance with the Contract Documents.

Notwithstanding the use of grant funds for a portion of the Project, Davis-Bacon prevailing wage requirements do not apply to this Project.

Federal Funding and Nondiscrimination Compliance

This Project is funded in whole or in part through the American Rescue Plan Act (ARPA) State Fiscal Recovery Fund under the Improving Neighborhood Outcomes in Disproportionately Impacted Communities (INODIC) Grant Program administered by the Georgia Office of Planning and Budget (OPB).

The Contractor shall comply with all applicable federal, state, and local nondiscrimination and equal opportunity laws, regulations, and executive orders, including but not limited to:

- Title VI of the Civil Rights Act of 1964
- Title VII of the Civil Rights Act of 1964, as amended
- Section 504 of the Rehabilitation Act of 1973
- Americans with Disabilities Act of 1990 (ADA), as amended
- Age Discrimination Act of 1975
- Executive Order 11246, as amended
- 2 CFR Part 200, Subpart D, and applicable U.S. Department of the Treasury ARPA regulations and guidance

The Contractor shall not discriminate against any employee, applicant for employment, subcontractor, or program beneficiary on the basis of race, color, national origin, sex, sexual orientation, gender identity, age, disability, religion, or any other protected classification under applicable law. These provisions shall be included in all subcontracts.

Encouragement of Small Business Participation

Augusta encourages meaningful participation by small, local, and economically disadvantaged businesses in this ARPA-funded project. Contractors are encouraged to:

- Actively consider small businesses when procuring goods and services;
- Publicize subcontracting opportunities in an open and transparent manner;
- Structure work, where practicable, to allow small businesses to compete; and
- Engage in early outreach and communication regarding upcoming subcontracting opportunities.

All efforts shall be conducted in a race- and gender-neutral manner. Nothing in this provision establishes a quota, set-aside, preference, or mandatory participation goal.

Clarifications and Design Intent

1. Incorporation into Contract Documents

These bid Clarifications and Design Intent provisions are incorporated into and made a part of the Contract Documents for the Boykin Road Park Improvements. These provisions shall govern where they clarify, supplement, or conflict with other provisions of the Contract Documents.

2. Davis-Bacon Requirements

Davis-Bacon prevailing wage requirements and certified payroll requirements do not apply to this Project. No federal wage determination is applicable.

3. Permit Fees

Permit fees required for the Project will be paid by the Owner. Bidders shall not include permit fees in the Base Bid.

The Contractor remains responsible for coordinating and obtaining all required permits and inspections and for complying with all applicable permitting requirements necessary for construction.

4. Water and Sewer Tap Fees

Water and sewer tap fees required for the Project will be paid by the Owner. Bidders shall not include water or sewer tap fees in the Base Bid.

The Contractor remains responsible for coordinating utility connections, scheduling inspections, and complying with all applicable utility and permitting requirements.

5. Bid Form Completion

Each bidder shall complete and submit the Bid Form in its entirety at the time of bid. Partial Bid Forms, summary-only Bid Forms, or pricing submissions that omit required line-item information will not be accepted.

Bidders shall include all required allocations of general conditions, fees, and other costs among the applicable Bid Schedule items.

6. Project Schedule and Grant-Funded Work

The Owner intends to proceed with contract award and issuance of the Notice to Proceed as expeditiously as practicable following completion of the bid evaluation and all required reviews and approvals. Any anticipated award or Notice to Proceed date stated in the solicitation is an estimate and is subject to change.

A portion of the Project is funded through the INODIC grant. INODIC grant funds may be used only for eligible portions of the Work completed and accepted on or before **October 31, 2026**.

The Contractor shall prioritize the grant-funded portion of the Work and shall provide a construction schedule demonstrating how the grant-funded work will be completed by October 31, 2026. Work completed after that date may remain required under the Contract but will not be eligible for payment or reimbursement from INODIC grant funds.

The October 31, 2026 grant-funding deadline does not replace or extend the Contract Time established elsewhere in the Contract Documents.

7. CMU Wall-Core Insulation

Perlite insulation fill shall be installed within CMU wall cores where grouted or reinforced cells are not used to improve thermal performance.

Alternate insulation methods may be submitted for consideration, provided that the proposed method does not alter the structural requirements, thermal performance, or overall design intent of the Contract Documents.

8. Long-Lead Materials and Equipment

No formal long-lead-item analysis was performed as part of the design process. The Owner does not represent that all specified materials and equipment are immediately available.

The Contractor shall review the Contract Documents promptly, coordinate with manufacturers and suppliers, identify anticipated procurement lead times, and account for material and equipment availability in the construction schedule.

9. High-Performance Coatings

Wall finishes identified as "PT" in the material legend shall receive epoxy paint in accordance with Specification Section 099600, High-Performance Coatings.

10. Playground Equipment

The playground and outdoor fitness equipment shall be provided using a performance-based approach in accordance with Specification Section 116800 and the applicable Division 32 requirements.

Reference manufacturers and products shown in **Appendix A, Design-Intent Playground and Outdoor Fitness Equipment**, are provided solely to establish the intended layout, scale, program, function, quality, durability, and appearance. The reference products are not proprietary requirements and do not preclude the submission of approved equal products.

All proposed playground equipment shall comply with:

1. ASTM F1487, Standard Consumer Safety Performance Specification for Playground Equipment for Public Use.
2. U.S. Consumer Product Safety Commission Publication No. 325, Public Playground Safety Handbook.
3. Applicable IPEMA third-party certification requirements.
4. Applicable ADA accessibility requirements.
5. The materials, finishes, fall-height, use-zone, anchoring, installation, and performance requirements of Specification Section 116800.

Before fabrication or installation, the Contractor shall submit complete product data, proposed layouts, certifications, anchoring information, color selections, and other required shop drawings for review and approval.

Final colors and finishes shall be selected by the Owner from the manufacturer's standard available color range.

Minority and Woman Owned Business Enterprise Program (M/WBE) Goal Waiver

The Minority and Woman Owned Business Enterprise Program (M/WBE) provides for goals to be set for Minorities and Women on all applicable Augusta, Georgia procurements over $300,000 in value.

After careful review of the specific work categories available on this procurement and a review of the MBE and WBE firms available to perform a CUF on this procurement, the Goal Setting Committee has determined that neither a MBE nor WBE goal could be placed on this procurement. **As such, the M/WBE Waiver applies** and therefore, the M/WBE goal for this procurement is:

0 %

As a result of the M/WBE Goal on this procurement being ZERO, no M/WBE goal documents are required as a part of the procurement process. However, even when a solicitation does not contain a M/WBE goal (or the goal is set at zero), each Bidder must negotiate in good faith with each minority and woman owned business that responds to the Bidder's solicitation and each minority, and woman owned business that contacts the Bidder on its own accord. All successful bidders are required to collect and maintain all records necessary for Augusta to evaluate the effectiveness of its M/WBE Program.

NO RESPONSE LETTER

Please submit by response due date

Bid Item #26-182	Construction Services for Boykin Road Park Improvements	Due: Tuesday, August 18, 2026 @ 3:00 p.m.

To: **Augusta, Georgia - Procurement Department**

This is to certify that _____, will not be submitting a response to the above referenced solicitation document prepared by Augusta Procurement Department.

Reason(s) for No Submission:

___ Unavailability of required resources

___ Prior commitments

___ Inadequate anticipated funding Level

___ Project Duration

___ Potential conflict of interest

___ Duplication of ongoing effort

___ Other (please explain)

_____

_____

Authorized Representative:

Name: _____

Title: _____

Signature: _____

Date: _____/ _____/ 20____

Augusta
GEORGIA

CONTRACT DOCUMENTS

FOR

ITB # 26-182

BOYKIN ROAD PARK IMPROVEMENTS

CONTENTS

1 Agreement for ITB 26-182
2 Scope of Services and Proposal
3 General Conditions
4 Special Conditions
5 Boykin Road Park Improvement Specs and Project Manual
6 Augusta, Georgia Conditions

Agreement

For

Bid 26-182

Boykin Road Park Improvements

between

Augusta, Georgia
535 Telfair Street
Augusta, GA 30901
(hereinafter "Owner")

and

_____

_____

_____
(hereinafter "Contractor")

THIS AGREEMENT, made on the ____ day of _____, 2026 (the "Effective Date") by and between Augusta, Georgia (Owner), a political subdivision of the State of Georgia, and Contractor

WITNESSETH, that Contractor and Owner, for the considerations hereinafter, agree as follows:

ARTICLE I – SCOPE OF THE WORK

Contractor hereby agrees to furnish all of the materials and all of the equipment and labor necessary, and to perform all of the work shown on the plans and described in the specifications for the project entitled **"ITB 26-182 BOYKIN ROAD PARK IMPROVEMENTS"** and in accordance with the requirements and provisions of the Contract Documents as defined in Article V – Contract Documents, which are hereby made a part of this agreement.

ARTICLE II – TIME OF COMPLETION

(a) Commencement and Contract Time

The Work to be performed under this Contract shall commence within ten (10) calendar days after the date of the written Notice to Proceed issued by the Owner to the Contractor. The Contractor shall achieve Substantial Completion within the Contract Time established by the Contract Documents, as adjusted only by a written Contract Time extension approved by the Owner in accordance with the Contract Documents.

The date of commencement, rate of progress, and time for Substantial Completion are essential conditions of this Contract, and time is of the essence. The Contractor shall execute the Work regularly, diligently, continuously, and without unnecessary interruption, at a rate sufficient to achieve Substantial Completion within the Contract Time. The Contract Time reflects a reasonable period for performance, taking into consideration average climatic conditions and construction conditions prevailing in the locality.

(b) INODIC Grant-Funded Work

The Contractor acknowledges that a portion of the Project is funded through an INODIC grant. Only otherwise eligible Work completed on or before October 31, 2026, may be paid or reimbursed with INODIC grant funds, subject to the Owner's verification and all applicable grant requirements. Work completed after October 31, 2026, is not eligible for payment or reimbursement from the INODIC grant. Notwithstanding the use of grant funds for a portion of the Project, Davis-Bacon prevailing wage requirements do not apply to this Project.

The Contractor shall plan, sequence, and diligently prosecute the Work to prioritize completion of grant-eligible portions by October 31, 2026, and shall timely provide all documentation reasonably required by the Owner to identify and verify Work completed by that date. The October 31, 2026, date governs eligibility for INODIC grant funding and does not replace or extend the Contract Time.

(c) Failure to Prosecute the Work - Continuous Progress Requirement
Once mobilized, the Contractor shall prosecute the Work continuously and diligently in accordance with the approved construction schedule and shall maintain sufficient labor, supervision, equipment, and materials to ensure timely completion of the Project within the Contract Time.

If, in the reasonable judgment of the Owner or Consultant, the Contractor fails to maintain progress in accordance with the approved schedule, or substantially suspends or reduces major construction activities for a period exceeding fourteen (14) consecutive calendar days without prior written approval of the Owner or Consultant, such failure shall constitute a failure to prosecute the Work. For purposes of this Article, "major construction activities" means on-site activities directly related to the critical path of the approved construction schedule.

Upon determination of such failure, the Owner shall provide written notice to the Contractor specifying the nature of the deficiency. Within seven (7) calendar days after receipt of the notice, the Contractor shall submit a written recovery plan acceptable to the Owner demonstrating how the Contractor will restore progress and meet the Contract Time.

If the Contractor fails to submit an acceptable recovery plan or fails to implement the approved recovery plan promptly, the Owner may, without prejudice to other rights and remedies available under the Contract, take one or more of the following actions:

1. Withhold progress payments until satisfactory progress is restored;
2. Require the Contractor to increase manpower, equipment, or working hours at no additional cost to the Owner;
3. Supplement the Contractor's forces; or
4. Declare the Contractor in default and terminate the Contract in accordance with the Contract Documents.

Any failure to maintain progress that results in delay to Substantial Completion shall remain subject to all rights and remedies available to the Owner under the Contract Documents and applicable law.
Nothing herein shall preclude the Contractor from requesting a time extension in accordance with the Contract Documents for excusable delays.

ARTICLE III – PAYMENT:

(a) The Contract Sum
Owner shall pay to Contractor for the performance of the contract the amount as stated in the Proposal and Schedule of Items. No variations shall be made in the amount except as set forth in the specifications attached hereto.

(b) Progress Payment

No later than the fifth day of every month, Contractor shall submit to Consultant, an estimate covering the percentage of the total amount of the contract which has been completed from the start of the job up to and including the last working day of the preceding month, together with such supporting evidence as may be required by Owner and/or Consultant. This estimate shall include only the quantities in place and at the unit prices as set forth in the Bid Schedule. On the vendor run, following approval of the invoice for payment, Owner shall after deducting previous payments made, pay to Contractor 90% of the amount of the estimate on units accepted in place. The 10% retained percentage may be held by Owner until the final completion and acceptance of all work under the Contract.

ARTICLE IV – ACCEPTANCE AND FINAL PAYMENT

(a) Upon receipt of written notice that the work is ready for final inspection acceptance, Consultant shall within 10 days, make such inspection and when he finds the work acceptable under the contract and the contract fully performed, he will promptly issue a final certificate, over his own signature, stating that the work required by this Contract has been completed and is accepted by him under the terms and conditions thereof, and the entire balance found to be due Contractor, including the retained percentage, shall be paid to Contractor by Owner within 15 days after the date of said final certificate.

(b) Before final payment is due, Contractor shall submit evidence satisfactory to Consultant that all payrolls, material bills, and other indebtedness connected with work have been paid, except that in case of disputed indebtedness of liens of evidence of payment of all such disputed amounts when adjudicated in cases where such payment has not already been guaranteed by surety bond.

(c) The making and acceptance of the final payment shall constitute a waiver of all claims by Owner, other than those arising from unsettled liens, from faulty work appearing within 12 months after final payment, from requirements of the specifications, or from manufacturer's guarantees. It shall also constitute a waiver of all claims by Contractor except those previously made and still unsettled.

(d) If after the work has been substantially completed, full completion thereof is materially delayed through no fault of Contractor, and Consultant so certifies, Owner shall upon certification of Consultant, and without terminating the contract, make payment of the balance due for that portion of the work fully completed and accepted.

(e) Notwithstanding any provision of the General Conditions, there shall be no substitution of materials or change in means, methods, techniques, sequences, or procedures of construction that are not determined to be equivalent to those indicated or required in the contract document, without an amendment to the contract.

(f) Each payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

ARTICLE V – CONTRACT DOCUMENTS:

(a) The Contract Documents consist of the following:

1. The Agreement Cover Sheet & Table of Contents (pages 1 to 2, inclusive)
2. This Agreement (pages 1 to 7, inclusive)
3. The Scope of Services and Proposal (pages 1 to 5, inclusive)
4. The Invitation to Bid # 26-XXX (1 page, inclusive)
5. The Addendum #X for ITB 26-XXX (1 page, inclusive)
6. The General Conditions (pages 1 to 41, inclusive)
7. The Special Conditions (pages 1 to 7, inclusive)
8. Rebid Clarifications and Design Intent (pages 1 to 4, inclusive)
9. The Boykin Road Park Improvements Specs and Project Manual (264 pages, inclusive)
10. The Augusta, Georgia Conditions (pages 1 to 5, inclusive)

(b) The documents listed in Article V, Section (a) are attached to this Agreement (except as expressly noted otherwise above).

(c) There are no Contract Documents other than those listed above in this Article.

(d) The Special Conditions include provisions addressing applicable grant funding requirements and compliance obligations associated with this Project.

ARTICLE VI – NOTICES AND AUTHORIZED REPRESENTATIVES

All notices, consents, approvals or communications required or permitted hereunder shall be and may be relied upon when in writing and shall be (i) transmitted by registered or certified mail, postage prepaid, return receipt requested, with notice deemed to be given upon receipt, or (ii) delivered by hand or nationally recognized courier service, or (iii) sent by facsimile transmission with confirmed receipt thereof, with a hard copy thereof transmitted pursuant to (i) or (ii) above. All such notices, consents, approvals or communications shall be addressed as follows:

For Owner: Augusta, Georgia
Office of the Mayor
535 Telfair Street

Suite 200
Augusta, Georgia 30901

With a Copy to:

Augusta Law Department
ATTN: General Counsel
535 Telfair Street, Building 3000
Augusta, Georgia 30901

Augusta Recreation & Parks Department
ATTN: Director Tameka Williams
2027 Lumpkin Road
Augusta, GA 30906

For Contractor: _____

_____

_____

[SIGNATURES ON THE FOLLOWING PAGE]

IN WITNESS WHEREOF, a duly authorized representative of each party has executed this Agreement in four (4) counterparts, each of which shall be deemed an original, as of the date(s) set forth below.

OWNER: AUGUSTA, GEORGIA

ATTEST: (SEAL)

By: _____

The Honorable Garnett L. Johnson

Mayor

Date: _____

By: _____

Lena J. Bonner

Clerk of the Commission

Date: _____

APPROVED AS TO FORM:

By: _____

Jim Plunkett

General Counsel

Date: _____

DEPARTMENT APPROVAL:

By: _____

Tameka D. Williams

Director, Augusta Parks & Recreation

Date: _____

CONTRACTOR: _____

ATTEST: (SEAL)

By: _____

Name: _____

Title: _____

Date: _____

By: _____

Name: _____

Title: _____

Date: _____

Augusta
GEORGIA

BID FORM

FOR

ITB 26-182

BOYKIN ROAD PARK IMPROVEMENTS

BOYKIN ROAD PARK IMPROVEMENTS
AUGUSTA, GEORGIA

PROPOSED SCOPE OF SERVICES

ITEM #	Description	Unit	Quantity	Unit Cost	Cost
1.00	**Demolition / Earthwork**				
1.01	Force Account	LS	1	$70,000.00	$70,000.00
1.02	General Conditions	LS	1		
1.03	Mobilization	LS	1		
1.04	Erosion & Sediment Control	LS	1		
1.05	Earthwork	SF	102,000		
1.06	Fine Grading	SF	102,000		
1.07	Construction Surveying	LS	1		
1.08	Remove and Dispose of Existing Asphalt	SF	11,500		
1.09	Remove and Dispose of Existing Gravel	SF	11,000		
1.10	Remove and Dispose of Existing Chain Link Fence	LF	1,100		
1.11	Remove and Dispose of Existing Concrete Curb	LF	163		
1.12	Remove and Dispose of Existing Basketball Goals	EA	3		
1.13	Remove and Dispose Existing Storm Structure	EA	3		
1.14	Remove and Dispose of Existing Storm Pipe	LF	280		
				Sub-Total #1	

BOYKIN ROAD PARK IMPROVEMENTS
AUGUSTA, GEORGIA

PROPOSED SCOPE OF SERVICES (continued)

ITEM #	Description	Unit	Quantity	Unit Cost	Cost
2.00	**Site Work**				
2.01	HD Asphalt Aggregate Base Course	TN	417		
2.02	HD Asphalt Intermediate Course	TN	178		
2.03	HD Asphalt Surface Course	TN	178		
2.04	Aggregate Base Course (Gravel Parking Area)	TN	313		
2.05	Driveway Entrance	LS	1		
2.06	Concrete Sidewalk	SY	949		
2.07	Concrete Curb	LF	937		
2.08	Turn Down Curb at Park Shelters	LF	208		
2.09	Concrete Steps	EA	2		
2.10	Turn Down Edge	LF	123		
2.11	Safety Railing	LF	123		
2.12	Playground Concrete Border	LF	252		
2.13	Valley Gutter	LF	129		
2.14	Decomposed Granite Trail	TN	45		
2.15	Aggregate Base Course (Trail)	TN	93		
2.16	Curb Ramps	EA	4		
2.17	Detectable Warning Plates	SF	281		
2.18	Solar Bollards	EA	8		
2.19	Bollards (Regular)	EA	20		
2.20	Pavement Markings	LS	1		
2.21	Signage	EA	5		
2.22	Seed Disturbed Areas	SF	31,600		
				Sub-Total #2	

BOYKIN ROAD PARK IMPROVEMENTS
AUGUSTA, GEORGIA

PROPOSED SCOPE OF SERVICES (continued)

ITEM #	Description	Unit	Quantity	Unit Cost	Cost
3.00	**Site Utilities**				
3.01	12" RCP Storm Pipe	LF	134		
3.02	12" HDPE Storm Pipe	LF	414		
3.03	18" RCP Storm Pipe	LF	73		
3.04	24" RCP Storm Pipe	LF	16		
3.05	24" HDPE Storm Pipe	LF	315		
3.06	Underdrainage	LS	1		
3.07	Storm Structures	EA	8		
3.08	Area Drains	EA	6		
3.09	Storm Water Control Measures	EA	1		
3.10	2" Domestic Water Service and Appurtences	LS	1		
3.11	6" Sanitary Sewer Lateral	LF	184		
3.12	5" Schedule 80 Conduit	LF	221		
3.13	Electric Service	LS	1		
				Sub-Total #3	

ITEM #	Description	Unit	Quantity	Unit Cost	Cost
4.00	**Buildings and Playground**				
4.01	36x50 Park Shelter with Restrooms	EA	1		
4.02	20x24 Park Shelter	EA	2		
4.03	Play Structures	EA	1		
4.04	Swings	LS	1		
4.05	Freestanding Play Components	LS	1		
4.06	Engineered Wood Fiber Surfacing	SY	400		
				Sub-Total #4	

BOYKIN ROAD PARK IMPROVEMENTS
AUGUSTA, GEORGIA

PROPOSED SCOPE OF SERVICES (continued)

ITEM #	Description	Unit	Quantity	Unit Cost	Cost
5.00	**Site Amenities and Landscaping**				
5.01	Benches	EA	2		
5.02	Trash Receptacles	EA	4		
5.03	Grills	EA	4		
5.04	Bike Rack	EA	1		
5.05	Bike Locker	EA	1		
5.06	Landscape Mulch	CF	2,000		
5.07	Landscape Plantings Allowance	LS	1	$50,000.00	$50,000.00
				Sub-Total #5	

Item #	Description	Unit	Quantity	Unit Cost	Cost
ALT	**Bid Alternates**				
ALT1	Park Shelter with Restrooms – Remove split face CMU pilasters from park shelter	LS	1		
ALT2	Park Shelter with Restrooms – Change construction material of pre-engineered park shelter to laminated wood columns and beams with tongue & grove wood roof decking	LS	1		
ALT3	Park Shelter with Restrooms – Change standing seam metal roof to multi-rib roof	LS	1		
				Sub-Total #ALT	

BOYKIN ROAD PARK IMPROVEMENTS
AUGUSTA, GEORGIA

Total Project Cost:

1. Demolition/Earthwork	
2. Site Work	
3. Site Utilities	
4. Building and Playground	
5. Site Amenities and Landscaping	
ALT. Bid Alternates	
Total Project Cost	

Determination of Low Bidder: Low bidder will be determined based on the total of the base bid plus all bid alternates regardless of the alternates chosen for the project. Owner shall reserve the right to award the overall project and alternate as deemed fit.

SUBMITTED BY: _____

Bidder's Name

_____

Address

_____

City, State and Zip Code

_____

Phone / Fax Date Completed

GENERAL CONDITIONS

ITB #26-182

Boykin Road Park Improvements

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GC-01. DEFINITIONS:

Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof.

1. ADDENDA: Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Drawings, and Specifications, by addition, deletion, clarifications, or corrections.

2. BID: The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the work to be performed.

3. BIDDER: Any person, firm, or corporation submitting a bid for the work.

4. BONDS: Bid, Performance and Payment Bonds and other instruments of security furnished by Contractor and Contractor's Surety in accordance with the Contract Documents.

5. CHANGE ORDER: A written order to Contractor authorizing an addition, deletion, or revision in the work within the general scope of the Contract Documents or authorizing an adjustment in the contract price or contract time.

6. CONTRACT DOCUMENTS: The contract including Advertisement for Bids, Information for Bidders, Proposal, Bid Bond, Notice of award, Agreement, Performance Bond, Payment Bond, Notice to Proceed, Change Order, General Conditions, Supplemental General Conditions, Special Conditions, Technical Specifications, Drawings and Addenda.

7. CONTRACT PRICE: Total monies payable to Contractor under the terms and conditions of the Contract Documents.

8. CONTRACT TIME: Number of calendar days stated in the Contract Documents for the completion of the work.

9. LIFE OF THE CONTRACT: Total duration of the contract from Notice to Proceed to completion of all the work.

10. CONTRACTOR: The person, firm, or corporation with whom Owner has executed the Agreement.

11. DRAWINGS: The part of the Contract Documents which show the characteristics and scope of the work to be performed and which have been prepared or approved by Consultant.

12. CONSULTANT: In all contract documents, specifications, supporting documents, and related materials, the term "CONSULTANT" refers to any company or designee appointed

by Owner to manage and/or provide engineering services for the project. Any reference to "Engineer" in this agreement shall be understood to have the same meaning as "Consultant."

13. FIELD ORDER: Written order effecting a change in the work not involving an adjustment in the contract price or an extension of the contract time issued by Consultant to Contractor during construction.

14. NOTICE OF AWARD: Written notice of the acceptance of the Bid from Owner to the successful Bidder.

15. NOTICE TO PROCEED: Written communication issued by Owner to Contractor authorizing the Contractor to proceed with the work and establishing the date of commencement of the work.

16. OWNER: A public or quasi-public body or authority, corporation, association, partnership, city, county, or individual for whom the work is to be performed.

17. PROJECT: Undertaking to be performed as provided in the Contract Documents.

18. RESIDENT PROJECT REPRESENTATIVE: Authorized representative of Owner who is assigned to the project site or any part thereof. Also called a Site Engineer.

19. SHOP DRAWINGS: All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by Contractor, a Subcontractor, Manufacturer, Supplier or Distributor, which illustrate how specific portions of the work shall be fabricated or installed.

20. SPECIFICATIONS: Part of the Contract Documents consisting of written descriptions of a technical nature or materials, equipment, construction systems, standards, and workmanship.

21. SUBCONTRACTOR: Individual, firm, or corporation having a direct contract with Contractor or any other Subcontractor for the performance of a part of the work at the site.

22. SUBSTANTIAL COMPLETION: That date as certified by Consultant when the construction of the project or a specified part can be utilized for the purposes for which it is intended.

23. SUPPLEMENTAL GENERAL CONDITIONS: Modifications and/or additions to the General Conditions of a specific nature generally aimed at the specific contract of which it is a part.

24. SUPPLIERS: Any person, supplier or organization who supplies materials or equipment for the work, including that fabricated to a special design, but who does not perform labor

at the site.

25. WORK: All labor necessary to produce the construction required by the Contract Documents and all materials and equipment incorporated or to be incorporated in the project.

26. WRITTEN NOTICE: Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the party at the party's last given address or delivered in person to said party or the party's authorized representative on the work.

GC-02. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS:

1. Contractor may be furnished additional instructions and detail drawings, by Consultant, as necessary to carry out the work required by the Contract Documents.

2. The additional drawings and instructions thus supplied will become a part of the Contract Documents. Contractor shall carry out the work in accordance with the additional detail drawings and instructions.

GC-03. SCHEDULES, REPORTS AND RECORDS:

1. Contractor shall submit to Owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as Owner may request concerning the work performed or to be performed.

The Contractor shall also submit the following information with the schedule.

a. List of available resources assigned to this project.

b. Name of Project Team (Project Manager, Superintendent, Foreman) assigned to this project.

c. Subcontractor information such as Company Name, Contact Name and Telephone, and type of assigned tasks.

2. Contractor shall also submit a schedule of payments anticipated to be earned during performance of the Work.

GC-04. SPENDOUT SCHEDULE:

A Spendout Schedule beginning with the *Notice to Proceed* and extending through the anticipated construction life of the project, shall be submitted at the Pre-Construction Conference. Such schedule shall include the anticipated earnings on a monthly basis.

GC-05. NOTICE TO PROCEED:

There will be one Notice to Proceed given to Contractor. The Notice to Proceed will be to Clear and Grub, site preparation and actual construction activities. This shall be the Contract Time that is actually shown in the contract.

GC-06. CONSTRUCTION LAYOUT:

Construction layout work shall be performed by Contractor.

GC-07. DRAWINGS AND SPECIFICATIONS:

1. The intent of the drawings and specifications is that Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the work in accordance with the Contract Documents and all incidental work necessary to complete the project in an acceptable manner, ready for use, occupancy, or operation by Owner.

2. In case of conflict between the drawings and specifications, the specifications shall govern. Figure dimensions on drawings shall govern over general drawings.

3. Any discrepancies found between the drawings and specifications and site conditions or any inconsistencies or ambiguities in the drawings or specifications shall be immediately reported to Consultant, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work performed by the Contractor after discovery of such discrepancies, inconsistencies, or ambiguities shall be done at Contractor's risk.

4. All work that may be called for in the specifications and not shown on the drawings, or shown and not called for in the specifications, shall be executed and furnished by Contractor as if described in both these ways and should any work or material be required which is not detailed in the specifications or drawings, either directly or indirectly, but which is nevertheless necessary for the proper carrying out of the intent thereof, Contractor is to understand the same to be implied and required and shall perform all such work and furnish any such material as fully as if they were particularly delineated or described.

5. It is understood and agreed that the Contractor, by careful examination, has satisfied itself as to the nature and location of the Work; the configuration of the ground; the character, quality, and quantity of materials to be encountered; the equipment and

facilities required prior to and during performance of the Work; the general and local conditions; and all other matters that may in any way affect performance under this Contract. No verbal agreement or conversation with any officer, agent, or employee of the Owner, whether occurring before or after execution of this Contract, shall modify or affect any term or obligation contained herein.

6. All storm pipes, manholes, junction boxes, catch basins, inlets, misc. pre-cast products and appurtenances shall comply with Georgia Department of Transportation (GDOT) standards and specifications. Storm pipes and other products shall be from current GDOT approved plants and stamped per GDOT inspection certification requirements. Submittal of data sheet, issued by the source (plant), containing pipe manufacturing and inspection data will be required at the time of arrival of material at project site.

GC-08. SPECIFICATIONS, STANDARDS AND OTHER DATA:

All references in this document, (includes all papers, writings, documents, drawings, or photographs used, or to be used, in connection with this document), to State Highway of Georgia, State Highway Department, Highway Department, or Department when the context thereof means the Georgia Department of Transportation means, and shall be deemed to mean, ***Augusta, GA Commission***-Augusta Recreation and Park Department.

The data, together with all other information shown on these plans, or indicated in any way thereby, whether by drawings or notes or in any other matter, are based upon field investigations, and are believed to be indicative of actual conditions. However, the same are shown as information only, are not guaranteed, and do not bind ***Augusta***, Georgia in any way.

GC-09. DESIGN ALTERATION :

Augusta, Georgia recognizes that various changes in design may be made as the project progresses. Any requests for additional payment or reduction in payment shall be processed based on actual work in place and the unit prices submitted as a part of this bid. Items not covered in this bid shall be priced separately and no work shall be done on these items until approved, in writing, by Consultant.

All changes in engineering design of the project shall be approved by the Design Engineer of record after consultation with Consultant. Revised design plan sheet(s) shall be signed and stamped by the Design Engineer of record and a copy shall be submitted to Owner.

GC-10. INCIDENTAL CONSTRUCTION ITEMS:

All work and materials without a specific pay item shall be considered incidental to related pay items, including, but not limited to, additional erosion and sediment control measures, all removals, and disposals, borrow, if needed, remove and reset fences,

remove and reset ornamental shrubs, bushes and sod, and the obtaining, maintaining and restoration of any required borrow and/or waste pits, establish and reset property boundary survey pins.

GC-11. SHOP DRAWINGS:

1. Contractor shall provide shop drawings as may be necessary for the prosecution of the work as required by the Contract Documents. Consultant shall promptly review all shop drawings. Consultant's approval of any shop drawings shall not release Contractor from responsibility for deviations from the Contract Documents. The approval of any shop drawing which substantially deviates from the requirement of the Contract Documents shall be evidenced by a Change Order.

2. When submitted for Consultant's review, shop drawings shall bear Contractor's certification that the contractor has reviewed, checked, and approved the shop drawings and that they are in conformance with the requirements of the Contract Documents.

3. Portions of the work that require shop drawing or sample submission shall not begin until the shop drawing or submission has been approved by Consultant. A copy of each approved shop drawing and each approved sample shall be kept in good order by Contractor at the site and shall be available to Consultant.

GC-12. MATERIALS, SERVICES AND FACILITIES:

1. It is understood that, except as otherwise specifically stated in the Contract Documents, Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature and all other services and facilities of any nature whatsoever necessary to execute, complete and deliver the work within the specified time.

2. Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the work. Stored materials and equipment to be incorporated in the work shall be located so as to facilitate prompt inspection.

3. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer.

4. Materials, supplies or equipment shall be in accordance with samples submitted by Contractor and approved by Consultant.
5. Materials, supplies or equipment to be incorporated into the work and purchased by Contractor of the Subcontractor shall be subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

GC-13. INSPECTION AND TESTING:

1. All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with generally accepted standards.

2. Owner shall provide, at Owner's expense, the necessary testing and inspection services required by the Contract Documents, unless otherwise provided. Owner shall employ a qualified material testing laboratory to monitor more fully the quality of materials and work and to perform such tests as may be required under the contract documents as conditions for acceptance of materials and work. CONSULTANT MAY ORDER TESTING AT ANY TIME CONSULTANT DEEMS PROPER TO CONTROL THE QUALITY OF THE WORK.

   Contractor is responsible for all material & labor quality control and quality assurance.

3. If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any work to specifically be inspected, tested, or approved by someone other than Contractor, Contractor shall give Consultant timely notice of readiness. Contractor shall then furnish Consultant the required certificates of inspection, testing or approval.

4. Neither observation by Consultant nor inspections, tests, or approvals by persons other than Contractor shall relieve Contractor from its obligations to perform the work in accordance with the requirements of the Contract Documents.

5. The project will be inspected by Consultant or Consultant's representative. Consultant and Consultant's representatives will at all times have access to the work. In addition, authorized representatives, and agents of any participating Federal or State Agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials and other relevant data and records. Contractor shall provide proper facilities for such access and observation of the work and also for any inspection or testing thereof.

6. If any work is covered contrary to the written request of Consultant, it must, if requested by Consultant, be uncovered for Consultant's observation, and replaced at Contractor's expense.

7. If any work has been covered which Consultant has not specifically requested to observe prior to its being covered or if Consultant considers it necessary or advisable that covered work be inspected or tested by others, Contractor at Consultant's request, will uncover, expose or otherwise make available for observation, inspection or testing as Consultant may require, that portion of the work in question, furnishing all necessary labor, materials, tools and equipment. If it is found that such work is defective, Contractor shall bear all the expenses of such uncovering, exposure, observation, inspection, and testing and of satisfactory reconstruction. If, however, such work is not found to be defective, Contractor shall be allowed an increase in the contract price or an extension of the

contract time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate change order shall be issued.

8. Contractor shall give Consultant 24 hours' notice of starting any new work. No work shall be done, or materials used without suitable supervision and inspection by Consultant. Contractor shall furnish Consultant with necessary samples of material for testing purposes.

GC-14. COMPACTION:

All compaction shall be as defined in the current edition of Georgia Department of Transportation Specifications. Special attention shall be given to the backfill of minor structures (pipe, box culverts, manholes, catch basins, drop inlets, etc.). Compaction shall be achieved using approved tamps and soil layers of approximately 6 inches (loose measure) and in accordance with Georgia Department of Transportation Standards 1030-D and 1401 or equivalent ASTM or other method approved by Consultant and Owner. Backfilling operations of this nature shall not begin until Contractor has on hand all equipment in good working condition, and competent operators.

The backfilling of pipe and other minor structures shall be in accordance with Georgia Department of Transportation Standard specifications, Current Edition. Backfilling with sand using jetting and/or flooding will not be allowed in any case without the written permission of Consultant. Backfilling of pipe structures shall be incidental to the pipe structure bid item.

NOTE: When sand and jetting/flooding method is used the warranty for the backfilled area is extended from 18 months to 24 months. A plan for the jetting/flooding shall be submitted at the Pre-Construction Conference.

GC-15. CONCRETE:

A qualified person contracted by Owner shall, in Consultant's presence, perform slump tests as directed by Consultant. Tests shall be performed by qualified personnel with a properly cleaned slump cone. Allowable slumps are 2" minimum and 4" maximum. Class "A" concrete shall have a minimum of 611 lbs. Cement per cubic yard. Class "B" concrete shall have a minimum of 470 lbs. Cement per cubic yard. Concrete not meeting these requirements will be rejected by Consultant.

NOTE: No concrete shall be placed until all required equipment such as slump cone, curing compound and dispenser, etc., all in good working condition, are on the site. Inspectors must be given a minimum four-hour advance notice. No concrete shall be placed without the Inspector present unless otherwise directed by Consultant. All concrete shall be placed during the Inspectors normal working hours, 8:30 a.m. to 5:00 p.m. unless otherwise directed by Consultant. Formed

surfaces shall receive finish immediately after removing forms. Forms shall be removed as provided in Section 500 of ***GeorgiaDOT*** Specifications.

GC-16. CONSTRUCTION:

Transition ties of proposed curb and gutter to existing curbs (valley gutter, granite curb, header curb, etc.) shall be paid for in the unit price bid for curb and gutter unless otherwise noted.

At locations where new pavement is to be placed adjacent to existing pavement, without an overlay, or where curbing is to be placed across paved parking lots, a joint shall be sawed on a line to ensure pavement removal to be neat. Only those joints sawed in concrete pavement will be paid for under the pay item-***Sawed Joints . . . per Linear Foot.***

Where curb and gutter is used and the shoulder elevations are higher than adjacent ground, the actual direction of drainage runoff shall be determined by Contractor. Contractor shall make such provisions as necessary to ensure that no ponding is caused by the new construction. Contractor may place additional fill to provide drain inlets. Compensation will be under the price bid for the appropriate pay item. Driveway profiles may also be altered allowing the concrete pad to slope down outside the back of the curb line not to exceed an algebraic difference of 0.07. This should be used primarily on the high side of super-elevated curves. Contractor should use caution with standard variance and place special emphasis on hydraulic considerations.

Contractor shall provide borrow and/or waste pits for this project. All pits acquired for use on this project shall be reclaimed in accordance with Subsection 107.23 and Section 160 of the Standard Specifications and page PPA-1 of this document.

All storm drainpipe, side drainpipe, pipe culvert wing-walls, steps, retaining walls, curbs and gutters, headwalls, all types of pavement, wooden structures, except those specifically shown as a removal pay item will be removed as ***Clearing and Grubbing, Grading Complete, or Grading Per Mile on Lump Sum Construction.***
Cut and fill slopes outside of clear zones may be adjusted on construction where necessary to remain within the right of way.

Curb cut ramps in accordance with Standard 9031-W are to be used at all street intersections on this project.

Asphalt milling where specified for use on existing pavement that is to be resurfaced adjacent to curb and gutter. Finished surface on asphalt pavement shall not exceed ¼" above the gutter line as shown on Georgia Standard 9031-J.

GC-17. TEST ROLLING :

Prior to placing any base course, the subgrade shall be proof rolled to locate unstable areas and achieve additional compaction. Area shall be proof rolled using a minimum 15 tons flat drum compactor or other equipment as recommended by the Geotechnical Engineer (such as a fully loaded tandem axle dump truck). Geotechnical Engineer and/or a representative of Augusta Environmental Services Department will observe and approve proof-rolling. Areas failing compaction shall be reworked. Any areas judged by the Geotechnical Engineer to rut shall be improved in place or undercut and replaced with fill compacted to 100% of the soil's maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D1557, Method D, or equivalent method approved by the Geotechnical Engineer and Augusta Environmental Services Department).

GC-18. SUBSTITUTIONS:

1. When a material, article or piece of equipment is identified on the drawings or specifications by reference to brand name or catalogue number, the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number and if, in the opinion of Consultant, such material, article or piece of equipment is of equal substance and function to that specified, Consultant may approve its substitution and use by Contractor. Any cost differential shall be deducted from the contract price and the Contract Documents shall be appropriately modified by change order. Contractor warrants that if substitutes are approved, no major changes in the function or general design of the project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by Contractor without a change in the contract price or contract time.

GC-19. PATENTS:

1. Contractor shall pay all applicable royalties and license fees. Contractor shall defend all suits or claims for infringement of any patent rights and save Owner harmless from loss on account thereof except that Owner shall be responsible for any such loss when a particular process, design or the product of a manufacturer or manufacturers is specified, but if Contractor has reason to believe that the design, process or product specified is an infringement of a patent, Contractor shall be responsible for such loss unless Contractor promptly gives such information to Consultant.

GC-20. SURVEYS, PERMITS AND REGULATIONS:

1. Contractor shall furnish all land surveys and establish all base lines for locating the principal component parts of the work together with a suitable number of benchmarks

adjacent to the work as shown in the Contract Documents. From the information provided by Owner, unless otherwise specified in the Contract Documents, Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

2. Contractor shall carefully preserve benchmarks, reference points and stakes and in case of willful or careless destruction, Contractor shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

3. Contractor shall re-establish property survey pins for parcels affected by new established right-of-way. This work shall be considered incidental to "As-built" plan preparation and will be paid as part of "As-built" plan pay item. This work shall be done by or under supervision of a qualified Georgia Licensed Professional Land Surveyor (PLS).

4. Permits and licenses of a temporary nature necessary for the prosecution of the work shall be secured and paid for by Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by Owner, unless otherwise specified. Contractor shall give all notices and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the work as drawn and specified. If Contractor observes that the Contract Documents are at variance therewith, Contractor shall promptly notify Consultant in writing and any necessary changes shall be adjusted as provided in Section 13, Changes in the Work.

GC-21. FENCE:

All new fences called for on the plans and/or contract documents shall meet the requirements of Section 643 of the Georgia Department of Transportation Standard Specifications, current edition. New fence not meeting these Specs will be rejected.

In contracts, where remove and reset fence items are involved (either as pay items or as Lump Sum Construction) all replacement fence shall be equal to or better than the existing fence as approved by Consultant. This means equal to or better than the original fence at the time of its installation. Contractor must furnish positive locking devices, padlocks, and keys with all gate assemblies.

GC-22. PROTECTION OF WORK, PROPERTY AND PERSONS:

1. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work. Contractor shall take all necessary precautions for the safety of and will provide the necessary protection to prevent damage, injury or loss to all employees on the work and other persons who may be affected thereby, all the work and all materials or equipment to be incorporated

therein, whether in storage on or off the site or other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

2. Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction. Contractor shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection. Contractor shall notify Owners of adjacent utilities when prosecution of the work may affect them. Contractor shall remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by Contractor, any subcontractor, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them are liable, except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of Owner or Consultant or anyone employed by either of them or anyone for whose acts either of them may be liable and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor.

3. In emergencies affecting the safety of persons or the work or property at the site or adjacent thereto, Contractor, without special instructions or authorization from Consultant or Owner, shall act to prevent threatened damage, injury, or loss. Contractor shall give Consultant prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby and a Change Order shall be issued covering the changes and deviations involved.

4. The work under this Contract in every respect shall be at the risk of Contractor until finished and accepted, except to damage or injury caused directly by Owner's agents or employees.

GC-23. FINISHING AND DRESSING:

All unpaved and natural areas which are disturbed by the construction of this project are to be returned to the pre-existing shape and slope and then finished and dressed. No separate payment will be made for grassing, fertilizing, and mulching of disturbed areas, unless specifically shown as a pay item.

GC-24. AGGREGATE SURFACE COURSE:

The item aggregate surface course is for use in inclement weather to facilitate the movement of local traffic along roadway construction and to permit ingress and egress at drives. When used for this purpose, Section 318, Georgia Standard Specifications, is modified to permit truck dumping on unprepared and muddy subgrade. Section 318 is further modified to permit the use of crusher run stone as described in Subsection 806.02.

Contractor shall have the choice of the following materials:

Graded Aggregate	Subsection 815.01
Coarse Aggregate Size 467	Subsection 800.01
Stabilizer Aggregate Type 1 or 2	Section 803
Crushed Stone	Subsection 806.02

All materials to be used as directed by Consultant.

GC-25. FOUNDATION BACKFILL MATERIAL, TYPE 1:

Foundation Backfill Material Type I shall conform to Georgia Standard 1030-D and Section 207 of the Standard Specifications. No separate payment will be made for this material or its placement.

GC-26. FOUNDATION BACKFILL MATERIAL, TYPE II:

Foundation Backfill Material, Type II shall conform to Georgia Standard 1030-D and Section 207 of the Standard Specifications and shall be used in wet/unstable conditions as directed by Consultant. It shall also be used beneath all concrete box culverts. Quantities shall be measured for payment in accordance with Georgia Standard 1030-D or as directed by Consultant. Payment shall be per cubic yard unless otherwise specified in the contract.

GC-27. INFESTATION:

The entire project is considered to be within the limits of an insect infested area. Contractor's attention is called to the following sections of the Standard Specifications: (A) 155 Insect control (B) 893 Miscellaneous Planting Materials.

GC-28. GRADES:

With the approval of Consultant, grades may be field adjusted to provide for best drainage.

GC-29. LANDSCAPING:

All the requirements of Section 702 of the Georgia Department of Transportation Specifications, current edition, are applicable to this project except as follows: there will be no separate pay for staking, including Perimeter Staking and for Spring Application of Fertilizer. All costs shall be included in prices bid for Landscape Items. Bag grown plants are <u>not</u> acceptable.

GC-30. MAILBOXES:

Existing mailboxes that are in conflict with the proposed construction shall be removed and relocated. Where feasible the existing mailboxes and supports may be utilized as approved by Consultant so long as the supports are of metal **PIPE** with a maximum diameter of two (2) inches or wood, with a maximum diameter of four (4) inches.

NOTE: There shall be no supports of any material other than the two mentioned above. All existing mailboxes and supports containing brick, masonry of any type, metal, etc. shall be disassembled and all components, not meeting the above requirements, shall be removed from the project, and disposed in a proper manner.

When not shown as a pay item, payment shall be included in the price bid for Lump Sum Construction and itemized as such.

GC-31. MISCELLANEOUS DRAINAGE STRUCTURES:

All miscellaneous drainage structure such as ***Catch Basins, Drop Inlets, Manholes, Junction Boxes, Spring Boxes, Drain Inlets, special Inlets***, etc., whether standard or special design shall be paid for ***Per Each***. There will be no separate payment for additional depth unless specifically shown as a pay item.

NOTE: All ***Catch Basins, Drop Inlets, manholes, exposed Junction Boxes***, etc., with concrete top-slabs shall include manhole rings and covers. Contractor shall install the manhole rings and covers such that the steps can be easily accessed.

GC-32. PATCHING AND REPAIR OF MINOR DEFECTS:

Where needed, Contractor is required to patch and repair existing potholes, minor pavement defects, and base failures in accordance with the Specifications.

GC-33. PAVEMENT CUTS:

All pavement cuts shall be sawed with a neat vertical edge, regardless of material, consistently straight enough that a roller can follow the edge precisely to achieve the desired compaction. Irregular edges will not be accepted. Payment shall be included in the price of the pipe.

GC-34. ADJUSTING MINOR STRUCTURES TO GRADE:

This item consists of raising or lowering the upper portion of existing manholes, water valve boxes, gas valve boxes or any other miscellaneous structures within the area of construction. There will be no separate payment for this work unless shown as a separate pay item.

***Prior to any resurfacing Contractor shall identify and reference all structures so the precise locations can be determined after resurfacing. This shall be done in the company of the ARC Inspector. This shall be the first order of work where minor structures requiring adjustment are included in the contract.**

GC-35. CASINGS:

All steel casings being installed across any roadway and/or right-of-way shall have the joints continuously welded to obtain a watertight seal. Contractor shall notify Consultant when welds are ready for inspection. Welded casings backfilled without Consultant's approval shall be uncovered for inspection at Consultant's request.

GC-36. PAYMENT FOR PIPE CULVERT INSTALLATION:

1. Payment for pipe culvert or utility installation includes sawing and/or cutting and removing existing pavement and replacing the pavement as specified in accordance with Standard 1401.

2. Payment for pipe culvert includes plugging existing pipe with Class "A" or "B" concrete (See Georgia Standard 9031-L).

GC-37. PIPE CULVERTS:

Unless otherwise noted, all storm drain, longitudinal and stub pipes are to be reinforced concrete. All required pipe culverts shall be in accordance with Standard 1030-D.

Foundation Backfill Material Type I shall conform to Georgia Standard 1030-D. No separate pay item will be made for this material for its placement.

Payment for pipe culvert or utility installation includes sawing and/or cutting and removing existing pavement, sidewalk, curbing, etc., and replacing same as specified in accordance with Standard 1401. Payment for pipe culvert includes plugging existing pipe with Class "A" or "B" concrete and for construction concrete collars.

Contractor shall include in Contractor's price bid for pipe, the additional cost of bends, tees, fasteners, appropriate gaskets (see Section 848 of the Standard Specifications), and structure excavation.

GC-38. PRECAST CONCRETE UNITS:

Precast Concrete Units, other than those specifically allowed by Georgia Department of Transportation Specifications, such as ***Drop Inlets, Catch Basins, Manholes***, etc., shall not be installed without written permission from Consultant. Any such units installed without such written permission shall be removed from the project.

GC-39. RELOCATED WATER METERS:

Relocated water meters and water meter boxes may not be placed in the sidewalk.

GC-40. REMOVAL AND RESETTING OF ORNAMENTAL SHRUBS AND BUSHES AND SOD:

It shall be Contractor's responsibility to remove and reset any and all existing ornamental shrubs and bushes and sod in conflict with proposed construction. Coordination with the property owners is essential in this endeavor. Contractor shall not be held responsible for care and maintenance after removing and resetting these plants and sod except in cases where Contractor's equipment causes irreparable damage or where plants and/or sod die as the result of negligence on Contractor's part. In which cases, Contractor shall be held responsible for replacement. Sod shall be reset with ground preparation in accordance with Subsection 700.05.A. No additional soil or fertilizer is required for resetting sod. Contractor shall remove the sod in a manner that will be conducive to ensuring that the reset sod will live. At Contractor's option, Contractor may replace any sod he removes with new sod of the same type. No separate payment will be made for this work or replacements unless specifically shown as a pay item.

GC-41. REMOVING AND RESETTING OF OBSTRUCTIONS:

It shall be Contractor's responsibility to remove and reset any and all obstructions, such as fences, signs, concrete or brick planters, steps, walkways, brick or concrete entrance columns, etc., which are in conflict with construction. Contractors are responsible for the security of pets and/or personal property through the use of temporary fence if necessary. No separate payment will be made for this work except when shown as a separate pay item.

GC-42. SAW CUTS:

When matching existing conditions, saw cuts shall be used as required by ***Augusta-Richmond County***. Only saw cuts in Portland Cement Concrete, which are shown, as contract pay items will be paid for separately. No saw cuts in asphaltic concrete will be paid for separately. Unless specifically noted this does not apply to pipe trenches.

GC-43. SOD:

Sod will not be paid for separately when used to match or replace sod on adjacent lawns as replacement in kind. See ***GDOT*** specifications, subsection 700.04 E.

GC-44. STORM DRAINPIPE:

Unless otherwise noted, all storm drain, longitudinal and stub pipe are to be reinforced concrete and shall include ***O-ring gaskets***.

GC-45. SUB-CONTRACTORS:

Contractor shall furnish the official name, plus the name and telephone number of the 24-hour emergency contact of all firms Contractor proposes to use as Subcontractors in the work. This information is to be furnished at the ***Preconstruction Conference***. However, no work shall be done on this project by a Subcontractor until Contractor receives approval of Contractor's Subcontractor(s) from Consultant.

NOTE: All submissions shall include the following information for each Subcontractor:

1. ***Name of Subcontracting Firm***
2. ***Description of Work To Be Done***
3. ***Contact Person's Name and 24-Hour Phone Number***

GC-46. SUPERVISION BY CONTRACTOR:

1. Contractor shall supervise and direct the work. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall employ and maintain on the work a qualified supervisor or superintendent who shall have been designated in writing by Contractor as Contractor's representative at the site. The supervisor shall have full authority to act on the behalf of Contractor and all communications given to the supervisor shall be as binding as if given to Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the work.

GC-47. CHANGES IN THE WORK:

1. Owner may at any time as the need arises, order changes within the scope of the work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents or in the time required for performance of the work, an equitable adjustment shall be authorized by Change Order.

2. Consultant, also, may at any time, by issuing a field order, make changes in the details of the work. Contractor shall proceed with the performance of any changes in the work so ordered by Consultant unless Contractor believes that such field order entitles the Contractor to a change in the contract price or time or both, in which event Contractor shall give Consultant written notice thereof within ten (10) days after the receipt of the ordered change pending the receipt of an executed change order or further instruction from Owner.

GC-48. CHANGES IN CONTRACT PRICE:

1. The contract price may be changed only by a change order. The value of any work covered by a change order or of any claim for increase or decrease in the contract price shall be determined by one or more of the following methods in the order of precedence listed below:

   1.1 Unit prices previously approved.
   1.2 An agreed lump sum.
   1.3 The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the work. In addition, there shall be added an amount to be agreed upon but not to exceed fifteen (15) percent of the actual cost of the work to cover the cost of general overhead and profit.

GC-49. TIME FOR COMPLETION AND LIQUIDATED DAMAGES:

1. The date of beginning and the time for completion of the work are essential conditions of the Contract Documents and the work embraced shall be commenced on the date specified in the Notice to Proceed.
2. Contractor shall proceed with the work at such rate of progress to ensure full completion within the contract time. It is expressly understood and agreed, by and between Contractor and Owner, that the contract time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the work.

3. If Contractor shall fail to complete the work within the contract time or extension of time granted by Owner, then Contractor shall pay to Owner the amount for liquidated damages as specified in the Agreement for each calendar day that Contractor shall be in default after the time stipulated in the Contract Documents.

4. Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to the following and Contractor has promptly given written notice of such delay to Owner or Consultant.

   4.1 To any preference, priority, or allocation order duly issued by Owner.

   4.2 To unforeseeable causes beyond the control and without the fault of negligence of Contractor, including but not restricted to, acts of God or of the public enemy, acts of Owner, acts of another Contractor in the performance of a contract with Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and abnormal and unforeseeable weather; and

   4.3 To any delays of subcontractors occasioned by any of the causes specified in Paragraphs 4.1 and 4.2 of this Article.

GC-50. CORRECTION OF WORK:

1. Contractor shall promptly remove from the premises all work rejected by Consultant for failure to comply with the Contract Documents, whether incorporated in the construction or not and Contractor shall promptly replace and re-execute the work in accordance with the Contract Documents and without expense to Owner and shall bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

2. All removal and replacement work shall be done at Contractor's expense. If Contractor does not take action to remove such rejected work within ten (10) days after receipt of written notice, Owner may remove such work and store the materials at the expense of Contractor.

3. Any omissions or failure on the part of Consultant to disapprove or reject any work or material shall not be construed to be an acceptance of any defective work or material. Contractor shall remove, at Contractor's own expense and shall rebuild and replace same without extra charge and in default thereof the same may be done by Owner at Contractor's expense or in case Consultant shall not consider the defect of sufficient importance to require Contractor to rebuild or replace any imperfect work or material, Consultant shall have the power and is hereby authorized to make an equitable deduction from the stipulated price.

GC-51. SUBSURFACE CONDITIONS:

1. Contractor shall promptly and before such conditions are disturbed, except in the event of an emergency, notify Owner by written notice of:

   1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents.

   1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

2. Owner shall promptly investigate the conditions and if Owner finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required, for performance of the work, an equitable adjustment shall be made, and the Contract Documents shall be modified by a Change Order. Any claim of Contractor for adjustment hereunder shall not be allowed unless the Contractor has given the required written notice; provided that Owner may, if Owner determines the facts so justify, consider, and adjust any such claims asserted before the date of final payment.

GC-52. SUSPENSION OF THE WORK, TERMINATION AND DELAY:

1. Owner may, at any time and without cause, suspend the work or any portion thereof for a period of not more than ninety days or such further time as agreed upon by Contractor, by written notice to Contractor. Consultant shall fix the date on which work shall be resumed. Contractor shall resume that work on the date so fixed. Contractor shall be allowed an increase in the contract price, an extension of the contract time, or both, directly attributable to any suspension.

2. If Contractor is adjudged bankrupt or insolvent, or if Contractor makes a general assignment for the benefit of Contractor's creditors or if a trustee or receiver is appointed for Contractor or for any of Contractor's property or if Contractor files a petition to take advantage of any debtor's act to reorganize under the bankruptcy or applicable laws or if Contractor repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if Contractor repeatedly fails to make prompt payments to subcontractors or for labor, materials or equipment or if Contractor disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the work or if Contractor disregards the authority of Consultant, or if, in the opinion of Consultant, Contractor fails to make satisfactory progress in prosecuting the work, or if Contractor otherwise violates any provision of the Contract Documents, then Owner may, without prejudice to any other right or remedy and after giving Contractor and the Contractor's Surety a minimum of ten (10) days from delivery of a written notice, terminate the services of Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by Contractor and finish the work by whatever method Owner may deem expedient. In such case, Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to Contractor. If such costs exceed such unpaid balance, Contractor shall pay the difference to Owner. Such costs incurred by Owner will be determined by Consultant and incorporated in a Change Order.

3. Contractor must obtain permission from Consultant before any equipment can be removed from the job site. In the event such equipment is removed without Consultant's approval, the job will be terminated until such time as the equipment is returned to the project and any time and money lost by Contractor as a result of moving the equipment shall be absorbed by Contractor.

4. Where Contractor's services have been so terminated by Owner, said termination shall not affect any right of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of monies by Owner due Contractor shall not release Contractor from compliance with the Contract Documents.

5. After ten (10) days from delivery of a written notice to Contractor and Consultant, Owner,

may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, Contractor shall be paid for all work executed and any expense sustained plus reasonable profit.

6. If, through no act or fault of Contractor, the work is suspended for a period of more than ninety (90) days by Owner or under an order of court or other public authority, or if Consultant fails to act on any request for payment within thirty (30) days after it is submitted or Owner fails to pay Contractor substantially the sum approved by Consultant within thirty (30) days of its approval and presentation, then Contractor may after ten (10) days from delivery of a written notice to Owner and Consultant, terminate the Contract and recover from Owner payment for all work executed and all expenses sustained. In addition, and in lieu of terminating the Contract, if Consultant has failed to act on a request for payment or if Owner has failed to make any payment as aforesaid, Contractor may, upon ten (10) days' notice to Owner and Consultant, stop the work until Contractor has been paid all amounts then due, in which event and upon resumption of the work, Change Orders shall be issued for adjusting the contract price or extending the contract time or both to compensate for the costs and delays attributable to the stoppage of the work.

7. If the performance of all or any portion of the work is suspended, delayed, or interrupted as a result of a failure of Owner or Consultant to act within the time specified in the Contract Documents, or if no time is specified, within reasonable time, an adjustment in the contract price or an extension of the contract time or both, shall be made by Change Order to compensate Contractor for the costs and delays necessarily caused by the failure of Owner or Consultant.

GC-53. PAYMENTS TO CONTRACTOR:

1. Between the first (1st) and the fifth (5th) of each month, Contractor shall submit to Consultant a partial payment estimate filled out and signed by Contractor on an approved form covering the work performed during the period covered by the partial payment estimate and supported by such data as Consultant may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the work but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to Owner, as will establish Owner's title to the material and equipment and protect its interest therein, including applicable insurance. Consultant will, within thirty days after receipt of each partial payment estimate, either indicate in writing Consultant's approval of payment and present the partial payment estimate to Owner, or return the partial payment estimate to Contractor indicating in writing Consultant's reasons for refusing to approve payment. In the latter case, Contractor may make the necessary corrections and resubmit the partial payment estimate. Owner will, within thirty days of presentation to Owner of an approved partial payment estimate, pay Contractor a progress payment on the basis of the approved partial payment estimate. Owner shall retain ten (10%) percent of the amount of each

payment until final completion and acceptance of all work covered by the Contract Documents and successful completion of required warranty period. On completion and acceptance of a part of the work on which the price is stated separately in the Contract Documents, payment may be made in full, excluding retained percentages, less authorized deductions.

2. The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

3. All work covered by partial payment shall thereupon become the sole property of Owner, but this provision shall not be construed as relieving Contractor of the sole responsibility for the care and protection of the work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of Owner to require the fulfillment of all terms of the Contract Documents.

4. Upon completion and acceptance of the work, Consultant shall issue a certificate attached to the final payment request that the work has been accepted by Consultant under the conditions of the Contract Documents. The entire balance, excluding the retained percentage, found to be due Contractor shall be paid to Contractor, except such sums as may be lawfully retained by Owner for saving Owner or Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material-men and furnishers of machinery and parts thereof, equipment, tools and supplies, incurred in the furtherance of the performance of the work. Contractor shall, at Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If Contractor fails to do so, Owner may, after having notified Contractor, either pay unpaid bills or withhold from Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon Owner to either Contractor, Contractor's Surety, or any third party. In paying any unpaid bills of Contractor, any payment so made by Owner shall be considered as a payment made under the Contract Documents by Owner to Contractor and Owner shall not be liable to Contractor for any such payments made in good faith.

5. If Owner fails to make payment 30 days after approval by Consultant, in addition to other remedies available to Contractor, there shall be added to each such payment, interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by Contractor.

GC-54. ACCEPTANCE OF FINAL PAYMENT AS RELEASE:

1. The acceptance by Contractor of final payment shall be and shall operate as a release to

Owner of all claims and all liability to Contractor other than claims in stated amounts as may be specifically excepted by Contractor for all things done or furnished in connection with this work and for every act and neglect of Owner and other relating to or arising out of this work. Any payment, however, final, or otherwise, shall not release Contractor or Contractor's Sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bonds.

GC-55. INSURANCE:

1. Contractor shall purchase and maintain during the life of this Contract such insurance as will protect Contractor from claims set forth below which may arise out of or result from Contractor's execution of the work, whether such execution by Contractor or by any Subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.

    1.1 Claims under Workman's Compensation, disability benefit and other similar employee benefit acts,

    1.2 Claims for damages because of bodily injury, occupational sickness or disease or death of Contractor's employees,

    1.3 Claims for damages because of bodily injury, sickness or disease or death of any person other than Contractor's employees,

    1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor or (2) by any other person; and

    1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.

2. Certificates of Insurance acceptable to Owner shall be filed with Owner prior to commencement of the work. These Certificates shall contain a provision that coverage afforded under the policies will not be canceled unless at least fifteen (15) days prior written notice has been given to Owner and Construction Manager.

3. Contractor shall procure and maintain, at Contractor's own expense, during the life of the Contract, liability insurance as hereinafter specified.

    3.1 Contractor's General Public Liability and Property Damage insurance including vehicle coverage issued to Contractor and protecting Contractor from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations under the Contract Documents, whether such operations be by Contractor or by any Subcontractor

under Contractor or anyone directly or indirectly employed by Contractor or by a Subcontractor under Contractor. Insurance shall be written with a limit of liability of not less than $200,000 for all damages arising out of bodily injury, including death, at any time resulting there from, sustained by any one person in any one accident; and a limit of liability of not less than $500,000 for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than $100,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than $200,000 for any such damage sustained by two or more persons in any one accident. Contractor's insurance policy shall name Owner and Consultant as insured under this policy.

Contractor shall either (1) require each Subcontractor to procure and maintain, during the term of the Subcontract, Subcontractor Liability and Property Damage Insurance of the type and in the amounts specified in the preceding paragraph, or (2) provide coverage for the activities of such Subcontractor under the Contractor's own policy.

3.2 Contractor shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the Project to the full insurable value thereof for the benefit of Owner, Contractor and Subcontractor as their interest may appear. This provision shall in no way release Contractor or Contractor's Surety from obligations under the Contract Documents to fully complete the Project.

4. Contractor shall procure and maintain, at Contractor's own expense, during the life of the Contract, in accordance with the provisions of the laws of the state in which the work is performed, Workman's Compensation Insurance, including occupational disease provisions, for all of Contractor's employees at the site of the project and in case any work is sublet, Contractor shall require such Subcontractor similarly to provide Workman's Compensation Insurance, including occupational disease provision for all of the latter's employees unless such employees are covered by the protection afforded by Contractor. In case any class of employees engaged in hazardous work under this Contract at the site of the Project is not protected under Workman's Compensation statute, Contractor shall provide and shall cause each Subcontractor to provide adequate and suitable insurance for the protection of Contractor's employees not otherwise protected.

5. Contractor shall secure, if applicable, "All Risk" type Builder's Risk Insurance for work to be performed. Unless specifically authorized by Owner, the amount of such insurance shall not be less than the contract price totaled in the bid. The policy shall cover not less than the losses due to fire, explosion, hail, lightening, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the contract time and until the work is accepted by Owner. The policy shall name as the insured Contractor, Consultant and Owner.

6. Contractor shall provide a Builders Risk All Risk insurance policy for the full replacement

value of all Project work including the value of all onsite Owner-furnished equipment and/or materials associated with Consultant's services. Such policy shall include coverage for loss due to defects in materials and workmanship and errors in design and will provide a waiver of subrogation as to Consultant and Owner, and their respective officers, employees, agents, affiliates, and subcontractors.

GC-56. CONTRACT SECURITY:

1. Contractor shall, within ten (10) days after the receipt of the Notice of Award, furnish Owner with a Performance Bond and a Payment Bond in penal sums equal to the amount of the contract price, conditioned upon the performance by Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents and upon the prompt payment by Contractor to all persons supplying labor and materials in the prosecution of the work provided by the Contract Documents. Such bonds shall be executed by Contractor and a corporate bonding company licensed to transact business in the state in which the work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these bonds shall be borne by Contractor. If at any time a Surety on any such bond is declared a bankrupt or loses its right to do business in the state in which the work is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, Contractor shall within ten (10) days after notice from Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other Surety or Sureties as may be satisfactory to Owner.

   The premiums on such bonds shall be paid by Contractor. No further payments shall be deemed due nor shall be made until the new Surety or Sureties shall have furnished an acceptable bond to Owner.

GC-57. ASSIGNMENTS:

1. Neither Contractor nor Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or its right, title, or interest therein, or its obligations thereunder, without written consent of the other party.

GC-58. INDEMNIFICATION:

1. Contractor shall indemnify and hold harmless Owner and Consultant and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of Contractor and Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

2. In any and all claims against Owner or Consultant or any of their agents or employees, by an employee of Contractor, Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any Subcontractor under Workman's Compensation acts, disability benefit acts or other employee benefits acts.

3. The obligation of Contractor under this paragraph shall not extend to the liability of Consultant, its agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, design, or specifications.

GC-59. SEPARATE CONTRACTS:

1. Owner reserves the right to let other contracts in connection with this Project. Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate Contractor's work with theirs. If the proper execution or results of any part of Contractor's work depends upon the work of any other Contractor, Contractor shall inspect and promptly report to Consultant any defects in such work that render it unsuitable for such proper execution and results.

2. The Owner may perform additional work related to the Project directly or may enter into separate contracts containing provisions similar to these. The Contractor shall afford other Contractors who are parties to such contracts (or the Owner, if performing the additional work directly) reasonable opportunity for the introduction and storage of materials and equipment and for the execution of their work, and shall properly connect and coordinate the Contractor's Work with such work.

3. If the performance of additional work by other Contractors or Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to Contractor prior to starting any such additional work. If Contractor believes that the performance of such additional work by Owner or others involves Contractor in additional expense or entitles Contractor to an extension of the contract time, Contractor may make a claim therefor as provided in Sections GC-13 and GC-14.

GC-60. SUBCONTRACTING:

1. Contractor may utilize the services of specialty Subcontractors on those parts of the work which, under normal contracting practices, are performed by specialty Subcontractors.

2. Contractor shall not award work to Subcontractor(s), in excess of fifty (50%) percent of

the Contract Price, without prior written approval of Owner.

3. Contractor shall be fully responsible to Owner for the acts and omissions of Contractor's Subcontractors, and of persons either directly or indirectly employed by them, as Contractor is for the acts and omissions of persons directly employed by Contractor.

4. Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind the Subcontractors to Contractor by the terms of the Contract Documents insofar as applicable to the work of Subcontractors and to give Contractor the same power as regards terminating any subcontract that Owner may exercise over Contractor under any provision of the Contract Documents.

5. Nothing contained in this Contract shall create any contractual relation between any Subcontractor and Owner.

GC-61. CONSULTANT'S AUTHORITY:

1. Consultant shall act as Owner's representative during the construction period. Consultant shall decide questions which may arise as to quality and acceptability of materials furnished and work performed. Consultant shall interpret the intent of the Contract Documents in a fair and unbiased manner. Consultant will make visits to the site and determine if the work is proceeding in accordance with the Contract Documents.

2. Contractor shall be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship, and execution of the work. Inspections may be made at the factory or fabrication plant or the source of material supply.

3. Consultant will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

4. Consultant shall promptly make decisions relative to interpretation of the Contract Documents.

GC-62. GUARANTEE:

1. Contractor shall guarantee all materials and equipment furnished and work performed for a period of eighteen (18) months from the date of substantial completion. Contractor warrants and guarantees for a period of eighteen (18) months from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials or workmanship and Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. Owner will give notice of observed defects with reasonable promptness. In the event that Contractor should fail to make such repairs, adjustments or other work that may be necessary by such defects, Owner may

do so and charge Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect though the guarantee period.

GC-63. TAXES:

1. Contractor shall pay all sales, consumer, use and other similar taxes required by the law of the place where the work is performed.

GC-64. WORK ADJACENT TO RAILWAY OR OTHER PROPERTY:

1. Whenever the work embraced in this Contract is near the tracks, structures or buildings of Owner or of other railways, persons, or property, the work shall be so conducted as not to interfere with the movement of trains or other operations of the railway, or, if in any case such interference be necessary, Contractor shall not proceed until Contractor has first obtained specific authority and directions therefore from the proper designated officer of Owner and has the approval of Consultant.

GC-65. ORDER AND DISCIPLINE:

1. Contractor shall at all times enforce strict discipline and good order among Contractor's employees and any employee of Contractor who shall appear to be incompetent, disorderly or intemperate or in any other way disqualified for or unfaithful to the work entrusted to that employee, shall be discharged immediately on the request of Consultant and they shall not again be employed on the work without Consultant's written consent.

GC-66. TRAFFIC CONTROL, WARNING DEVICES AND SIGNS:

1. Contractor shall furnish, erect, paint and maintain warning devices when construction is on or near public streets for the protection of vehicular and pedestrian traffic. Such devices will be in accordance with the Georgia Manual on Uniform Traffic Control Devices for Street and Highways, "Traffic Control for Highway Construction and Maintenance Operations," latest edition.

2. A 20" x 30" sign, mounted on a solid post, 8 feet above the ground, indicating the name and a 24-hour phone number of Contractor in 4" letters, shall be erected at prominent locations on the construction site as directed by Consultant. Contractor may remove the sign following the maintenance period.

GC-67. SPECIAL RESTRICTIONS:

1. No work shall be allowed after the hours of darkness or on Sunday without permission of Owner.

GC-68. AS-BUILT DRAWINGS:

Contractor shall furnish a complete, legible set of "as-built" plans, prepared, and certified by a qualified Georgia Licensed Professional Land Surveyor (PLS), to Consultant seven (7) days prior to the date of the Final Inspection. The As-Built plans shall include all above, at, and underground improvements and utility work, including storm sewer, traffic control and operational items, and fiber. Consultant or Consultant's designee shall review the submitted as-built plans for accuracy, legibility, completeness, and conformity with approved construction plans. Upon approval of submitted as-built, three (3) hard copies and one electronic (CD- in GA State plan coordinate) copy shall be submitted to Owner. There shall be no separate payment unless otherwise shown.

GC-69. CONTRACTOR NOT TO HIRE EMPLOYEES OF OWNER:

Contractor shall not employ or hire any of the employees of Owner.

GC-70. DRAWINGS:

1. Owner will furnish to Contractor, free of charge, up to two (2) sets of direct black line prints together with a like number of complete bound specifications for construction purposes. Location of all primary features of the work included in the Contract are indicated on the Contract Drawings.

GC-71. FIELD OFFICE FACILITIES:

1. Owner may require Contractor to provide field office depending on project location, size, and type of work.

2. Contractor shall provide, at a point convenient to the work, suitable office facilities for housing records, plans and contract documents. A telephone and Fax shall be provided at Contractor's office for expediting the work and be made available for the use of Consultant. A complete and up-to-date set of the plans and specifications shall be available at the field office at all times that the work is in progress.

GC-72. RIGHTS-OF-WAY AND EASEMENTS:

1. Owner will furnish all land and rights-of-way necessary for the carrying out of this contract and the completion of the work herein contemplated and will use due diligence in acquiring said land and rights-of-way as speedily as possible. But it is possible that all land and rights-of-way may not be obtained as herein contemplated before construction begins, in which event Contractor shall begin Contractor's work upon such land and rights-of-way as Owner may have previously acquired and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining lands and rights-of-way. Should Owner be prevented or enjoined from proceeding with the work or from

authorizing its prosecution, either before the commencement, by reason of any litigation or by reason of its inability to procure any lands or rights-of-way for the said work, Contractor shall not be entitled to make or assert any claim for damage by reason of said delay or to withdraw from the contract except by consent of Owner; but time for completion of the work will be extended to compensate for the time lost by such delay; such determination to be set forth in writing and approved by Owner.

2. Contractor shall not perform any work outside the limits of the right-of-way or easements. In addition, no equipment or material shall be placed outside these areas without written permission of both the property owner and Consultant. In the event that Contractor elects to utilize private property for any purpose connected with the project, such as, but not limited to, staging areas, equipment and/or material storage or simply as a convenience, Contractor shall submit a written agreement to Consultant containing vital information such as limits of both area and time the property is to be utilized and a description of the intended use. The agreement must be signed by both the property owner and Contractor and will be reviewed and recorded by Consultant. Such agreements must be submitted prior to Contractor's use of the property.

   All buildings located on newly acquired R/W and/or easements shall be relocated by Contractor. Such buildings on existing R/W and/or easements shall be removed by Owner or will become the property of Contractor.

3. Owner will furnish all land and rights-of-way necessary for carrying out and for the completion of the work to be performed pursuant to the Contract Documents. If all land and rights-of-way are not obtained prior to the issuing of the Notice to Proceed, Contractor shall begin work upon lands and rights-of-way that have been acquired.

4. Owner shall provide to Contractor information which delineates and describes the lands owned and rights-of-way acquired.

5. Contractor shall provide at Contractor's own expense and without liability to Owner any additional land and access thereto that Contractor may desire for temporary construction facilities, or for storage of materials.

GC-73. ESTIMATE OF QUANTITIES:

1. The estimated quantities of work to be done and materials to be furnished under this contract if shown in any of the documents including the bid are given only for use in comparing bids and to indicate approximately the total amount of the contract and the right is especially reserved except as herein otherwise specifically limited to increase or diminish them as may be deemed reasonably necessary or desirable by Owner to complete the work contemplated by this contract and such increase or diminution shall in no way vitiate this contract nor shall any such increase or diminution give cause for claims or liability for damages.

GC-74. EXISTING STRUCTURES AND UTILITIES:

1. The existence and location of structures and underground utilities indicated on the plans are not guaranteed and shall be investigated and verified in the field by Contractor before starting work. Contractor shall be held responsible for any damage to and for maintenance and protection of existing utilities and structures.

GC-75. CONTRACTOR'S BREAKDOWN OF LUMP SUM PAYMENT ITEMS:

1. Contractor shall, immediately after the contract has been awarded, submit to Consultant for Consultant's approval, a breakdown showing estimates of all costs apportioned to the major elements of equipment, material and labor comprising the total work included under any of the lump sum items shown in the proposal. These estimates as approved will serve as the basis for estimating of payments due on all progress estimates.

GC-76. PRIOR USE BY OWNER:

1. Prior to completion of the work, Owner may take over the operation and/or use of the uncompleted project or portions thereof. Such prior use of the facilities by Owner shall not be deemed as acceptance of any work or relieve Contractor from any of the requirements of the Contract Documents.

GC-77. CLEANING UP:

1. Contractor shall keep the premises free from the accumulation of waste material and rubbish and upon completion of the work, prior to final acceptance of the completed project by Owner, Contractor shall remove from the premises all rubbish, surplus materials, implements, tools, etc., and leave the Work in a clean condition, satisfactory to Consultant.

GC-78. SALVAGE MATERIALS/EXCESS MATERIALS:

All salvageable materials, such as drainage pipe, which require removing but not used on this project, are to be removed from the Right-of-Way, as directed by Consultant, and recycled or properly disposed of per applicable local and state regulations. Augusta Environmental Services reserves the right to request a copy of disposal documents for these materials. Granite curb and any other material identified by Consultant shall be saved and stored at location determined by Owner.

GC-79. MAINTENANCE OF TRAFFIC:

1. In any work within the public right-of-way, Contractor shall provide adequate warning and protection for pedestrian and vehicular traffic from any hazard arising out of Contractor's operations and will be held responsible for any damage caused by negligence

on his part or by the improper placing of or failure to display danger signs and road lanterns. All traffic lanes, sidewalks and driveways will be kept open and clear at all times except as provided below. Contractor shall not block traffic on any street more than 30 minutes or without written permission from such agency. Before leaving the work each night, it shall be placed in such condition as to cause the least possible hazard therefrom. Should Contractor fail to comply with the provisions of this paragraph, Owner may, with Owner's own forces, provide signs, flagmen, barricades and/or passageways or clear the pavement and deduct the cost thereof from sums due to Contractor.

Contractor shall provide construction signs in accordance with requirements of "Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways"; current edition with added supplements and provisions.

The attention of the Contactor is specifically directed to Subsection 107.09 of the Supplemental Specification- "Barricades and Danger, Warning, and Detour Signs". "Contractor shall furnish, install, and maintain all necessary and required barricades, signs, and other traffic control devices in accordance with these specifications, Project Plans, Special Provisions, and MUTCD, and Take all necessary precautions for the protection of the work and safety of the public."

All temporary signs, barricades, flashing lights, striping and any other traffic control devices required during construction of this project shall meet all requirements of the MUTCD current addition, as directed by Consultant and be furnished by Contractor with payment in accordance with Section 150.

Contractor shall so conduct his operations that there will be a minimum of interference with, or interruption of, traffic on the travelway. This applies to initial installation and the continuing maintenance and operation of the facility. At least one-lane, two-way, traffic shall be maintained at all times unless approved otherwise by Consultant. As a minimum, Contractor must comply with MUTCD, current edition and Georgia Standard 9102.

Contractor shall provide all temporary traffic control devices needed to safely direct traffic through the construction area.

All temporary traffic control devices are to be placed in accordance with Georgia Department of Transportation Standards and Specifications.

GC-80. FLAGGING:

Flaggers shall be provided as required to handle traffic, as specified in the Plans or Special Provisions, and as required by Consultant.

All **Flaggers** shall meet the requirement of part 6F of the MUTCD Current Edition and must have received training and a certificate upon completion of the training from a

Department approved training program. Failure to provide certified ***Flaggers*** as required above shall be reason for Consultant suspending work involving the *Flagger*(s) until Contractor provides the certified ***Flagger***(s).

Flaggers shall wear a fluorescent orange cap or hat, and a fluorescent orange vest, shirt, or jacket, and shall use a *Stop*/slow paddle meeting the requirements of Section 6F-2 of the MUTCD Current Edition for controlling traffic. The ***Stop***/slow paddle shall have a shaft length of seven (7) feet minimum. In addition to the ***stop***/slow paddle, a *Flagger* may use a 24-inch square red/orange flag as an additional device to attract attention. For night work, the vest shall have reflectorized stripes on front and back.

Signs for ***Flagger*** traffic control shall be placed in advance of the flagging operation in accordance with the MUTCD Current Edition. In addition to the signs required by the MUTCD, signs at regular intervals, warning of the presence of the ***Flagger*** shall be placed beyond the point where traffic can reasonably be expected to stop under the most severe conditions for that day's work.

GC-81. TRAFFIC DETOURS:

Where detours are required and in accordance with Section 150 of the Standard Specifications and any Supplements thereto, Contractor shall file for approval a detour plan of operation for this project. This plan shall include details of staging and rerouting of traffic including estimated length of time for use of the detours.

Contractor shall so conduct his operations that there will be a minimum of interference with, or interruption of, traffic upon and along the roadway. This applies to the initial installation and the continuing maintenance and operation of the facility. At least one-lane, two-way traffic shall be maintained at all times unless approved otherwise by Consultant. As a minimum, Contractor must comply with the Manual on Uniform Traffic Control Devices, current edition, and Georgia Standard 9102.

GC-82. MAINTENANCE OF ACCESS:

1. Contractor shall be required to maintain access to business establishments during all time they are open for business, to churches, schools, and other institutions during the time they are open and to all residential and other occupied buildings or facilities at all times. Bridges across open trenches and work areas will be required to provide vehicular and pedestrian access. Bridges with handrail protection will be required for crosswalks at street intersections. It is recognized that it will be necessary to remove bridges and to block cross traffic while equipment is in operation. Contractor shall, however, plan and pursue his operations so as to minimize the time that direct entrance is blocked.

GC-83. SPECIAL EVENTS:

When Special Events occur, such as the Augusta Masters Golf Tournament, all work shall be safe up, shut down and maintained until Consultant approves the resumption of work. No project is exempt without the expressed approval of Consultant. If these type work stoppages impose a hardship, contract time wise, consideration will be given to extending the contract time in an amount commensurate with the delay caused by such work stoppages provided Contractor has otherwise pursued the work diligently.

GC-84. EROSION CONTROL AND RESTORATION OF PROPERTY:

1. Contractor shall be required to schedule his work and perform operations in such a manner that siltation and bank erosion will be minimized during all phases of construction. Any areas disturbed during the course of construction shall be restored to a condition equal or better than the original condition. Contractor shall be required to submit a Soil Erosion, Sedimentation and Stormwater Pollution Control plan that is in compliance with the work site erosion control and NPDES plan, per the Georgia Department of Transportation and Georgia Environmental Protection Erosion, Sediment and Stormwater Pollution Control requirements.

2. Contractor shall be responsible for NPDES monitoring and documentation to keep the project in compliance with applicable NPDES permit requirements. Contractor shall be responsible to bring project incompliance and pay penalty imposed on the project due to noncompliance to NPES permit and other permits.

3. The cost of this work shall be included in the cost of Lump Sum Construction unless Shown as a Separate pay item.

GC-85. UTILITIES:

All utility facilities except those owned by Augusta Utilities Department which are in conflict with construction, not covered as specified items in the detailed estimate, are to be removed and relocated to clear construction by the respective owners with the exception of Augusta Utilities and Augusta Traffic Engineering unless added later to the contract as a supplemental item. All "above ground" utility structures will be located as near as possible to the right-of-way line.

Contractor shall not be paid for any delays or extra expense caused by utility facilities obstructions, or any other items not being removed or relocated to clear construction in advance of his work.

All known utility facilities are shown schematically on the plans, and not necessarily accurate in location as to plan or elevation. Utility facilities such as service lines or unknown facilities not shown on the plans will not relieve Contractor of his responsibility

under this requirement except as noted below. "Existing Utility Facilities" means any utility facility that exists on the highway project in its original, relocated or newly installed position. Other than service lines from street mains to the abutting property Contractor shall not be held responsible for the cost of repairs to damaged underground utility facilities when such facilities are not shown on the plans and their existence is unknown to Contractor prior to the damage occurring, providing Consultant determines Contractor has otherwise fully complied with the Specifications.

Contractor shall use the one-call center telephone number 1-800-282-7411 for the purposes of coordinating the marking of underground utilities.

Contractor's attention is directed to the probability of encountering private utility installations consisting of sanitary sewers, water, sprinkler systems, ornamental light systems, gas, and underground telephone cables that either are obstructions to the execution of the work and need to be moved out of the way or, if not, must be properly protected during construction. No separate payment will be made for this work. Public utilities of this nature except Augusta Utilities and Augusta Traffic Engineering will be handled by the utility owner.

THE FOLLOWING UTILITY COMPANIES SHALL BE NOTIFIED BEFORE WORK BEGINS:

Southern Company (Gas) 10 Peachtree Place, NE Atlanta, GA. 30309 Phone: (470) 316-6836 **Attn: Ginny Mauldin** e-mail: ***vmauldin@southernco.com***	Augusta Utilities 452 Walker Street, Suite 200 Augusta, Georgia 30901 Phone: (706) 821-1851 Fax: (706) 821-1859 **Attn: Wes Bynes** e-mail: **wbyne@augustaga.gov**
AT&T 3841 Wrightsboro Road Augusta, Georgia 30909 Phone: (706) 228 -5203/ (706) 210-8237 Fax: (706) 855-1917 **Attn: Jeff Surrency** e-mail: ***Ws1449@att.com***	Georgia Power 642 Woodland Road Waynesboro, Ga. 30830 Cell Phone: (706) 589-0657 **Attn: Jason Eddie** e-mail***: jeddie@southernco.com***
WOW of Augusta 3714 Wheeler Road Augusta, Georgia 30909 Phone: (706) 832-7648 **Attn: Joseph Narvarte** e-mail: **joseph.narvarte@wowinc.com**	Jefferson Energy Cooperative P.O. Box 457 Wrens, Georgia 30833 Phone: (706) 833-8335 **Attn: Craig Pardue** e-mail: ***cpardue@jec.com***
Comcast Communications P.O. Box 3579 Augusta, Georgia 30904 Phone: (706) 840-8724 Fax: (706) 733 – 6942 **Attn: Duane Bohler** e-mail: ***Duane_Bohler@comcast.com***	

GC-86. UTILITY ACCOMMODATION POLICY:

In so far as possible, work shall be scheduled so that open excavations will not be left overnight. Where trenches, pits or other excavations are within the clear roadside areas and cannot be backfilled before leaving the job site, they shall be covered by timbers or metal plates and protected by reflectorized and/or lighted barricades as appropriate and as directed by Consultant. Barricades sufficient to prevent a person from falling into an excavated or work area must be erected in areas where these conditions exist.

GC-87. BYPASSING SEWAGE:

1. Contractor shall be required to schedule and coordinate construction sequences and to use temporary construction and other approved methods which will minimize the bypassing of sewage during construction of the sewer facilities. The diversion of sewerage to open ditches or streams will not be permitted.

GC-88. SAFETY AND HEALTH REGULATIONS:

1. Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational and Health Act of 1970 (PL31-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL91-54).

GC -89. WARRANTY:

Unless otherwise specified, all contract work is subject to an 18-month warranty. The 18-month warranty is hereby modified to include the following: Any repairs, corrections or modifications performed within the last six months of the original 18-month warranty shall have the original 18-month warranty extended 180 calendar days past the date of such repairs, corrections, or modifications.

GC-90. PRECONSTRUCTION CONFERENCE:

1. A preconstruction conference shall be held at an acceptable time to Owner and Contractor prior to the "Notice to Proceed" to coordinate the work and satisfy all requirements of the Contract Documents.

SPECIAL CONDITIONS

ITB #26-182

Boykin Road Park Improvements

INDEX TO SPECIAL CONDITIONS

SECTION

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SC-06	Record Drawings
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SC-19	Contract Termination
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SC-22	Encouragement of Small Business Participation

SC-01 Bonds. Contractor shall include in the lump sum payment for Lump Sum Construction the cost of Contractor's performance and payment bonds.

SC-02 Project sign. Contractor shall furnish and install two (2) project signs on the construction site. Each sign shall prominently display the name of the Project, Owner, Consultant, Contractor, and a 24-hour telephone number for Contractor in four (4)-inch letters. The sign shall be constructed and erected on wood posts in a substantial manner 8 feet above the ground. The full-size stencil shall be approved along with colors before fabrication. Contractor shall include the cost of the project signs in the lump sum bid item for Lump Sum Construction.

SC-03 Protection of the environment. Contractor shall carefully schedule Contractor's work so that a minimum amount of exposed earth will be subject to erosion by rainfall or wind, and Contractor shall provide means satisfactory to the Consultant to minimize the transportation of silt and other deleterious material into the streambeds or watercourses adjacent to the project. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in conformance with printed instructions.

SC-04 Temporary toilets. Contractor shall provide temporary toilet facilities at the site for personnel engaged in the Work. Such facilities shall be adequate for the number of workers present and shall be maintained in a clean and sanitary condition. All personnel shall be required to use only these facilities. Upon completion of the Work, the Contractor shall remove all temporary facilities and restore the premises to the condition required by the Contract.

SC-05 Owner acceptance. Notwithstanding any other obligations of Contractor, Contractor shall complete the work to the full satisfaction of Owner. This provision shall not relieve Contractor of Contractor's responsibilities for guarantees.

SC-06 Record drawings. Contractor shall maintain in Contractor's office one complete set of drawings (including any supplemental sketches) pertaining to the project upon which, at the end of each day's work, any deviations from the construction lines shown thereon and all changes ordered by the Engineer will be shown accurately in red pencil. If necessary, supplemental drawings will be made to show details of deviations or changes, and these will be kept with the marked set. The drawings will be available to the Engineer for inspection during construction. Satisfactory progress toward the preparation of the record drawings shall be a condition of approval of monthly payment estimates. At the completion of construction, prior to submitting Contractor's estimate for final payment, and as a condition for payment thereof, three copies of the record drawings, satisfactorily completed, will be transmitted to the Engineer.

SC-07 Basis of payment. As explained in the section "Instructions to Bidders," payment for all items of construction will be made at the total of the actual number of units installed at the unit prices stated in the Bid Schedule to the Proposal. The partial payments described in the Agreement will be made based on the actual number of units of work completed during the month and in-place at the unit prices stated in the Bid Schedule.

SC-08 Existing structures. Where sidewalks, street signs, private signs, walls, fences, etc., are removed in accomplishing the work, each and every item will be replaced in the same or better manner or condition than that in which it was before construction began. Contractor shall protect and hold harmless Owner from any suit, action, or dispute whatever arising from Contractor's work adjacent to private property.

SC-09 Salvage material. All existing installations to be removed, including but not limited to masonry and concrete rubble, asphalt, pipe, etc. will be disposed of at an approved location by Contractor.

SC-10 Referenced specifications. Where specifications or standards of trade organizations and other groups are referenced in these specifications, they are made as much a part of these specifications as if the entire standard or specification were reprinted herein. The inclusion of the latest edition or revision of the referenced specification or standard is intended.

SC-11 Traffic control. Traffic control shall conform to the Manual on Uniform Traffic Control Devices (MUTCD) of the Federal Highway Administration, latest edition. Contractor shall give prior written notification to and shall obtain the approval of the Augusta Fire Department, Richmond County Sheriff's Office, Emergency Medical Services, and the Augusta Traffic Engineering Division of any street closures.

SC-12 Compliance with laws, codes, and regulations, etc. Supplementing the provision of the GENERAL CONDITIONS, the successful bidder, by signing the Contract, acknowledges the following; however, this is not to be construed as all-inclusive or being these only:

1. Underground Gas Pipe Law:
   Contractor signing the Contract acknowledges that Contractor is fully aware of the contents and requirements of "Georgia Laws 1969, Pages 50 and the following, and any amendments and regulations pursuant thereto", and Contractor shall comply therewith.

2. High Voltage Act:
   Contractor by signing the Contract acknowledges that Contractor is fully aware of the contents and requirements of "Act No. 525, Georgia Law

1960, and any amendments thereto, and Rules and Regulations of the Commissioner of Labor pursuant thereto" (the preceding requirements within quotation marks being hereinafter referred to as the "high voltage act"), and Contractor shall comply therewith. The signing of Contract shall also confirm on behalf of Contractor that Contractor:

A. has visited the premises and has taken into consideration the location of all electrical power lines on and adjacent to all areas onto which the Contract documents require to permit the Contract either to work, to store materials, or to stage operations, and

B. that Contractor has obtained from Owner of the aforesaid electric power lines advice in writing as to the amount of voltage carried by the aforesaid lines.

Contractor agrees that Contractor is the "person or persons responsible for the work to be done" as referred to in the high voltage act and that accordingly Contractor is solely "responsible for the completion of the safety measures which are required by Section 3 of the high voltage act before proceeding with any work." Contractor agrees that prior to the completion of precautionary measures required by the high voltage act Contractor shall neither bring nor permit the bringing of any equipment onto the site (or onto any area or areas onto which the Contract documents require or permit Contractor to work, to store materials, or to stage operations) with which it is possible to come within eight feet of any high voltage line or lines pursuant to operations arising out of performance of the Contract. The foregoing provisions apply to power lines located (a) on the site and (b) on any area or areas onto which the Contract documents require or permit Contractor either to work, to store materials, or to stage operations, or (c) within working distance for equipment or materials, being used on (a) and (b) above. These provisions of the Contract do not limit or reduce the duty of Contractor otherwise owed to Owner, to other parties, or to both. Contractor agrees that the foregoing provisions supplement provisions of the General Conditions. Contractor agrees and acknowledges that any failure on Contractor's part to adhere to the high voltage act shall not only be a violation of law but shall also be a breach of Contract and specific violation of the provisions of the General Conditions which pertains to safety precautions.

3. <u>Occupational Safety & Health Act</u>:

Contractor by signing the Contract acknowledges that Contractor is fully aware of the provisions of the Williams-Steiger Occupational Safety and Health Act of 1970 and Contractor shall comply therewith.

SC-13 Site access. In order to minimize damage to existing paving and landscaping, access to the site for Contractor's personnel and equipment will be restricted to the routes designated by Owner. Contractor shall be required to use only these routes unless prior written approval is given by Owner.

SC-14 Equivalent materials: Notwithstanding any provision of the general conditions, there shall be no substitution of materials that are not determined to be equivalent to those indicated or required in the Contract documents without an amendment to the Contract.

SC-15 After hours inspection: If Contractor opts to work before or after normal working hours, 8 a.m. to 5 p.m., Monday through Friday, or on Augusta, Georgia Legal Holidays, then Contractor must pay for the cost of inspection by the City of Augusta, Georgia and follow all necessary procedures listed in "Section 15, Right-of-way Encroachment Guidelines, Part E, Outside of Normal Working Hours," of the *Augusta, Georgia Planning Commission Development Documents* dated September 1999. If inspection services are required outside normal business hours, Owner must be notified in advance.

SC-16 Suspension of the work, termination and delay. To the extent that it does not alter the scope of this Contract, Owner reserves the unilateral right to order, without any cause, a temporary stopping of the work or delaying of the work to be performed by Contractor under this Contract. Owner will not be held liable for compensation to Contractor for an extension of Contract time or increase in Contract price, or both, directly attributable to this action of Owner.

SC-17 Estimate of quantities. The estimated quantities of work to be done and materials to be furnished under this Contract if shown in any of the documents including the bid are given only for use in comparing bids and to indicate approximately the total amount of the Contract and the right is especially reserved except as herein otherwise specifically limited to increase or diminish them as may be deemed reasonably necessary or desirable by Augusta, Georgia to complete the work contemplated by this Contract and such increase or diminution shall in no way vitiate this Contract nor shall any such increase or diminution give cause for claims or liability for damages.

SC-18 Specified excuses for delay or non-performance. Contractor is not responsible for delay in performance caused by acts of nature, strikes, lockouts, accidents, or other events beyond the control of Contractor. In any such event, the Contract Price and Contract Time shall be equitably adjusted.

SC-19 Contract termination.

1. Contractor shall promptly remove from the premises all work rejected by the Consultant for failure to comply with the Contract Documents, whether

incorporated in the construction or not, and Contractor shall promptly replace and re-execute the work in accordance with the Contract Documents and without expense to Owner and shall bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

2. All removal and replacement work shall be done at Contractor's expense. If Contractor does not take action to remove such rejected work within ten (10) days after receipt of written notice, Owner may remove such work and store the materials at the expense of Contractor.

3. Any omissions or failure on the part of the Consultant to disapprove or reject any work or material shall not be construed to be an acceptance of any defective work or material. Contractor shall remove, at Contractor's own expense and shall rebuild and replace same without extra charge and in default thereof the same may be done by Owner at Contractor's expense or in case the Consultant shall not consider the defect of sufficient importance to require Contractor to rebuild or replace any imperfect work or material, the Consultant shall have the power and is hereby authorized to make an equitable deduction from the stipulated price.

SC-20 Site conditions: Site conditions differing from those indicated in the Contract, or ordinarily encountered, except that a differing site conditions clause need not be included in a Contract:

(i) When the Contract is negotiated,
(ii) When Contractor provides the site or design, or
(iii) When the parties have otherwise agreed with respect to the risk of differing site conditions

SC-21 Federal Nondiscrimination and Equal Opportunity Compliance. This Project is funded in whole or in part with funds provided to the State of Georgia under the American Rescue Plan Act (ARPA) State Fiscal Recovery Fund and awarded to Owner through the Improving Neighborhood Outcomes in Disproportionately Impacted Communities (INODIC) Grant Program administered by the Georgia Office of Planning and Budget (OPB).

The Contractor agrees to comply with all applicable federal, state, and local nondiscrimination and equal opportunity laws, regulations, and executive orders, including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq.)
- Title VII of the Civil Rights Act of 1964, as amended
- Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794)
- Americans with Disabilities Act of 1990 (ADA), as amended
- Age Discrimination Act of 1975 (42 U.S.C. § 6101 et seq.)
- Executive Order 11246, as amended

- 2 CFR Part 200, Subpart D, and applicable U.S. Department of the Treasury ARPA regulations and guidance

The Contractor shall not discriminate against any employee, applicant for employment, subcontractor, or program beneficiary on the basis of race, color, national origin, sex, sexual orientation, gender identity, age, disability, religion, or any other protected classification under applicable law.

This provision shall be included in all subcontracts, and the Contractor shall make all records available for inspection, audit, or monitoring as required by the grant agreement and applicable laws and regulations.

SC-22 Encouragement of Small Business Participation. Owner encourages Contractors to provide meaningful opportunities for small, local, and economically disadvantaged businesses to participate in this ARPA-funded project. To support broad and open competition, Contractors are encouraged to:

- Actively consider small businesses when procuring goods and services;
- Publicize contracting and subcontracting opportunities in a manner that is open, transparent, and accessible;
- Where practicable, structure work in ways that allow small businesses to compete, including dividing work into smaller tasks or scopes; and
- Engage in early communication and outreach to inform small businesses of upcoming opportunities.

All such efforts shall be conducted in a race- and gender-neutral manner and in compliance with all applicable federal, state, and local nondiscrimination and equal opportunity requirements. Nothing in this provision creates a preference, quota, set-aside, or participation goal, and no minimum participation requirements apply to this solicitation.

PROJECT MANUAL

AUGUSTA RECREATION & PARKS DEPARTMENT
BOYKIN ROAD PARK IMPROVEMENTS
BID SET

July 17, 2026

CHA PROJECT #: 093489

Prepared for:

AUGUSTA RECREATION & PARKS DEPARTMENT
AUGUSTA, GEORGIA

Prepared by:

CHA Consulting, Inc.
317 Tattnall Street
Savannah, Georgia 31401
(912) 721-6999

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete Subcontractor.
      e. Special concrete finish Subcontractor.
   2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor retarders.
   12. Semirigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:
   1. Aggregates.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
   1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301 (ACI 301M).
   2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
1. Portland Cement: ASTM C 150/C 150M, Type I/II gray.
2. Fly Ash: ASTM C 618, Class F.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Water: ASTM C 94/C 94M and potable.

2.6 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless, that penetrates, hardens, and densifies concrete surfaces.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Curecrete Distribution Inc.; Ashford Formula.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Husky Yellow Guard 15-mil.
      b. Meadows, W. R. Inc.; Perminator 15-mil.
      c. Stego Industries, LLC; Stego Wrap 15-mil Class A.
      d. Americover – 15 mil.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Slag Cement: 50 percent.
   4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
   5. Silica Fume: 10 percent.
   6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and grade slabs: Normal-weight concrete.
   1. Minimum Compressive Strength: As indicated at 28 days.
   2. Maximum W/C Ratio: 0.50.
   3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view.

2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
4. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
5. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
7. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

END OF SECTION

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide unit masonry work, as indicated on Drawings and as specified herein. Include, but do not limit to:
   1. Concrete masonry unit (CMU) work.
   2. Masonry reinforcing and anchors.
   3. Masonry flashings.
   4. All other unit masonry work shown on Drawings or reasonably required to make work of this Section complete in all respects.

1.2 REFERENCES

A. Comply with applicable requirements of following standards. Where these standards conflict with other specified requirements, most restrictive shall govern.
   1. International Masonry Institute (IMI):

Ref. 1	Recommended Practices & Guide Specifications for Cold Weather Masonry Construction

1.3 TESTS

A. Testing and inspection of mortar and masonry materials will be conducted by testing laboratory selected and paid for as described under Division 01, GENERAL REQUIREMENTS.

B. No materials shall be used on work without prior test and written approval of Testing Laboratory. Materials shall be submitted to Testing Laboratory at least three weeks in advance of proposed first use in structure for subjection to basic acceptance tests and determination of basic mixtures.

C. At start of field operations, and periodically during course of work, Testing Laboratory will test materials and mortar and conduct on-job inspections of measuring, mixing, laying, and curing of mortar and masonry materials, including prism tests, in conformance with ASTM C 952 and ASTM E 447 (Method B), to ensure compliance with these specifications and originally approved samples. Number and frequency of tests shall be determined by Testing Laboratory and Architect. Recommendations of Testing Laboratory shall be strictly followed.

D. Prepare seven-day and 28-day prisms for each 5,000 sq. ft. of CMU wall area installed, and deliver to testing laboratory as directed.
   1. Height:thickness ratio for CMU prisms shall be no less than 1.33:1 and no more than 3:1.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for the following:
   1. Show coursing and location of special shapes.
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

3. Control Joint Shop Drawings: Submit shop drawings for locations of control joints in concrete unit masonry work. Copies of the "A" Series Drawings with additional notations are acceptable.

B. Samples: Submit representative samples for each material as follows. Delivered materials shall closely match approved samples.
   1. Split Face & Ground Face CMU: Submit six full size units of each type, size, and color for approval prior to construction of Field Mock-Ups.
   2. Mortar: Submit sample box containing actual mortar samples of full range of mortar colors available. Submit cured mortar samples of each mortar color selected.

C. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
   1. Each type of masonry unit required.
   2. Include size-variation data for masonry, verifying that actual range of sizes falls within specified tolerances.
   3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Each type of masonry unit required. Include size-variation data for units, verifying that actual range of sizes falls within specified tolerances.
      a. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
      b. Each material and grade indicated for reinforcing bars.
      c. Each type and size of joint reinforcement.
      d. Each type and size of anchor, tie, and metal accessory.
      e. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.5 QUALITY ASSURANCE

A. Mockups: Build one (1) mockup to verify selections made and to demonstrate aesthetic effects and set quality standards for materials and execution.

B. Build mockups for typical exterior wall in sizes approximately 72 inches (1800 mm) long by full veneer height by full thickness, including face and backup wythes and accessories.
   1. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.
   2. Include veneer anchors, flashing, cavity drainage material, and weep holes in each mockup.

C. Protect accepted mockups from the elements with weather-resistant membrane.

D. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
   1. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.6 PROJECT CONDITIONS

A. Hot Weather Protection: Use mortar within 1-1/2 hours after mixing. Discard mortar over 1-1/2 hours old and mortar stiffened due to hydration (setting).

B. Cold Weather Protection: Strictly comply with IMI Ref. 1.

C. Protection: Cover walls at end of each days' work. Extend cover 24 in. down sides of walls and hold securely in place.

D. Loading: Do not apply loads until work has set and cured and is ready to accept loading.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered, stored, and handled fully protected from wetting, staining, chipping, and other damage. Store masonry materials on raised timber or platforms, above ground, under weathertight covers or indoors, and kept clean and dry.

B. Deliver and store cement, lime, and other perishable materials in their original containers, plainly marked with brand name and manufacturer's name, indoors or in weathertight sheds.

C. Protect metal accessories and reinforcement from elements. Immediately before placing, remove loose rust, dirt, and other foreign materials.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Provide moisture-controlled, normal weight, load bearing units of Portland cement, water, sand, and gravel. Provide hollow and/or solid configurations as indicated, and conforming to ASTM C 90. Provide concrete masonry units with following characteristics:
   1. Moisture Content: Not more than 35% of total absorption when tested in accordance with ASTM C 140. Maintain moisture content within this limit throughout storage and construction.
   2. Residual Linear Shrinkage: Not more than 0.01% when dried to equilibrium of 50% relative humidity at 73°F. ambient temperature.
   3. Provide block exposed in finished work with uniform light gray color and uniform medium-fine texture. Manufacture units in a single run, uninterrupted except at ends of normal working days, to assure uniformity of color and texture. Moderate "manufacturing range" of variation in color and texture will be permitted, but such variations shall not exceed those shown on approved sample panels.
   4. Size: Provide units 8 in. by 16 in. nominal face size, and of indicated nominal thicknesses.

5. Provide special shapes of each type of block as required to complete work as indicated at no additional cost to Owner. Carefully review Drawings to determine scope and varieties of special block shapes required. Provide lip stretcher block 100% solid.
6. Concrete Masonry Units for Fire-Resistive Construction: Provide concrete block for construction of fire-rated masonry block construction as listed by Underwriters' Laboratories, Inc. of Minimum Equivalent Thickness(es) defined and required by governing code.
7. Faces of units exposed in finished work shall be handled and stored with extreme care to prevent chipping or marring. Chipped or otherwise damaged faces will not be permitted in exposed work.
8. Provide half-blocks, lintel blocks, beam "U" blocks, other special blocks, and required special cutting. Provide jamb blocks, end blocks, control joint blocks, and lintel blocks with exposed ends closed.

2.2 CONCRETE MASONRY UNITS

A. Split Face and Ground Face Units: Provide units where indicated. Provide colors and textures as indicated in the "Material & Color Legend" on the Drawings.
   1. Manufacturers: Johnson Concrete Products; or approved equal
   2. Portland Cement Color: White.
   3. Colored Aggregate: Combination of white and local multi-colored aggregate.
   4. Provide special shapes of each type of block as required to complete work as indicated at no additional cost to Owner. Carefully review Drawings to determine scope and varieties of special block shapes required. Provide lip stretcher block 100% solid.
   5. Weight Classification: Normal weight.

B. Size: Provide units with nominal face dimensions as scheduled or shown on Drawings.

C. Sealer/Graffiti Control:
   1. Prosoco.
   2. Rainguard Pro.
   3. Rheopel; Master Builders.

2.3 MORTAR MATERIALS

A. Portland cement: ASTM C 150, Type I, free from water soluble salts and alkalies. Provide cement which exhibits no efflorescence when tested in conformance with these specifications.

B. Lime: ASTM C 207, hydrated, Type S.

C. Grout Aggregate: Complying with ASTM C 404.

D. Mortar Aggregate: Complying with ASTM C 144, well graded.

E. Mortar Pigment: Natural and synthetic oxides of iron and chrome, compounded for use in mortar. Use only pigments with proven record of performance. Provide products equal to Davis Colors or Solomon Grind-Chem.

F. Water: Clean, potable.

2.4 REINFORCING TIES AND ANCHORS

A. Horizontal Joint Reinforcing and Masonry to Masonry Ties: Provide ladder type, welded wire units fabricated from 3/16 in. ASTM A 82 cold-drawn steel wire, deformed side rods and smooth cross wires spaced 16 in. o.c. maximum. Provide prefabricated corners and tees. Provide one side rod for each concrete masonry shell face. Provide two-piece adjustable eye and pintel type units for concrete masonry composite wall construction. with pintel units welded to truss-type reinforcing. Provide width as recommended by manufacturer for wall which gives minimum of 5/8 in. cover on exterior walls. Provide units factory welded equal to Hohman and Barnard Lox-All Adjustable Eye Wire Truss Type #170. Hot-dip galvanize units after fabrication.

B. Masonry to Concrete Anchors: Furnish 24 gauge hot-dip galvanized steel dovetail slots to General Contractor for installation by concrete trade. Provide hot-dip galvanized flexible dovetail ties equal to Hohman and Barnard #315, sized for dovetail slot.

C. Masonry to Structural Steel Anchors: Provide two-piece, hot-dip galvanized flexible anchors that permit horizontal and vertical movement and that provide secure lateral restraint.

D. Miscellaneous Ties: Provide hot dip galvanized steel straps, bars, rods, and similar items which are fabricated from minimum 16 gage steel sheet or 3/16 in. diameter steel wire.

E. Reinforcing Bars: ASTM A 615, Grade 60, deformed rebars.

F. Galvanizing: Provide hot-dip galvanized, ASTM A 153, Class B, 1.5 oz./ft.^{2} zinc coating on ties, joint reinforcing, anchors, and similar items which extend into exterior wall assemblies.

2.5 FLASHING MATERIALS

A. Through-Wall Flashing: Electrolytically deposited sheet of copper weighing not less than 5 oz. per sq. ft., bonded to two layers of asphalt saturated fiberglass fabric, equal to that produced by Wasco/York Mfg. Co., Sandell Mfg. Co., or Afco Products Co. Flexible polyester reinforcement mat for use at control joints shall be equal to Karnak "Poly-Mat" used with Karnak "AR Elastomeric" mastic.

Note: Sample cuts of delivered materials may be taken by Owner for testing to assure compliance with the specified weight requirements.

B. Membrane Flashing: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products, or approved equal, consisting of 32 mils of self-adhesive rubberized asphalt integrally bonded to 8 mils of cross-laminated, high-density polyethylene film to provide a min. 40 mil thick membrane. Membrane flashing shall be interleaved with disposable silicone-coated release paper until installed. Performance Requirements:

1. Water Vapor Transmission: ASTM E 96, Method B – 2.9 ng/m^{2}sPa (0.05 perms) maximum
2. Water Absorption: ASTM D 570 – Max. 0.1% by weight
3. Puncture Resistance: ASTM E 154 – 178 N (40 lbs.)
4. Tear Resistance:
   a. Initiation – ASTM D 1004 – min. 58 N (13.0 lbs.) M.D.
   b. Propagation – ASTM D 1938 – min. 40 N (9.0 lbs.) M.D.
5. Lap Adhesion at -4°C (25°F): ASTM D 1876 – 880 N/M (5.0 lbs./in.) of width
6. Low Temperature Flexibility – ASTM D 1970 – Unaffected to-43°C (-45°F)
7. Tensile Strength: ASTM D 412, Die C Modified – Min. 5.5 MPa (800 psi)

8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C – Min. 200%.
9. Roll Width: 12 in., 18 in., or 36 in. as required.

C. Elastomeric Membrane Flashing Accessories: Provide manufacturer's standard surface conditioners, primers, preformed corners, end dams, and other related materials as required for proper installation.

2.6 MISCELLANEOUS MATERIALS

A. Bond Breaker: 15 lb. roofing felt complying with ASTM D 226.

B. Control Joint for CMU: Solid rubber strips, Shore A hardness of 60-80 and designed to fit standard control joint concrete masonry units and maintain lateral stability.

C. Masonry Cleaning Materials: Provide one of the following products as applicable for cleaning mortar stains, job dirt, and job stains from masonry work:
1. Cleaning Material for Dark Colored Masonry: Sure Klean 600 Detergent; ProSoCo, Inc., Kansas City, KS 66117.
2. Cleaning Material for Light Colored Masonry: Sure Klean 101 Lime Solvent; ProSoCo, Inc., Kansas City, KS 66117.
3. Cleaning Material for Masonry with Colored Mortar Joints: Sure Klean Vana-Trol; ProSoCo, Inc., Kansas City, KS 66117.

2.7 MORTAR AND GROUT MIXES

A. Mortar: Provide mortar complying with ASTM C 270. Mix using known volume measures. Do not batch by shovel.
1. Provide Type N mortar for masonry above grade and interior and exterior work, except as indicated otherwise.
2. Provide Type M mortar for reinforced and load bearing masonry, and elsewhere as indicated.
3. Provide Type M mortar for masonry below grade and in contact with earth and elsewhere as indicated.

B. Grout: Provide grout complying with ASTM C 476 and with consistency appropriate to conditions so that grout will completely fill spaces intended to receive grout.

C. Do not use admixtures or anti-freeze agents. Do not use masonry cement. Do not use calcium chloride or any compounds or mortar ingredients containing chlorides.
1. To prevent color variations, do not retemper mortar which contains color pigments.

D. Mortar Color: Provide mortar color tas selected by Architect. Do not exceed pigment to mortar ratio by 1:10.

PART 3 - EXECUTION

3.1 MASONRY CONSTRUCTION, GENERAL

A. Masonry work shall be done by skilled masons, fully instructed as to requirements of this specification, and adequately supervised during work.

B. Cold weather masonry shall conform to BIA Ref. 1 and following:

1. Do no masonry work when outdoor temperature is less than 40°F. unless provisions are made to adequately protect materials and finished work from frost by heating materials, enclosing work, and heating enclosed spaces.
2. If masonry work must be done when ambient temperature is freezing or below, all masonry material must be at temperature between 50°F. and 90°F., and mortar, when used, shall have a temperature between 60°F. and 80°F. In addition, all masonry shall be protected from temperatures below 40°F. for at least 48 hours after being laid.

C. Lay masonry plumb, true to line, and with level courses, with straight, clean, uniform joints, and true surfaces, and plumb corners. Maintain vertical alignment of joints as required by bond patterns indicated. Align horizontal joints with tops of openings, as indicated. Lay units in solid partitions to provide same evenness of surface on each side.

D. Adjust each masonry unit in final position while mortar is still soft and plastic. Remove units disturbed after mortar has stiffened and re-lay with fresh mortar.

E. Provide chases, slots, and recesses as required to accommodate work of other trades. Close only after such work has been installed, tested, and approved. As work progresses, set anchors, bolts, frames, and work of other Sections required to be built into masonry. No cutting and patching of completed masonry work will be permitted except as approved by Architect.

F. Do not use installed masonry work to support or in any way receive scaffolding or other temporary supports.

G. Cooperate and coordinate work of this Section with Waterproofing trades. Coordinate work of this Section with installation of flashings by other trades. Apply 6 in. depth of weep baffle material directly above built-in flashings to ensure free weepage. Provide weepholes 16 in. on center horizontally at courses of exterior wythes above flashings.

H. Maintain masonry clean as work progresses. Exercise extreme care at exposed work to prevent smearing or staining with mortar.

I. At completion of work cut out and rejoint holes and defective joints, leaving entire work free of blemishes.

3.2 CONCRETE MASONRY UNIT WORK

A. Lay concrete masonry units in running bond pattern unless otherwise indicated. Finish height of each course of block (unit plus one joint) shall be 8 in. Construct concrete masonry unit work to conform to approved mock-up panels.

1. Provide solid units at corners and control joints.

B. Use full mortar bedding when laying starting courses, courses in load-bearing walls, and courses of fire-resistive walls. Use face shell bedding when laying other courses. Fully butter shells of vertical joints. Fully mortar webs and face shells at masonry ties and anchors. Strike joints flush with exposed faces of block when units are laid, and then finish as specified below.

C. Cutting of exposed units shall be done with a dry, motor-driven carborundum blade to ensure straight, even cut edges. Cutting by hand or wet cutting will not be permitted. Drill and cut holes, chases, notches, and other penetrations with power tools.

D. Where it is necessary to decrease thickness of face web in order to accommodate conduit, pipes, and similar items, void surrounding such items shall be filled solidly with mortar to reduce danger of cracking. Also, longitudinal reinforcing shall not be cut or otherwise interrupted at these points.

E. In addition to grouting at structural reinforcing, hollow concrete masonry unit work shall be grouted solidly with pouring grout at following locations:
   1. The first two cells of units abutting wall openings and wall ends.
   2. Cells of course immediately above and below wall openings.
   3. Cells where necessary for embedment of concealed anchor plates, anchors, bolts, bearing on structural members, and similar items, as indicated or reasonably required.
   4. Cells of other units where specifically called for on Drawings.

G. Where anchor plates, anchors, bolts, and other metal items are embedded in concrete unit masonry, provide screening in joint below to prevent mortar from dropping through voids.

H. When mortar at exposed joints of regular concrete masonry units has become partially set and will make a thumbprint under pressure without displacement of mortar, tool joints to a glassy-hard, smooth, concave finish using 1 in. diameter stainless steel sled jointer.
   1. Horizontal and vertical joints at exposed interior face of scored block shall be raked to match vertical score line.
   2. At concealed work, strike joints flush and do not finish.

I. Control Joints in Concrete Masonry Unit Work: Provide control joints as follows:
   1. Provide vertical control joints in field of interior concrete masonry unit work, including inner wythes of exterior walls, as shown on Drawings. Unless otherwise indicated, construct control joint with closed-end type block to form a continuous, full-height open joint approximately 3/8 in. wide. Omit mortar from joint and substitute compressible semi-rigid glass fiber joint filler to within 3/4 in. of each face, ready to receive joint backing and sealant by sealant trade.
   2. Provide control joints at ends of interior concrete masonry unit walls at steel columns. Longitudinal reinforcing "Tees" (concrete unit masonry-to-concrete unit masonry) and masonry anchors (masonry-to-steel columns) at these joints shall be as specified in this Section. Fill masonry-to-masonry joints solidly with mortar and rake out 3/4 in. deep, ready to receive joint backing and sealant. Install compressible joint filler at masonry-to-steel column joints, held back 3/4 in. on each face to receive joint backing and sealant.
   3. Provide control joints at top of each interior non-bearing wall and partition and ceiling or framing member above, as indicated. Control joints shall be thickness as required by conditions encountered, but not less than 1-1/2 in. at steel framing members and 1 in. at steel deck.

3.3 INSTALLATION OF THROUGH WALL FLASHINGS

A. At exterior walls, in general, through wall flashings shall be installed at the following locations, but the work is not limited to the applications listed. Carefully review the Drawings to determine the exact scope and nature of the work.
   1. Horizontally at bases of all cavities and veneers in exterior masonry finished walls, but not lower than 4 in. above adjacent finish grade or pavement.
   2. Horizontally under sills and over heads of all openings in exterior masonry finished walls.
   3. Horizontally at all lintels and shelf angles in exterior masonry finished walls.
   4. Vertically at jambs of all openings in exterior masonry finished walls.
   5. At other places where through flashings are called for on the Drawings.

B. Through Wall Flashing Installation:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.4 CLEANING AND POINTING

A. Soon after masonry work is completed, vacuum clean interior work with brush type head attachment to remove loose granules and building dust from pores of units prior to subsequent finishing operations.

B. Upon completion, thoroughly clean exposed exterior masonry with a solution of specified detergent and water, using stiff fiber or stainless steel brushes. Cleaners or other solutions which may cause discoloration or damage will not be permitted. Muriatic acid is not permitted.

1. Prior to applying any cleaning materials on finished masonry work, provide a test cleaning mock-up on masonry mock-ups at locations acceptable to the Architect.
2. Test cleaning techniques and solutions to determine the best methods for the conditions encountered. Demonstrate Contractor's quality control system to ensure uniform final appearance. Test adjacent non-masonry surfaces for possible adverse reactions to cleaning methods. Use all cleaning products in strict compliance with the manufacturers' instructions and recommendations. Keep accurate, detailed records of concentrations, solutions, and techniques used to assist in replicating satisfactory results.

C. Rake out imperfect mortar joints of masonry work and repoint to match appearance of surrounding acceptable work. Leave entire work free of defects.

END OF SECTION

SECTION 054000 – COLD-FORMED METAL FRAMING

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. Section Includes:
1. Interior ceiling support framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports:
1. Mechanical fasteners.
2. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

A. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. ClarkWestern Building Systems, Inc.

2. Dietrich Metal Framing; a Worthington Industries Company.
3. MarinoWARE.
4. Nuconsteel; a Nucor Company.
5. State Building Products, Inc.
6. Steel Construction Systems.
7. Steel Network, Inc. (The).
8. Steel Structural Systems.
9. Telling Industries, LLC.
10. United Metal Products, Inc.
11. United Steel Manufacturing.

2.2 PERFORMANCE REQUIREMENTS

A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance, ST33H (ST230H) minimum.
   2. Coating: G90.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows and as necessary:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Gusset plates.
   7. Joist hangers and end closures.
   8. Hole reinforcing plates.
   9. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A 36M, zinc coated by hot-dip process according to ASTM A123/A 123M.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488 conducted by a qualified testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.6 MISCELLANEOUS MATERIALS

A. Shims: Load bearing, high-density multi-monomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

B. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

G. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Mineral-wool blanket insulation.
2. Cellular glass insulation.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Mineral-wool blanket insulation.
2. Cellular glass insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
2. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to 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.

PART 2 - PRODUCTS

2.1 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

2.2 CELLULAR-GLASS INSULATION

A. Cellular-Glass Insulation: Type V, ASTM C1902, structural insulating block with compressive strength of minimum 304 psi (2096 kPa), per ASTM D1621.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 079200 – JOINT SEALANTS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Caulk and seal joints as indicated on the Drawings and as specified. Include, but do not limit to:
   1. Sealing of joints in exterior construction.
   2. Sealing of joints between perimeter of exterior door frames, vents, louvers, and other items occurring in openings in exterior walls, and the surrounding construction, including bed sealing of thresholds.
   3. Sealing of interior perimeter joints at door frames, vents, louvers, and other wall openings.
   4. All other exterior and interior sealing called for, or reasonably inferred from the Drawings, and as required to provide weathertight conditions in exterior assemblies.

1.2 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M220, Preformed Elastomeric Compression Joint Seals for Concrete
   2. American Society for Testing and Materials (ASTM):
      a. C719, Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement.
      b. C790, Use of Latex Sealing Compounds.
      c. C834, Latex Sealing Compounds.
      d. C920, Elastomeric Joint Sealants.
      e. C962, Use of Elastomeric Joint Sealants.
      f. D412, Test Methods for Rubber Properties in Tension.
      g. D624, Test Method for Rubber Property - Tear Resistance.
      h. D2628, Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each sealant material used. Provide certifications that sealant materials comply with specified requirements.

B. Initial Selection Samples: Submit samples manufacturer's color charts showing complete range of colors, textures, and finishes available for each material used.

C. Verification Samples: Submit actual representative samples of each sealant material that is to be exposed in the completed work. Show full color ranges and finish variations expected. Provide sealant samples having minimum size of 4 inches long.

D. Test Reports: Provide certified reports for all specified tests.

1.4 COMPATIBILITY

A. Provide sealant and sealant joint backing materials suitable for the use intended and compatible with the materials with which they will be in contact. Compatibility of sealant and accessories shall be verified by the sealant manufacturer.

1.5 QUALITY ASSURANCE

A. Source: For each sealant material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Installer: A firm with a minimum of 5 years of experience in type of work required by this Section and which is acceptable to the manufacturers of the primary materials.

C. Mock-Ups: Prior to commencing the primary work of this Section, provide mock-ups at locations acceptable to Architect. Obtain Architect's acceptance of visual qualities. Protect and maintain accepted mock-ups throughout the remainder of the work of this section to serve as criteria for acceptance of the work.

1.6 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.

B. Substrates: Proceed with work only when substrate construction and penetration work is complete.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Materials under this Section shall be delivered to, and stored at, the job site in unbroken factory sealed containers with labels intact.

1.8 WARRANTY

A. Furnish joint sealant manufacturer's written single-source performance warranty that joint sealant work will be free of defects related to workmanship or material deficiency for five years from date of Substantial Completion of the Project.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Before installation check each sealant for compatibility with adjacent materials and surfaces and with indicated exposures. Select sealers which are recommended by manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants which are non-tracking and are strong enough to withstand the traffic without damage.

B. Provide colors as selected by Architect from manufacturer's full range of colors.

C. Liquid-Applied Joint Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

2.2 SELF-LEVELING POLYURETHANE SEALANT (SEALANT TYPE 1)

A. Provide two-component, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C920, Fed. Spec. TT-S-00227E Type 1 Class A, having Shore A hardness of not less than 30 when tested according to ASTM C920, cured modulus of elasticity at 100 percent elongation of not more than 150 psi when tested according to ASTM D412, and tear resistance of not less than 50 pounds per inch when tested according to ASTM D624.

B. Where joint surfaces contain bituminous materials, provide modified sealants which are compatible with bituminous materials encountered.

C. Provide one of the following products that meet or exceed specified requirements:

1. Pecora Urexpan NR-200.
2. Mameco Vulkem 245 or 255.
3. SikaFlex-2c SL.
4. Sonneborn Sonolastic PvJtSt.
5. Tremco THC 900.

D. Extent: Provide self-leveling polyurethane sealant for paving and floor joints not indicated to be sealed with another type of sealant.

2.3 NON-SAG SILICONE SEALANT (SEALANT TYPE 2)

A. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for Project.

B. Single-Component Neutral-Curing Silicone Sealant:

1. Dow Corning Corporation; 790, in color selected by Architect.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.

C. Extent: Provide non-sag sealant for all concrete joints, masonry to metal joints, masonry to masonry joints, masonry to concrete joints, concrete-to-concrete joints, cast-stone joints; and other joints not indicated to be sealed with another type of sealant.

2.4 SILICONE RUBBER SEALANT (SEALANT TYPE 3)

A. Provide one part, silicone rubber based elastomeric sealant, complying with ASTM C920 Type S, Class 25, Grade NS and Fed. Spec. TT-S-001543A Class A.

B. Provide mold and mildew resistant, sanitary interior type sealant.

C. Provide one of the following products that meet or exceed specified requirements:
   1. Dow 786.
   2. General Electric 1702 Sanitary.
   3. Pecora 863.
   4. Rhodorsil 6b White.
   5. Sonneborn OmniPlus.
   6. Tremco Proglaze.

D. Extent: Provide silicone rubber sealant for interior joints around plumbing fixtures and tile to tile joints in ceramic tile work.

2.5 ACRYLIC LATEX SEALANT (SEALANT TYPE 4)

A. Provide permanently flexible, latex rubber modified acrylic emulsion sealant, complying with ASTM C834.

B. Provide one of following products that meet or exceed specified requirements:
   1. Pecora AC-20.
   2. Tremco Acrylic Latex 834.
   3. Sonneborn Sonolac.

C. Extent: Provide acrylic latex sealant for use at mirrors, for exposed acoustical sealant, and for interior joints except where silicone rubber sealant is indicated.

D. At interior joints greater than 1/2 inch in width or subjected to periodic building movement, substitute exterior type sealant specified above.

E. Where surrounding wall surfaces are to be left unpainted, substitute exterior type sealant as specified above.

2.6 METAL SEAM SEALANT (SELANT TYPE 5)

A. Provide metal seam sealant, specifically compounded to seal very thin joints in metal to metal joints and to match adjacent metal colors and finishes.

B. Provide one of the following products:
   1. Protective Treatments, Inc. PTI 200
   2. Tremco Seam Sealer.

C. Extent: Provide seam sealant for metal to metal joints at metal roofing panels.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Provide primer recommended by sealant manufacturer for surfaces to be adhered to.

B. Bond Breaker Tape: Provide polyethylene or other plastic tape recommended by sealant manufacturer to prevent three-sided adhesion.

C. Backer Rod: Provide compressible rod of durable non-absorptive material recommended by sealant manufacturer for compatibility with sealant. Provide products of one of the following manufacturers:

1. Industrial Thermco Polymers Ltd. – ITP Standard Backer Rod (Basis of Design)
2. Backer Rod Manufacturing and Supply Co.
3. Dow Chemical Co.
4. W. R. Meadows, Inc.
5. Williams Products, Inc.
6. Woodmont Products, Inc.

D. Joint backing for general use at joints in horizontal surfaces shall consist of two rows of butyl rubber or neoprene foam rod in contact with one another, and each compressed to approximately two-thirds of original width when in place.

E. Provide miscellaneous materials of type that will not bleed through sealant, discolor surface, or produce other deleterious effects. Select size to provide compression to approximately two-thirds of original width when in place. Provide backing material profile concave to the rear of the sealant, and equipped with a bond-breaking film.

PART 3 – EXECUTION

3.1 INSPECTION

A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning of sealant work means Installer's acceptance of joint surfaces and conditions.

3.2 PREPARATION

A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this Section.

B. Clean joint surfaces immediately before installation of sealants, primers, tapes and fillers. Remove substances which could interfere with bond. Etch or roughen joint surfaces to improve bond. Surfaces which have been given protective coatings and those that contain oil or grease shall be thoroughly cleaned with xylol or MEK solvent, with due precautions taken to minimize hazards.

C. Unless otherwise indicated, use of sealants shall conform to the following: ASTM C790 for latex sealants and ASTM C1193 for other sealants.

D. Tape or mask adjoining surfaces to prevent spillage and migration problems.

E. Prime surfaces as recommended by sealant manufacturer.

3.3 INSTALLATION

A. Schedule work as long as possible after completion of concrete work.

B. Provide backer rods for liquid sealants except where specifically recommended against by sealant manufacturers.

C. Prevent three-sided adhesion by use of bond breaker tapes or backer rods.

D. Force sealant into joints to provide uniform, dense, continuous ribbons free from gaps and air pockets. Completely wet both joint surfaces equally on opposite sides.

E. Except in hot weather, make sealant surface slightly concave. Install sealants so that compressed sealants do not protrude from joints. Dry tool sealants to form a smooth dense surface. At horizontal joints form a slight cove to prevent trapping water.

F. Provide sealants to depths indicated, or if not indicated, follow manufacturer's recommendations.

3.4 EXTENT OF SEALANT WORK

A. General Extent: Seal joints indicated, and all interior and exterior joints, seams, and intersections between dissimilar materials. Provide elastomeric sealant installation with backer rod in all interior and exterior control joints.

B. Interior Sealing: Without limitation, the work of this Section includes sealing the following:
   1. Perimeters of door frames, and metal frames.
   2. Between ceiling edge angle and irregular walls.
   3. Completely around plumbing fixtures, fittings, walls and floors.

3.5 CURING

A. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

3.6 CLEANING AND PROTECTION

A. Remove smears from adjacent surfaces immediately, as the work progresses. Exercise particular care to prevent smearing or staining of surrounding surfaces which will be exposed in the finished work, and repair any damage done to same as result of this work without additional cost to Owner.

B. Remove and replace work that is damaged or deteriorated.

C. Clean adjacent surfaces using materials and methods recommended by sealant manufacturer. Remove and replace work that cannot be successfully cleaned.

D. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protection immediately before final acceptance.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
1. Exterior standard steel doors and frames.

B. Related Requirements:
1. Section 042000 – Unit Masonry.
2. Section 079200 – Joint Sealants.
3. Section 087100 – Door Hardware for door hardware for hollow-metal doors.
4. Section 099000 – Painting and Coatings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Standard steel doors and frames.

B. Product Data Submittals: For each product.
1. Include construction details, material descriptions, core descriptions, and finishes.

C. Shop Drawings: Include the following:
1. Elevations of each door type.
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.

D. Samples for Verification:
1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
2. Fabrication: Prepare Samples approximately 8 by 10 inches 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.

E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

PART 2 – PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

A. 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:
   1. Apex Industries, Inc.
   2. Ceco Door; AADG, Inc.; ASSA ABLOY
   3. Curries, AADG, Inc.; ASSA ABLOY Group
   4. Daybar Industries, Ltd.
   5. DCI Hollow Metal on Demand
   6. Mesker Door; Mesker Openings Group
   7. Steelcraft; Allegion plc
   8. Approved Equal.

2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule on Drawings.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule on Drawings.
      b. Thickness: 1-3/4 inches (44.5 mm).
      c. Face: Metallic-coated steel sheet, minimum thickness of 14 GA, with minimum A40 (ZF120) coating.
      d. Edge Construction: Model 2, Seamless.
      e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
      f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
      g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
      h. Core: Polystyrene.
      i. Exposed Finish: Prime.

2. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 14 GA with minimum A40 (ZF120).
   b. Construction: Full profile welded.
3. Exposed Finish: Prime.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. U=0.70 when tested in accordance with ASTM C1363 or ASTM E1423.

2.4 FRAME ANCHORS

A. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.5 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      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.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface- mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Field Paint:
   1. Refer to materials and finish schedule for colors.

PART 3 – EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: 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 without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Floor Anchors: Secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
   4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.

3.3 REPAIR

A. 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.

END OF SECTION

SECTION 087100 – DOOR HARDWARE

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 commercial door hardware for the following:
   1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 08 Section "Hollow Metal Doors and Frames".

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:
   1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

D. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Final Acceptance, unless otherwise indicated.

D. Special Warranty Periods:
   1. Ten years for mortise locks and latches.
   2. Twenty five years for manual surface door closer bodies.
   3. Twenty five years for manual surface door closer bodies.
   4. Twenty five years for manual surface door closer bodies.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.
      c. Four Hinges: For doors with heights 91 to 120 inches.
      d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
      a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
      b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:
   a. Hager Companies (HA).
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
   c. Stanley Hardware (ST).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
   1. Manufacturers:
      a. Hager Companies (HA).
      b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
      c. Stanley Hardware (ST).

2.3 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
   1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
   2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
   3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
   4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
   5. Manufacturers:
      a. Hiawatha, Inc. (HI).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

2.4 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
   1. Manufacturers:
      a. Sargent Manufacturing (SA).
      b. Falcon – 24/25 Series Heavy Duty.
      c. Von Duprin 35A/98 XP Series.

C. Cylinders: Original manufacturer cylinders complying with the following:
   1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
   2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
   4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
   5. Keyway: Match Facility Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
   3. Existing System: Field verify and key locks to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Two (2)
   2. Master Keys (per Master Key Level/Group): Five (5).
   3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):
   1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
   2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
   1. Manufacturers:
      a. Sargent Manufacturing (SA) – 8200 Series.
      b. Schlage – L Series Grade 1.
      c. Best – 40H Series.

B. Knurling: Where required by local code provide knurling or abrasive coating to all levers on doors leading to hazardous areas such as mechanical rooms, boiler and furnace rooms, janitor closets, and as otherwise required or specified.

2.6 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
   1. Manufacturers:
      a. Sargent Manufacturing (SA) - 4870 Series.
      b. Schlage – L Series Grade 1 Mortise Deadbolt.
      c. Best – 40H Series Deadbolt.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.8 ARCHITECTURAL TRIM

A. Door Protective Trim
   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

   2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

   3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

   4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
      a. Stainless Steel: 300 grade, 050-inch thick.

   5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

   6. Manufacturers:
      a. Hiawatha, Inc. (HI).
      b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
      c. Trimco (TC).

2.9 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will

impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
   a. Hiawatha, Inc. (HI).
   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
   c. Trimco (TC).

2.10 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:
   1. National Guard Products (NG).
   2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
   3. Reese Enterprises, Inc. (RE).

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

Hardware Set 1

3 EA	Hinge, Full Mortise	Schlage 4" Square Hinges	
1 EA	Thumbturn & Deadbolt	Schlage	
1 EA	Interchangeable Core	Best 7 Pin	
1 EA	Pull & Push Plate	Hager 4" x 16"	
1 EA	Rain Drip	Hager 810S x 40"	Aluminum MIL
1 EA	ADA Threshold	Hager 413S - 5" Wide x 36" w/ #10 SS MS & Lead Anchors	Aluminum MIL
1 EA	Gasketing	Hager 736 - 18 ft.	
1 EA	Door Bottom Sweep	Hager 750S-N x 36"	
1 EA	Door Closer	Sargent 1331 Series	EN
1 EA	Kick Plate	Hager 190S 10" x 34" CSK	
1 EA	Dome Stop	Hager 241F	

Hardware Set 2

3 EA	Hinge, Full Mortise	Schlage 4" Square Hinges	
1 EA	Single Cylinder Keyed Entry	Schlage F80-ELA Storeroom Door Lever Set	
1 EA	Rain Drip	Hager 810S x 40"	Aluminum MIL
1 EA	ADA Threshold	Hager 413S - 5" Wide x 36" w/ #10 SS MS & Lead Anchors	Aluminum MIL
1 EA	Gasketing	Hager 736 - 18 ft.	
1 EA	Door Bottom Sweep	Hager 750S-N x 36"	
1 EA	Door Closer	Sargent 1331 Series	EN
1 EA	Kick Plate	Hager 190S 10" x 34" CSK	
1 EA	Dome Stop	Hager 241F	

Hardware Set 3

3 EA	Hinge, Full Mortise	Schlage 4" Square Hinges	
1 EA	Single Cylinder Keyed Entry	Schlage F80-ELA Storeroom Door Lever Set	
1 EA	Rain Drip	Hager 810S x 40"	Aluminum MIL
1 EA	ADA Threshold	Hager 413S - 5" Wide x 36" w/ #10 SS MS & Lead Anchors	Aluminum MIL
1 EA	Gasketing	Hager 736 - 18 ft.	
1 EA	Door Bottom Sweep	Hager 750S-N x 36"	
1 EA	Dome Stop	Hager 241F	

END OF SECTION

SECTION 089119 - FIXED LOUVERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fixed extruded-aluminum louvers.

B. Related Requirements:
1. Section 042000 "Unit Masonry".
2. Section 076200 "Sheet Metal Flashing and Trim".
3. Section 079200 "Joint Sealants".

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris- impact resistance, as determined by testing according to AMCA 540.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Windborne-debris-impact-resistance test reports.

C. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 10 years from date of Final Acceptance.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed and operable louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation

of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Mechanical Drawings.

C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade shall pass basic protection, when tested according to AMCA 540.

D. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

G. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Basis-of-Design Product: Greenheck Combination Louver/Damper ECD-601 or approved equal product meeting requirements listed below.
2. Louver Depth: 6 inches (150 mm).
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
4. Mullion Type: Exposed.
5. Louver Performance Ratings: Refer to Mechanical Drawings.
6. Mounting angles: provide mounting angles as necessary to complete installation.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5,.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c. whichever is less.
   1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with semi-recessed mullions at corners.

G. Provide extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 092410 - DIRECT APPLIED FINISH SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide direct applied finish system for interior ceiling applications, as indicated on the Drawings and as specified herein. Work includes, but is not limited to:
   1. Application over cement backerboard systems.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
   1. Section 079200, JOINT SEALANTS.
   2. Section 099100, PAINTING.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirement shall govern.
   1. American Society for Testing and Materials (ASTM): C 150 Portland Cement

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.

B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Show all interfaces and relationships to work of other trades.

C. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used. Submit sealant manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available.

D. Verification Samples: Submit 2 ft. square panels of each finish, color, and texture specified. Prepare samples using same tools and techniques intended for the actual work. Incorporate within each sample a typical control joint filled with sealant of color indicated or selected.

E. Test Reports: Provide certified reports for all specified tests.

F. Qualification Data: Submit copies of license or certification indicating that installer is certified in writing by system manufacturer as qualified to install manufacturer's system.

1.5 QUALITY ASSURANCE:

A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Installer: A firm with a minimum of three years' experience in type of work required by this section and which is certified by the system manufacturers.

1.6 PERFORMANCE REQUIREMENTS

A. Bond Integrity: Provide system free from bond failure within system components, and between system and substrates, resulting from exposure water spray, moisture, or high humidity.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened containers or packages with labels intact and legible identifying brand name and contents. Stack materials flat, and off the ground, and protected from direct sunlight.

B. Store materials in original packaging under cover, protected from weather and physical damage, and at temperatures not less than 40°F.

C. Handle products in a manner that prevents physical damage.

1.8 JOB CONDITIONS

A. Environmental Requirements: Do not install finish system when ambient air temperature is less than 40°F. Temperature at time of installation shall be 40°F. or greater and rising and shall remain so for at least 24 hours thereafter.

1. Do not apply finish system to frozen substrates.

B. Protection: Protect surrounding surface areas to preclude damage during finish system application.

1. Protect completed sections of the finish system at the end of each day or when inclement weather is threatening so as to prevent water penetration behind system.

C. Coordination: Coordinate the work of this Section with work of other Sections. Schedule and sequence the work to ensure continuous operation, free of cold joints, scaffold lines, texture variations, etc.

PART 2 – PRODUCTS

2.1 ACCEPTABLE SYSTEM AND MANUFACTURERS

A. Direct Applied Finish System Basis-of-Design Product: Subject to compliance with requirements, products by Sto Corp are specified as the basis-of-design. Provide these products, or approved equal from another listed manufacturer Provide:

1. Sto Corp (Basis of Design).
2. BASF Wall Systems.
3. Dryvit Systems, Inc.
4. Approved equal.

2.2 FINISH SYSTEM MATERIALS

A. Gypsum Soffit Board: glass mat faced gypsum sheathing in compliance with ASTM C1177. Thickness as indicated on drawings.

B. Surface Reinforcement:
   1. Sto Mesh – nominal 4.5 oz/yd^2 (153 g/m2) glass fiber reinforcing mesh treated for compatibility with Sto materials.
   2. Sto Detail Mesh – nominal 4.2 oz/yd^2 (142 g/m2) glass fiber reinforcing mesh treated for compatibility with Sto materials.
   3. Sto Flexyl – acrylic based, fiber reinforced, flexible adhesive and waterproofer.

C. Base Coat: Sto BTS Plus, one component polymer modified portland AQMD Rule 1113 for primers.

D. Finish Coat: Provide Stolit 1.0 + Freeform Limestone Finish.

E. Color: As indicated in the Material and Color Legend on the Drawings.

F. Accessories: Provide high-impact PVC plastic casing beads, starter tracks, j-beads, corner beads and control joints, in conformance with ASTM D1764. Flanges shall be perforated.

G. Mechanical Fasteners: Non-corroding fasteners as appropriate for substrate.

H. Job Mixed Ingredients:
   1. Portland Cement: ASTM C150, Type I.
   2. Water: Clean and potable.

PART 3 – EXECUTION

3.1 INSPECTION

A. Prior to system installation, examine substrates to ensure they are sound and of type approved by system manufacturer.

B. Condition of Substrates to Receive Finish System.
   1. Surfaces shall be free of oil, dust, dirt, form-release agents, paint, wax, glazing materials, water, moisture, frost, or any other foreign materials.
   2. In addition, examine substrates for compliance with Contract Documents, for soundness, tightness of connections, crumbling or looseness of surfaces, voids, projections, dimensional correctness, and no planar irregularities greater than 1/4in.

C. Report any unsatisfactory substrate condition to the Architect in writing, and do not proceed with installation until such condition have been satisfactorily corrected.

3.2 INSTALLATION

A. Installation shall conform to manufacturer's published recommendations and specifications, and to approved Submittals.

B. Reinforcing Fabric: Overlap reinforcing glass fabric joints 3 in. Mechanically anchor reinforcing fabric with manufacturer's standard anchors suitable for substrate, spaced not more than 12 in. vertically nor more than 16 in. horizontally on masonry, or 16 in. on studs. Provide expansion joints so that no area exceeds 150 sq. ft. Coordinate placement with Architect.

C. Base Coat: Mix base coat in accordance with manufacturer's instructions. Apply base coat to surface by troweling materials into the reinforcing fabric in tight coat and doubling back to 1/8 in. to 3/16

in. thickness. Base coat shall be applied to level out surface areas and to fill joints smooth with adjacent areas.

D. Finish Coating: Apply and level specified finish coat in single operation. Apply final texture with trowels or floats, as necessary to achieve required finish. Finish coating shall be 1/16 in. to 1/8 in. thick. Texture shall match approved sample. Color shall be added to finish coat mix to approximate color of colored sealer being used.

E. Colored Sealer: For textured finish, one coat of colored sealer shall be rolled or sprayed over entire surface.

3.3 INSTALLING ACCESSORIES

A. General: Install according to ASTM C 841.

B. Cornerbeads: Install at external corners.

C. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.

D. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated, with spacing between joints in either direction not exceeding the following and in specific locations approved by Architect for visual effect:

1. Partitions: 30 feet (9 m).
2. Ceilings: 30 feet (9 m).

3.4 ADJUSTMENTS

A. Upon completion of work, cut out and patch defective and damaged finish. Patch finish to match accepted work in place in color, texture, and finish; flush and level.

3.5 CLEAN UP

A. Remove and dispose of excess materials, debris, and litter resulting from the work.

B. Clean any displaced finish or adhesive materials from adjacent surfaces following system manufacturer's recommended cleaning procedures.

C. Leave work and surrounding surfaces clean and free of stains.

END OF SECTION

SECTION 099000 - PAINTING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Field painting of exposed interior items and surfaces.
   2. Field painting of exposed exterior items and surfaces.
   3. Surface preparation for painting.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 042200 – Unit Masonry.
   2. Section 081110 – Hollow Metal Doors and Frames for factory priming steel doors and frames.

1.3 DEFINITIONS AND EXTENT

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

D. Do NOT paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:
   a. Toilet enclosures.
   b. Kitchen appliances.
   c. Finished mechanical and electrical equipment.
   d. Light fixtures.
2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Foundation spaces.
   b. Furred areas.
   c. Ceiling plenums.
   d. Pipe spaces.
   e. Duct shafts.
3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.4 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   a. Disclose material ingredients by name and Chemical Abstract Service (CAS) Registry Number.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
   a. Wall Surfaces: Provide samples on at least 100 sq. ft.
   b. Small Areas and Items: Architect will designate items or areas required.
2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
   a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Paint Colors (PT-#): Provide colors as selected by Architect. Refer to Material & Color Legend on the Drawings.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
2. Use low-emitting, environmentally friendly cleaning agents and procedures, including but not limited to trisodium phosphate (TSP) diluted with warm water. Do not use ammonia-, chlorine bleach-, or solvent-based cleaners, unless authorized in writing by Architect.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions and technical bulletins for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
   c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
   b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
   c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.
4. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
   1. Uninsulated metal piping.
   2. Uninsulated plastic piping.
   3. Pipe hangers and supports.
   4. Tanks that do not have factory-applied final finishes.
   5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
   7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
   1. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 PAINT SCHEDULE

A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.

B. Interior Paint Schedule, Typical:
   1. Interior Concrete Masonry Unit (CMU), Acrylic Latex Paint Finish:
      a. One Coat, Block Filler:
         1) Moore; Ultra Spec Hi-Build Masonry Block Filler 571.
         2) PPG; Perma-Crete 4-603. Less than 100 g/L.
         3) PPG; Speedhide Interior Masonry Hi Fill Latex Block Filler 6-15XI.
         4) S-W; PrepRite Block Filler B25W25.
      b. And Two Coats, Semi-gloss Finish: At walls and elsewhere as indicated.
         1) Moore; Ultra Spec 500 Interior Latex.
         2) PPG; Speedhide Zero VOC Interior Latex.
         3) S-W; ProMar 200 HP Zero VOC Interior.

C. Exterior Paint Schedule; Typical:
   1. Exterior Hollow Metal Doors and Frames:
      a. Base Coat:
         1) S-W: Pro Industrial Pro-Cryl Univeral Acrylic Primer.
         2) PPG: Pitt-Tech Plus EP Acrylic Primer.
         3) Moore: Ultra Spec HP Acrylic Metal Primer.
      b. Intermediate Coat: Matching top coat.
         1) S-W: Pro Industrial Pre-Catalyzed Waterbased Urethane.
         2) PPG: Pitt-Tech Plus EP DTM Acrylic.
      c. Top Coat:
         1) S-W: Pro Industrial Pre-Catalyzed Waterbased Urethane.
         2) PPG: Pitt-Tech Plus EP DTM Acrylic.
         3) Moore: HP High Performance Command.

D. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork. Same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. High performance coatings.

1.2 REFERENCE STANDARDS

A. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

B. SSPC-SP 5 - White Metal Blast Cleaning; Society for Protective Coatings; 2006.

C. SSPC-SP 6 - Commercial Blast Cleaning; Society for Protective Coatings; 2006.

D. SSPC-SP 10 - Near-White Blast Cleaning; Society for Protective Coatings; 2000 (Ed. 2004).

E. SSPC-SP 11 - Power Tool Cleaning to Bare Metal; Society for Protective Coatings; 1987 (Ed. 2004).

1.3 SUBMITTALS

A. See General Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials.

C. Samples: Submit two samples 8x10 inch in size illustrating colors available for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.4 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.5 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

D. Restrict traffic from area where coating is being applied or is curing.

1.6 WARRANTY

A. Correct defective Work within a one year period after Date of Substantial Completion.

B. Warranty: Include coverage for bond to substrate.

C. Special Color Retention Warranty: 15 year gloss and color retention warranty will be issued from the coating manufacturer to the owner prior to the start of the job.

1.7 MAINTENANCE PRODUCTS

A. Provide 1 gallon of each color of each type of coating specified, for Owner's maintenance use.

B. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Sherwin Williams Company: www.sherwin-williams.com.

B. High Performance Coatings: Other Acceptable Manufacturers.
1. PPG Architectural Finishes, Inc: www.ppgaf.com.
2. Tnemec Company: www.Tnemec.com
3. Approved equal.

.2.2 MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
1. Lead content: Not greater than 0.06 percent by weight of total nonvolatile content.
2. Chromium content, as hexavalent chromium, zinc chromate, or strontium chromate: None.
3. Maximum volatile organic compound (VOC) content: As required by applicable regulations.
4. Topcoat Colors:
a. As indicated in the "Material & Color Legend" on the Drawings.

B. Coating System Type: Zinc/Epoxy/Fluoropolymer.
1. Primer: Zinc-Rich, Urethane.
a. Sherwin-Williams Company:
1) Primer: B69A00100- Zinc Clad® III HS Organic Zinc-Rich Epoxy Primer.
2) Spot Primer: B58W00610 – Macropoxy® 646 Fast Cure Epoxy Part A Mill White.
b. Tnemec Company, Inc.; Tnemec-Zinc Product 90-97. Applied at a dry film thickness of 2.5 to 3.5 mils per coat.
c. PPG; 97-694 Metalhide 2000 Inorganic Zinc Rich Coating. Applied at a dry film thickness of 2.0 to 5.0 mils.
2. Intermediate Coating (1st Field Coat): Polyamidoamine Epoxy.
a. Sherwin-Williams Company: B58W00610 – Macropoxy® 646 Fast Cure Epoxy.

b. Tnemec Company, Inc.; Tnemec Hi-Build Epoxoline N69. Applied at a dry film thickness of 2.0 to 3.0 mils.
c. PPG; Coraflon ADS Epoxy Primer/Intermediate ADS573/ADS574. Applied at a dry film thickness of 3.0 to 5.0 mils.

3. Top Coat (2nd Field Coat): Advanced Thermoset Solution Fluoropolymer.
   a. Sherwin-Williams Company: B65W00580 – FLRKM HS GL.
   b. Tnemec Company, Inc.; Tnemec Series 1071 Fluoronar. Applied at a dry film thickness of 2.0 to 3.0 mils.
   c. PPG; Coraflon ADS + Component B ADS1B. Applied at a dry film thickness of 1.5 to 2.0 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.

3.2 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:
   1. Strip existing paint and coatings from surface.
   2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

F. Ferrous Metal:
   1. Solvent clean.
   2. Remove loose rust, loose mill scale, and other foreign substances using blast cleaning according to SSPC-SP 6 Commercial Blast Standard.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.3 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.4 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 116800 - PLAYGROUND EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Freestanding playground equipment and structures.
2. Composite playground equipment and structures.

B. Related Sections include the following:
3. Division 03 Section "Cast-in-Place Concrete" for concrete footings.
4. Division 32 Section "Playground Protective Surfacing" for protective surfacing under and around playground equipment.

1.3 DEFINITIONS

A. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."

B. HDPE: High-density polyethylene.

C. IPEMA: International Play Equipment Manufacturers Association.

D. LLDPE: Linear low-density polyethylene.

E. MDPE: Medium-density polyethylene.

F. Use Zone: According to ASTM F 1487, "the area beneath and immediately adjacent to a play structure that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

G. Composite Play Structures: According to ASTM F 1487, this means "two or more play structures, attached or functionally linked," creating one integral unit with more than one play activity.

H. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur".

I. Play Structure: According to ASTM F 1487, this is "a free-standing structure with one or more components and their supporting members".

J. Protective Surfacing: According to ASTM F 1487, this means impact-attenuating "materials to be used within the use zone of any playground equipment" for playground surface systems.

K. PVC: Polyvinyl chloride.

L. Transfer Point: According to ASTM F 1487, this is "a platform or deck along an accessible route of travel or an accessible platform provided to allow a child in a wheelchair to transfer from the chair onto the equipment".

1.4 DESIGN REQUIREMENTS

A. Applicable technical for Public Playground Equipment by the U.S. Consumer Product Safety Commission.

B. Contractor is to install and maintain temporary fencing around playground areas while under construction until the play equipment has been inspected and released by the Architect and representative of the manufacturer. Play areas are to be marked by visible, easily readable signs identifying the area as "Area Under Construction, Do Not Enter".

C. Manufacturer shall conform to ADA (Americans with Disabilities Act) requirements that will be in effect at the time of bidding. ADA requirements supersede Technical Specifications in this Section.
   1. Playground equipment and entire area shall conform to the accessibility requirements of the ADA Guidelines including Section 15.6.

D. Manufacturer shall conform to Standard Consumer Safety Performance Specification for Playground Equipment for Public Use, ASTM F-1487-01, or most current version of this guideline.
   1. Third party certification is required to guarantee compliance with ASTM Standards.

E. Themed playground structures shall be designed and installed to comply with ASTM F1487, ADA accessibility requirements, and applicable state and local playground safety regulations. Coordinate use zones, fall heights, and protective surfacing requirements with playground Protective Surfacing.

1.5 SUBMITTALS

A. Themed Playground Structures and Equipment
   1. Detailed product literature.
   2. Dimensioned shop drawings
   3. Site layout indicating use zones and fall heights
   4. Foundation and anchorage requirements.
   5. Swing seat types and quantities.
   6. IPEMA certification documentation where applicable
   7. Third-party compliance documentation demonstrating compliance with ASTM F1487 and CPSC Publication No. 325.

B. Samples for Initial Selection: For each type of playground equipment and structure indicated.
   1. Manufacturer's color charts.
   2. Include similar Samples of playground equipment and accessories involving color selection.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Posts and Rails: Not less than 6 inches long.
   2. Platforms: Not less than 6 inches square.
   3. Molded Plastic: Not less than 3 inches square.

D. Quality Assurance/Control Submittals:
   1. Product Data: For each type of product indicated.
   2. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

Extent of surface systems and use zones for equipment.

Critical heights for playground surface, or fall heights for equipment.

3. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
4. Qualification Data: For Installer, manufacturer, testing agency.
5. Field quality-control test reports.

E. Closeout Submittals:
1. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.
2. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
1. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.

C. Testing Agency Qualifications: An independent agency qualified according to ANSI Z34.1 for testing indicated.

D. Safety Standards: Provide playground equipment complying with or exceeding requirements in the following:
1. ASTM F 1487.
2. CPSC No. 325.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify A/E at least two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without A/E's written permission.
3. Before excavating, contact utility-locator service for area where Project is located.

1.8 SEQUENCING

A. Coordinate construction of equipment use zones and fall heights during installation of playground equipment with installation of protective surfacing specified in Division 32 Section "Playground Surface Systems". Sequence work so protective surfacing can be installed immediately after concrete footings has set.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:

a. Structural Failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: Kompan. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

B. Comparable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. BCI Burke Company, Inc.
2. Columbia Cascade
3. GameTime, Inc.
4. Kompan
5. Landscape Structures, Inc.
6. Little Tikes Commercial Play Systems, Inc.
7. Miracle Recreation Equipment Co.; a division of PlayPower, Inc.
8. Olympic Recreation
9. Park Structures, Inc.
10. PlayDesigns
11. Playground Environments
12. Playland International, LLC
13. Playworld Systems, Inc.
14. Recreation Creations, Inc.
15. Play Mart, Inc.
16. Pinecraft.com
    a. Pirate Ship Play Structure (Ages 5-12)
        1) Model No. D119
    b. Pirate Ship Play Structure (Ages 2-5)
        1) Model No. Itty Bitty Collection Pirate Ship Play Set
17. KinzerBilt Woodworking
18. Approved Equal

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:
1. Steel Plates, Shapes, and Bars: ASTM A 36, hot-dip galvanized.
2. Steel Pipe: ASTM A 53 or ASTM A 135, standard-weight, hot-dip galvanized.
3. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed, hot-dip galvanized.
4. Steel Sheet: ASTM A 1011, hot-dip galvanized.
5. Perforated Metal: Steel sheet not less than 0.0747-inch uncoated thickness; hot-dip galvanized, manufacturer's standard perforation pattern.
6. Expanded Metal: ASTM F 1267, Type II (expanded and flattened), Class 1 manufacturer's standard carbon-steel sheets, hot-dip galvanized, deburred after expansion.

7. Woven Wire Mesh: Manufacturer's standard, with wire complying with ASTM A 510.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666; Type 304.

D. Chain and Fittings: ASTM A 467/A 467M, Class CS, 4/0 or 5/0, welded-straight-link coil chain; hot-dip galvanized. With commercial-quality, hot-dip galvanized steel connectors and swing or ring hangars.

E. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, Grade 32510, hot-dip galvanized.

F. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

G. Platform Clamps and Hangers: Cast aluminum.

H. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a secure and vandal-resistant design.

I. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or plated steel and iron, or stainless steel; permanently capped, and theft resistant

J. Wood: Species indicated, free of heart center.
   1. Robinia Wood.
   2. Wood for themed playground structures shall be No. 1 or better pressure-treated Southern Yellow Pine. Preservative treatment shall comply with AWPA requirements.

K. Opaque Plastic: Color impregnated, UV stabilized, and mold resistant.
   1. Polyethylene: Fabricated from virgin plastic resin; rotationally molded HDPE, LLDPE, or MDPE with not less than 1/4-inch wall thickness.

L. Transparent Plastic: Abrasion-resistant, UV-stabilized monolithic polycarbonate sheet; clear, colorless; not less than 3/16 inch thick.

M. Pressure-treated Southern Yellow Pine framing and decking.

N. Structure shall be designed for ages specified on drawings and furnished complete with all hardware, anchors, and accessories required for a complete installation.

2.3 PLAYGROUND EQUIPMENT FABRICATION

A. General: Provide sizes, strengths, thicknesses, wall thickness, and weights of components as indicated but not less than required to comply with structural performance and other requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structure, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required to comply with referenced standards for equipment indicated.
   1. Composite Play Structure: Provide complete play structure, designed to be modular, linked, and expandable, forming one integral unit for more than one play activity.

B. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing with cross-section profile and dimensions as indicated. Form metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
   1. Fabricate secondary frame members, bracing, and connections from either steel or aluminum. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange.
   2. Form simple and compound curves in bars and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
   3. Cut, drill, and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.
   4. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
   5. Comply with AWS recommended practices for shop welding and brazing. Weld and braze behind finished surfaces without distorting or discoloring exposed side. Clean exposed, welded, and brazed joints of flux, and dress exposed and contact surfaces.
   6. Provide weep holes where water may accumulate.

D. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap to receive finish hardware, screws, and similar items, unless otherwise indicated.

E. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

F. Composite Frame: Fabricate main-frame upright support posts from metal and plastic with profile and dimensions as indicated. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

G. Play Surfaces: Provide manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from wood plank made into floor units with slip-slip-resistant foot surfaces. Fabricate units in manufacturer's standard modular sizes and shapes to form assembled play surfaces indicated.

H. Elevated Play Surfaces: Guardrails or protective barriers completely surround elevated play surface except for access openings, if play-surface heights above protective surfacing exceed the following for use by age group indicated:
   1. Elevated surface greater than 20 inches intended for use by children aged 2 through 5.
   2. Elevated surface greater than 30 inches intended for use by children aged 5 through 12.

I. Stepped Play Surfaces: Provide manufacturer's standard infill between stepped platforms according to referenced standards and where indicated on Drawings.

J. Protective Barriers and Guardrails: Fabricate according to ASTM F 1487 and as follows:
   1. Welded metal pipe or tubing with vertical bars.
   2. Steel sheet with openings for vision and ventilation.
   3. Welded metal-pipe or -tubing frame with woven wire mesh infill panels.
   4. Solid plastic panels with openings.
   5. Vertical wood balusters with metal pipe or tubing or wood frame.

K. Handrails: Welded metal pipe or tubing, OD between 0.95 and 1.55 inches. Provide handrails at height for use by age group indicated below:
   1. Ages: Between 2 and 5 and 5 and 12 years.
   2. Height of Top Surface: 29 inches intended for use by children aged 2 through 5 and 38 inches intended for use by children aged 5 through 12.
   3. Close exposed ends of handrails with returns with clearance of 1/4 inch or less.

L. Roofs and Canopies: Manufacturer's standard wood.

M. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to upright support posts.

2.4 FREESTANDING SWINGS

A. Single-Post Swing Frame
   1. Subject to compliance with requirements

B. Configuration
   1. Two-bay swing frame
   2. Four swing positions total
   3. Freestanding design supported by single centerline posts

C. Materials
   1. Robinia wood, steel, aluminum recycled plastic, or combinations thereof as standard with the manufacturer.
   2. Swing frame fabricated from galvanized steel tubing.
   3. Support posts: 5-inch outside diameter galvanized steel tubing.
   4. Top rail and braces: Manufacturer's standard galvanized steel tubing.
   5. Hardware shall be corrosion resistant and tamper resistant.
   6. Provide stainless steel or galvanized swing hangers and attachment hardware.

D. Swing Seats
   1. Swing Seats as indicated on Drawings.
   2. ADA / Adaptive seat where indicated on Drawings.
   3. Chain suspension shall be galvanized steel with protective coating.

E. Finish
   1. Manufacturer's standard TGIC polyester powder-coat finish.
   2. Color as selected by Owner from manufacturer's standard colors.

F. Performance
   1. Provide complete swing assembly designed for commercial public playground use.
   2. Comply with ASTM F1487 requirements for public playground equipment.
   3. Comply with CPSC Public Playground Safety Handbook recommendations.

G. Accessories
   1. Swing hangers
   2. Chains
   3. Seats
   4. Hardware

5. Anchorages
6. Footing
7. All components required for complete installation.

2.5 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" to produce normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch- maximum-size aggregate.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Baked-Enamel Finish: Prepare, treat, and coat metal to comply with paint manufacturer's written instructions and as follows:
1. Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness not less than 1.5 mils, medium gloss.

B. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 80 mils.

C. Color: As selected by Architect from manufacturer's full range.

2.8 IRON AND STEEL FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled-, pressed-, and forged-steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.
1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153.
2. Galvanized Steel Sheet: Commercial steel sheet, hot-dip galvanized, complying with ASTM A 653 for not less than G60 coating designation; mill phosphatized.

B. Powder-Coat Finish: Prepare, treat, and coat ferrous metal to comply with resin manufacturer's written instructions and as follows:
1. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.

C. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 80 mils.

D. Color: [Refer to "List of Finishes"] [As selected by Architect from manufacturer's full range].

2.9 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish on exposed faces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance.
   1. Do not begin installation before final grading required for placing protective surfacing is completed, unless otherwise permitted by Architect.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
   1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.
   1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
   2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.
   3. Concrete Footings: Smooth top, and shape to shed water.

3.4 FREESTANDING SWINGS

A. Installation
   1. Install swing frames in accordance with manufacturer's written instructions.
   2. Install posts plumb and true within cast-in-place concrete footings.

3. Install swing chains, hangers, and seats after concrete has achieved required design strength.
4. Verify required use zones and clearances are maintained.
5. Coordinate installation with playground surfacing requirements.
6. Verify all swing bearings, hangers, connectors, and fasteners operate properly and are securely installed.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Arrange for playground equipment manufacturer's technical personnel to inspect playground and playground equipment and components during installation and] at final completion and to certify compliance with the following:
   1. ASTM F 1487.
   2. CPSC No. 325.C.Retain paragraph below if Architect or Owner wants to be present during final inspection.

C. Notify Owner 48 hours in advance of date and time of final inspection.

END OF SECTION

SECTION 129300 - SITE FURNISHINGS AND AMENITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Seating.
   2. Tables.
   3. Bicycle Racks / Storage Locker
   4. Trash Receptacles.
   5. Charcoal Grill
   6. Prefabricated Wooden Garden Planters.
   7. Bollards
      7.1 Concrete Core Bollards
      7.2 Solar Powered

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for installation of pipe sleeves cast or anchor bolts cast in concrete footings.
   2. Division 31 Section "Earth Moving" for excavation for installation of concrete footings.

1.3 SUBMITTALS

A. Samples for Initial Selection: For units with factory-applied color finishes.

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Size: Not less than 6-inch- long linear components and 4-inch- square sheet components.

C. Quality Assurance/Control Submittals
   1. Product Data: For each type of product indicated.
   2. Material Certificates: For site furnishings, signed by manufacturers.

D. Closeout Submittals
   1. Maintenance Data: For site furnishings to include in maintenance manuals.

1.4 WARRANTY

A. Pergola:
   1. Strucutral Warranty shall be a minimum of 5-years against structural failure.
   2. Finish Warranty shall be 1-year against peeling, blistering, or excessive fading.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
   1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211.
   2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221.
   3. Structural Pipe and Tube: ASTM B 429.
   4. Sheet and Plate: ASTM B 209.
   5. Castings: ASTM B 26.

B. Steel and Iron: Free of surface blemishes and complying with the following:
   1. Plates, Shapes, and Bars: ASTM A 36.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53, or electric-resistance-welded pipe complying with ASTM A 135.
   3. Tubing: Cold-formed steel tubing complying with ASTM A 500.
   4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011 and complying with dimensional tolerances in ASTM A 500; zinc coated internally and externally.
   5. Sheet: Commercial steel sheet complying with ASTM A 1011.
   6. Perforated Metal: From steel sheet not less than 0.0897-inch nominal thickness; manufacturer's standard perforation pattern.
   7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
   8. Malleable-Iron Castings: ASTM A 47, grade as recommended by fabricator for type of use intended.
   9. Gray-Iron Castings: ASTM A 48, Class 200.

C. Stainless Steel: Free of surface blemishes and complying with the following:
   1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
   2. Pipe: Schedule 40 steel pipe complying with ASTM A 312.
   3. Tubing: ASTM A 554.
   4. Concealed connectors where possible, exposed hardware to be decorative or architecturally finished.

D. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
   1. Wood Species:
      a. Pine: Southern pine; No. 2 or better; preservative treated, kiln dried after treatment rated for ground contact.
      b. Red Cedar: Select Grade or better.
      c. Finish: Manufacturer's standard transparent wood preservative treatment and sealer.

E. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant, or concealed, recessed, and capped or plugged. Provide one of the following:
   1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on-grade substrate; one per leg, unless otherwise noted.
   2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit.
   3. Heavy-Duty steel post bases or concealed anchoring systems.
      a. Anchored to concrete footings or slabs with stainless steel or galvanized anchor bolts.

F. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

G. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
   1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
   2. Hot-Dip Galvanizing: According to ASTM A 123, ASTM A 153, or ASTM A 924.

H. Bollard Shell
   1. ASTM A53 Schedule 40 Steel Pipe
   2. Nominal diameter: 6 inches unless otherwise indicated
   3. Height above finished grade: 36 to 42 inches.
   4. Pipe wall thickness as required to withstand anticipated impact loads.

I. Core Fill
   1. Concrete fill: Minimum 3,000 psi compressive strength

J. Top Cap
   1. Fully welded steel cap, factory fabricated to prevent water infiltration.

K. Finish
   1. Hop-dip galvanized after fabrication or zinc-rich primer with exterior powder-coat finish.
   2. Color as selected by Owner from manufacturer's standard color chart.

L. Concealed connectors where possible, exposed hardware to be decorative or architecturally finished.

2.2 BENCHES, TABLES, TRASH RECEPTACLES, BIKE RACKS, AND BOLLARDS

A. New benches, tables, trash receptacles, and bike racks as indicated.

B. Benches: Bench with a solid wood slat pattern and surface mounting. The color selection is by Architect from the manufacturers standard color chart.
   1. Subject to conformance with requirements, provide one of the following:
      a. Du-Mor, Mifflintown, Pennsylvania
         1) 6 foot bench with back, Model No. 98-631
         2) 8 foot bench with back, Model No. 98-831
      b. Victor Stanley, Dunkirk, Maryland
         1) 6 foot bench with back, Model No. PRS-10
         2) 8 foot bench with back, Model No. PRS-10
      c. Wabash Valley, Silver Lake, Indiana
         1) 6 foot bench with back, Model No. CTR-6
         2) 8 foot bench with back, Model No. CTR-8
      d. Uline, Pleasant Prairie, Wisconsin
         1) 6 foot bench with back, Model No. H-6570

C. 8 foot bench with back, Model No. H-867Tables: 60-72" rectangular table with seats on two sides, except accessible tables as shown on plans, with a wood solid slat pattern and surface mounting. The color selection is by Architect from the manufacturers standard color chart.
   1. Subject to conformance with requirements, provide one of the following:
      a. Du-Mor, Mifflintown, Pennsylvania
         1) 6' Wood Slat Picnic Table, IPE, Model No. 298-60-2I
      b. Victor Stanley, Dunkirk, Maryland
         1) 6' Wood slat picnic table, IPE, Model No. pt-2Wabash Valley, Silver Lake, Indiana
         2) 6' Wood slat picnic table, IPE, Model No. Courtyard / Urbanscape

D. Trash Receptacles: 28-36 gallon capacity receptacle with wood solid slat pattern and surface mounting. The color selection is by Architect from the manufacturers standard color chart.
   1. Subject to conformance with requirements, provide one of the following:
      a. Du-Mor, Mifflintown, Pennsylvania
         1) Model No. 272-I
      b. Victor Stanley, Dunkirk, Maryland
         1) Model No. REN-36, standard lid
      c. Wabash Valley, Silver Lake, Indiana
         1) Model Nos. Woodridge Collection
      d. Uline, Pleasant Prairie, Wisconsin
         1) Model No. H-2889BR

E. Charcoal Grills: Commercial grade, permanent-mount, heavy-duty steel firebox and grate assembly and integral pedestal post and required accessories with tilt-back capability for loading charcoal and cleaning.
   1. Firebox
      a. Minimum 3/16 inch steel plate, formed and welded.
   2. Cooking Grate:
      a. Solid steel bar grate, welded both sides for durability.
      b. Multi-level height adjustment
   3. Pedestal Post:
      a. Heavy-duty steel pipe pedestal designed for permanent mounting.
   4. Finish:
      a. High-temperature, corrosion-resistant coating or powder coat.
   5. Subject to conformance with requirements, provide one of the following:
      a. R.J. Thomas Mfg. Co., Inc. / Pilot Rock
         1) Model No. N-Series
      b. Du-Mor
         1) Model No. 21
      c. Wabash Valley
         1) Model No. GR101N

F. Single Loop Bike Rack
   1. Frame: Galvanized steel.
      a. Pipe or Tubing OD: Not less than 1-5/8 inches.
      b. Locking Bars: Solid round bar, not less than 3/4 inch in diameter.
      c. Subject to compliance with requirements, provide one of the following:
         1) Du-Mor, Mifflintown, Pennsylvania
            (a) Model No. 83-00G/S-2
         2) Victor Stanley, Dunkirk, Maryland

(a) Model No. BRWS-101

3) Wabash Valley, Silver Lake, Indiana

(a) Model No. BRH539I

G. Bicycle Storage Locker

1. General: Two-door, two-compartment all weather storage locker
2. Entry Doors: Two Doors
3. Standalone
4. Stacking: Single-Tier
5. Door Lock: Swing-Handle that allows for first-come, first-served basis where cyclist secures bike in the locker with their own padlock or U-lock.
6. Color: As selected by Owner from Manufacturer's standard color chart.

i. CycleSafe, Inc., Grand Rapids, Michigan

1. Model No. ProPark Standard Model

ii. AmeriBike, Ventura, California

1. Model No. 302

iii. Dero, Minneapolis, Minnesota

1. Model No. D2

2.3 PREFABRICATED WOODEN GARDEN PLANTERS

A. Prefabricated Wooden Garden Planters

1. Composition and Materials: Original Natural Cedar Raised Garden Bed
2. Size: 4 feet wide by 8 feet long by 10 – 18 inches in height

a. Greenes Fence

1) Model No. RC6T21B

b. Gardener's Supply Company, Vermont, USA

1) Model No. 12387

c. Eden, USA

1) Model No. RGB-4818

2.4 SOLAR BOLLARDS

A. Provide solar-powered architectural bollards for pedestrian pathways, plazas, trail systems, and site circulation areas.

B. General

1. Integrated photovoltaic panel, battery, controls, and LED luminaire contained within a single bollard assembly.
2. Entirely off-grid operation.
3. Automatic dusk-to-dawn operation.
4. Surface-mounted configuration.

C. Manufacturer's – Subject to conformance with requirements, provide one of the following:

1. Landscape Forms

a. Annapolis Smart Bollard

2. Functional Lighting Technologies (FLT)

a. PLB Architectural Solar Bollard

3. Fonroche Lighting America (Nowatt Collection)

a. FOLLOW Solar Bollard

4. Approved Equal

D. Physical Characteristics

1. Nominal bollard diameter: 6 inches or as indicated on Drawings.
2. Height above finished grade: 33 to 39 inches or as indicated on Drawings.
3. Housing:
   a. Cast aluminum or extruded aluminum construction.
   b. Architectural powder-coat finish.
4. Color
   a. As selected by Owner from manufacturer's standard color chart.

E. Lighting Performance

1. Integrated LED light source
2. Full-cutoff or controlled-distribution optics.
3. Minimum LED life: 50,000 hours.
4. Rechargeable lithium-ion or LiFePO4 battery system.
5. Intelligent energy management system maintaining dusk-to-dawn operation.

F. Mounting

1. Furnish manufacturer's standard surface-mounted base assembly.
2. Stainless steel or galvanized anchor hardware.
3. Install on concrete foundation or slab in accordance with manufacturer's recommendations.

2.5 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Factory-applied exterior-grade penetrating stain, sealer, semi-transparent, or solid finish.
   1. Color as selected by owner from manufacturer's standard color chart.
   2 UV-resistant and mildew-resistant formulation

2.7 STEEL AND GALVANIZED STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.8 MOUNTING

A. Surface-mounted configuration as indicated on Drawings.

B. Provide welded base plate and anchor bolts designed for concrete installation.

C. Anchors shall be stainless steel or hot-dip galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.E.

E. Surface-mounted site furnishings shall be installed in accordance with the manufacturer's written instructions using the hardware provided. Position the unit in its final location, verify alignment and required clearances, and mark anchor hole locations on the paving surface. Drill holes to the diameter and depth specified by the manufacturer, clean debris from holes, and install the furnished anchors (typically stainless steel or galvanized concrete expansion anchors). Place the unit, insert anchors through the mounting plates, and tighten to the manufacturer's recommended torque. Ensure that all mounting points are fully engaged, the unit is rigidly secured, and no rocking or movement occurs. Touch up any marred finishes per manufacturer's recommendations.

3.3 CLEANING AND MAINTENANCE REQUIREMENTS

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

B. Provide manufacturer's recommendations for cleaning, resealing, and refinishing.

C. Identify expected maintenance cycle for wood finish based on exposure conditions.

END OF SECTION

SECTION 133440 - SITE SHELTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Examine contract documents for requirements that affect work of this section.

1.2 SUMMARY

A. This Section includes prefabricated metal shelter with concrete foundations and slab.

B. Related Sections include the following:
1. Division 3 Section "Cast-In-Place Concrete."

1.3 REFERENCES

A. American Institute of Steel Construction (AISC).

B. American Iron and Steel Institute (AISI) Specifications for Cold Formed Members.

C. American Society of Testing of Materials (ASTM).

D. American Welding Society (AWS).

E. Steel Structures Painting Council (SSPC-SP2) as outlined in AISC 6.5.

1.4 SYSTEM DESCRIPTION

A. Design Loads:

1.	Roof Snow Load (Pavilion):		
	a.	Ground Snow Load P_g:	14 PSF
	b.	Flat-Roof Snow Load, P_f:	10 PSF
	c.	Snow Exposure Factor, C_e:	1.0
	d.	Snow Load Importance Factor, I_s:	1.0
	e.	Thermal Factor, C_t:	1.2
	f.	Slope Factor(s), C_s:	1.0
2.	WND Design Data (Pavilion):		
	a.	Basic Design SND Speed (3-Second Gust), V:	110 MPH
	b.	Allowable Stress Design WND Speed, V_{asd}	85 MPH
	c.	RISK Category:	II
	d.	WND Exposure Category:	C
3.	Earthquake Design Data:		
	a.	Risk Category:	II
	b.	Seismic Importance Factor, I_e:	1.0
	c.	Mapped Spectral Response Acceleration	$S_s = 0.38$
	d.	Parameters:	$S_1 = 6.11$
	e.	Site Soil Class:	D
	f.	Design Spectral Response Acceleration:	$S_{DS} = 0.29$
	g.	Parameters:	$S_{D1} = 0.15$
	h.	Seismic Design Category:	C

B. Delegated Design: Provide signed and sealed calculations and drawings prepared by a professional engineer licensed in the State where the project is to be constructed.
   1. For Wood Shelters, design shall include all wood framing members, connectors, anchorage devices, and required structural attachments resisting gravity, wind, seismic, and uplift loads indicated in Contract Documents

C. The pre-engineered package shall be shipped as a pre-cut and pre-fabricated package that shall include the structural frame members, roof material, fasteners, trim and installation instructions. The structure shall be shipped in knocked down for minimum shipping charges. Field labor will be kept to a minimum by pre-manufactured parts. No onsite welding will be required. Connection bolts shall be concealed within the tubing where possible.

1.5 SUBMITTALS

A. Product Data:
   1. Manufacturer's product literature for pavilion structure, roofing system, hardware, connection components, and accessories.
   2. Installation instructions and maintenance recommendations.
   3. Manufacturer's standard finish and color selection.

B. Shop Drawings
   1. Submit shop drawings showing:
      a. Plan layout
      b. Roof Configuration and pitch
      c. Overall dimensions and clearances
      d. Post locations and sizes
      e. Framing members and connection details
      f. Roof overhangs and trim details
      g. Anchorage requirements and foundation interface
   2. Indicate all field – installed accessories and optional components shown on the drawings.

C. Structural Calculations
   1. Submit structural calculations prepared, signed, and sealed by a Professional Engineer licensed in the state where the project is located.
   2. Calculations shall verify compliance with project design loads, applicable building code requirements, and local permitting requirements.
   3. Include reactions, anchorage requirements, and foundation design criteria required for the pavilion structure.

D. Samples
   1. Submit manufacturer's available wood finish, stain, paint, roofing, and trim color samples for selection by Landscape Architect.

E. Certificates
   1. Certificate verifying pressure-treated lumber complies with applicable AWPA treatment standards.
   2. Certification that hardware and connectors are suitable for contact with preservative-treated wood.

F. Closeout Submittals
   1. Manufacturer's maintenance instructions
   2. Warranty documentation
   3. Final engineered drawings, if revised from approved submittal documents.

G. Delegated Design Submittals
   1. Submit signed and sealed engineering drawings and calculations for complete structural system.
   2. Design shall include all framing members, connection hardware, anchorage systems, and uplift resistance requirements.

1.6 QUALITY ASSURANCE

A. Provide evidence of commitment of quality craftsmanship as demonstrated by the following:
   1. Supplier Qualifications:
      a. The product shall be designed and produced at a facility owned and directly supervised by the supplier. The product shall be shipped from a single source.
      b. The supplier shall have been making steel frame pre-manufactured shelters for a minimum of five years and list three similar projects in the territory.
      c. Membership in American Institute of Steel Construction.
      d. Membership in American Welding Society.
      e. Full-time, on-staff licensed engineer.
      f. Full-time, on-staff quality control manager.
      g. Published quality assurance manual.
      h. Full-time, on-staff AWS certified welding inspectors.
   2. Certifications:
      a. Welder certificates and AWS welding inspector certificates.

1.7 DELIVERY AND STORAGE

A. Unload materials with necessary equipment (no hand unloading), store covered out of weather, and keep out of direct sun. Inspect parts within 48 hours of delivery, compare with manufacturer's bill of material, and report any missing or non-conforming parts to manufacturer within this time.

1.8 WARRANTY

A. Supply manufacturer's standard five-year warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Manufacturers:
   1. Superior Shelter (Basis of Design)
   2. Poligon.
   3. MRC Recreation
   4. Amish Wholesale Gazebos, Cody, Wyoming
   5. RCP Shelters, Inc.
   6. Approved Equal

B. Size & Dimensions:
   1. Size: As indicated in drawings.
   2. Height: As indicated in drawings.
   3. Shape: As indicated in drawings.

2.2 MATERIALS

A. Structural framing: structural steel tube minimum ASTM A500 Grade B or cold formed box sections minimum ASTM A570 Grade 55. "I" beams, tapered columns, open channels, or wood products shall not be accepted.

B. Compression ring: structural channel or welded plate minimum ASTM A36.

C. Fasteners: ASTM A325 structural bolts, ASTM A307 anchor bolts, self tapping screws, rivets.

D. Metal Roofing: 24-gauge galvalume factory finished with Kynar 500 paint system or powder coat. Ribs shall be manufacture standard ribs 1-3/16-inch high, 12 inches on center. Panels shall be 3 feet wide, and angles shall be factory cut. Ribs shall run with the pitch of the roof for proper drainage.
   1. Color:
      a. Top Side: As indicated in drawings.
      b. Underside: As indicated in drawings.

E. Metal roofing trim shall match the color of the roof, and shall be formed from 26-gauge painted galvalume steel as follows:
   1. Panel end caps shall be prebent to a "U" shape to fit over ridge end-of-roof panels. The inside of the "U" shall match the roof color.
   2. Ridge caps shall be preformed metal strips with a single central bend to match the roof pitch. They shall be hemmed on the sides. A preformed metal roof cap shall be supplied.
   3. "J" channel shall be shaped like a "J" with colored metal on the outside wrapped around 20-gauge galvanized core material. "J" channel shall be applied all along the eave to strengthen and straighten the eave. Both colored metal and galvanized core shall have 7/16-inch weep holes 6 inches on center.
   4. Eave splice channels shall be provided to fit behind "J" channel butt joints to create strength at the joint and maintain a straight eave line.
   5. Special "J" channel corner trim shall be provided which fits over the main "J" channel to simplify final detailing of corners.

F. Structural Lumber
   1. Pressure-treated Southern Yellow Pine complying with applicable grading rules of the Southern Pine Inspection Bureau (SPIB).
   2. All lumber shall be preservative treated for exterior exposure in accordance with AWPA standards.
   3. Posts: Solid core pressure-treated Southern Yellow Pine, nominal 5-inch by 5-inch minimum, unless otherwise indicated on Drawings.
   4. Headers, beams, rafters, blocking, and framing members shall be manufacturer's standard members designed for project loading requirements.

G. Roof Structure
   1. Four-sided hipped roof configuration unless otherwise indicated on Drawings.
   2. Roof pitch as indicated on Drawings.
   3. Rafters, ridge framing, and connection details shall be manufacturer's engineered standard design.

H. Roofing
   1. Architectural asphalt shingles, manufacturer's standard color, unless otherwise indicated.
   2. Roofing underlayment and accessories as required by manufacturer for a complete weather-resistant installation.
   3. Alternate roofing materials, if indicated on Drawings, may include:
      a. Exposed-fastener metal roofing

b. Standing-seam metal roofing
c. Cedar shake roofing
d. Synthetic slate roofing

I. Hardware and Fasteners
1. Manufacturer's complete hardware package required for assembly.
2. Hot-dip galvanized steel fasteners, connectors, bolts, screws, and brackets suitable for use with preservative-treated lumber.
3. Stainless steel fasteners where indicated on Drawings
4. Anchor brackets and anchor bolts furnished by manufacturer for attachment to concrete footings or slab.

J. Decorative Components
1. Decorative post base covers, manufacturer's standard.
2. Decorative wood braces and trim as indicated on Drawings.

K. Finishes
1. Pressure-treated lumber may be left natural or field-finished.
2. Stain or paint color shall be as selected by Owner from manufacturer's standard colors.

L. Concrete: Refer to specification section 033000 Cast-in-Place Concrete.

2.3 FABRICATION

A. All base plates, stiffener plates, U-clips, and end plates shall be factory welded into place and bolt connection holes shall be factory cut.

B. Welded connections shall be made by certified welders in accordance with AWS Specifications and be supervised by an AWS certified welding inspector.

C. Factory Frame Finish:
1. Kynar 500 or powder coat.
2. Color: As indicated in drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The shelter shall be set on prepared footings or concrete slab. Foundation will be constructed to local codes and good construction practices for the specific site conditions. The structure shall be attached to the top of the concrete by use of stainless steel epoxy anchor bolts furnished by the manufacturer. Anchor bolts shall be inside the column if applicable.

B. Before installing roof deck, clean steel and touch up primer as needed. Apply two coats weather resistant paint per recommendation of local paint supplier.

C. Verify dimensions, locations, elevations, and readiness of concrete foundations prior to installation.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

E. Verify anchor bolt locations and foundation tolerances comply with manufacturer's requirements.

F. Install pavilion in accordance with manufacturer's written instructions, approved shop drawings, and engineered details.

G. Assemble all framing, roof structure, hardware, and accessories plumb, level, square, and true.

H. Anchor pavilion posts to concrete foundations using manufacturer-supplied brackets, anchor bolts, and attachment hardware.

I. Tighten all fasteners securely and adjust components for proper alignment.

J. Install roofing materials in accordance with roofing manufacturer's published installation requirements.

K. Field-cut materials only as required for fitting and installation. Treat exposed cuts in preservative-treated lumber with preservative solution recommended by lumber manufacturer.

L. Replace damaged materials prior to Substantial Completion

3.2 FIELD QUALITY CONTROL

A. Inspect complete pavilion for alignment, structural integrity, and compliance with approved shop drawings.

B. Verify all hardware is securely fastened and all connections are complete.

C. Correct deficiencies and replace damaged components at no additional cost to Owner.

3.3 CLEANING AND PROTECTION

A. Remove packaging materials, excess fasteners, and construction debris from site.

B. Clean installed work to like-new condition.
   1. Clean exposed wood and roofing surfaces of dirt, markings, and stains resulting from installation.

C. Protect installed products from damage until completion of project.

D. Touch-up, repair, or replace damaged finishes, lumber, roofing, and accessories before Substantial Completion. Touch up paint provided by manufacturer.

END OF SECTION

SECTION 220500 - BASIC PLUMBING MATERIALS AND METHODS

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. Section includes the following basic plumbing materials and methods to complement other plumbing sections.
   1. Non-shrink grout for equipment installations.
   2. Fire stopping.
   3. Installation requirements common to equipment specification sections.
   4. Touchup painting and finishing.
   5. Concrete equipment base construction requirements.

B. See individual piping sections for pipe and pipe fitting materials.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, 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.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Prepare coordination drawings of Mechanical Rooms to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:
   1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
      a. Planned piping layout, including valve and specialty locations and valve stem movement.
      b. Planned duct systems layout, including elbow radii and duct accessories.
      c. Clearances for installing and maintaining insulation.

d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
e. Equipment service connections and support details.
f. Exterior wall and foundation penetrations.
g. Fire-rated wall and floor penetrations.
h. Sizes and location of required concrete pads and bases.

2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting plumbing and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

B. Coordinate all electrical service requirements for plumbing equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 26. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.

C. Coordinate the 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 plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where plumbing items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 GROUT

A. Nonshrink, 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-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.2 FIRE STOPPING

A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, provide products by one of the following:
   1. Dow Corning Corp.
   2. 3M Corporation
   3. General Electric Co.
   4. Standard Oil Engineered Materials Co.
   5. Hilti, Inc.
   6. Tremco Corp.

PART 3 - EXECUTION

3.1 GROUTING

A. Install nonmetallic nonshrink grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.2 FIRESTOPPING

A. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials

3.3 COMMON INSTALLATION REQUIREMENTS

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of plumbing systems. Indicated locations and arrangements were used to size ductwork and pipe; and calculate friction loss, expansion, pump sizing, and other design considerations. Install ductwork and piping as indicated, except where deviations to layout are approved on coordination drawings.

B. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

E. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Install equipment giving right-of-way to piping systems installed at a required slope.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   7. Use 3000-psi, 28-day compressive strength concrete with 6 x 6 x #10 reinforcing wire mesh.
   8. Outdoor concrete bases shall extend a minimum of 4" above grade and be a minimum thickness of 6".

END OF SECTION

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

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. Section Includes:
1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2.4 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. 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.
   3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

B. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

C. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section "Sheet Metal Flashing and Trim."

D. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

E. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

F. Using grout, seal the space around outside of stack-sleeve fittings.

G. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Exterior Concrete Walls below Grade:
   1. Cast-iron wall sleeves. Foam core not allowed.

B. Concrete Slabs-on-Grade:
   1. Cast-iron wall sleeves with sleeve-seal system. Foam core not allowed.
      a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

C. Concrete Slabs above Grade:
   1. Piping Smaller Than NPS 6: Schedule 40 PVC pipe sleeves. Foam core not allowed.

D. Interior Partitions:

1. PVC-pipe sleeves. Foam core not allowed.

END OF SECTION

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

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. Section Includes:
1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, split-casting brass type with polished, chrome-plated finish.
      c. Insulated Piping: split-plate, stamped-steel type with concealed hinge.
      d. Bare Piping in Finished and Unfinished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

   2. Escutcheons for Existing Piping:
      a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
      b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
      c. Bare Piping in Finished and Unfinished Spaces: Split-casting brass type with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. New Piping: One-piece, floor-plate type.
   2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

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. Section Includes:
1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.

B. Related Sections:
1. Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Section "Domestic Water Piping" for water meters inside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Trerice, H. O. Co.
   b. Weiss Instruments, Inc.
   c. Weksler Instruments Corp.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Back angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.

7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:
   1. Standard: ASME B40.200.
   2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
   3. Material for Use with Copper Tubing: CNR.
   4. Type: Stepped shank unless straight or tapered shank is indicated.
   5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
   6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
   7. Bore: Diameter required to match thermometer bulb or stem.
   8. Insertion Length: Length required to match thermometer bulb or stem.
   9. Lagging Extension: Include on thermowells for insulated piping and tubing.
   10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMETEK, Inc.; U.S. Gauge.
      b. Ashcroft Inc.
      c. Weiss Instruments, Inc.
      d. WIKA Instrument Corporation - USA.
      e. Winters Instruments - U.S.

   2. Standard: ASME B40.100.
   3. Case: Liquid-filled; 4-1/2-inch nominal diameter.
   4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
   5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
   6. Movement: Mechanical, with link to pressure element and connection to pointer.
   7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
   8. Pointer: Dark-colored metal.
   9. Window: Glass.
   10. Ring: Metal.
   11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMETEK, Inc.; U.S. Gauge.
      b. Ashcroft Inc.
      c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Sealed; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball with NPS 1/4, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
2. Miljoco Corporation.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Inlets and outlets of each domestic water heat exchanger.
   3. Inlet and outlet of each domestic hot-water storage tank.

L. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Test plug with EPDM self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Test plug with EPDM self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
   1. Liquid-filled, bimetallic-actuated type.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 120 deg F.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:
   1. Liquid-filled direct-mounted, metal case.
   2. Test plug with EPDM self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
   1. Liquid-filled direct -mounted, metal case.
   2. Sealed, direct -mounted, plastic case.
   3. Test plug with EPDM self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
   1. Liquid-filled direct-mounted, metal case.
   2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

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. Section Includes:
1. Brass ball valves.
2. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
   1. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

   1. Include 2-inch stem extensions.
   2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. One-Piece, Brass Ball Valves:
   1. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 400 psig.
      c. Body Design: One piece.
      d. Body Material: Forged brass or bronze.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Brass or stainless steel.
      h. Ball: Chrome-plated brass or stainless steel.
      i. Port: Reduced.

B. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. American Valve, Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Stockham Valves.
      d. Hammond Valve.
      e. Kitz Corporation.
      f. Milwaukee Valve Company.
      g. NIBCO INC.
      h. Red-White Valve Corporation.
      i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Brass.

h. Ball: Chrome-plated brass.
i. Port: Full.

2.3 BRONZE BALL VALVES

A. One-Piece, Bronze Ball Valves with Bronze Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by the following
   a. Conbraco Industries, Inc.; Apollo Valves.
   b. NIBCO INC.
   c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

B. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded and soldered.
   f. Seats: PTFE.
   g. Stem: Bronze or brass.
   h. Ball: Chrome-plated brass.
   i. Port: Full.

C. Two-Piece, Bronze Ball Valves with Regular Port and Bronze or Brass Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Conbraco Industries, Inc.; Apollo Valves.
   b. DynaQuip Controls.
   c. Hammond Valve.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.

f. Seats: PTFE.
g. Stem: Bronze or brass.
h. Ball: Chrome-plated brass.
i. Port: Regular.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
   3. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

2. One piece, brass ball valve.
3. One piece, bronze ball valve with bronze trim.
4. Two-piece, brass ball valves with full port and brass trim.
5. Two-piece, bronze ball valves with full port and bronze trim.

B. Pipe NPS 2-1/2 and Larger:
1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Class 150, steel ball valves with full port.
3. Class 125, iron ball valves.

END OF SECTION

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

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. Section Includes:
1. Bronze lift check valves.
2. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
1. Certification that products comply with NSF 6161 Annex Gand NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from a single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   4. ASME B16.18 for solder joint.
   5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 61 Annex G and NSF 372for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Valves.
   2. Description:
      a. Standard: MSS SP-80, Type 1.
      b. CWP Rating: 200 psig.
      c. Body Design: Vertical flow.
      d. Body Material: ASTM B 61 or ASTM B 62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.
      f. Disc: Bronze.

2.3 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. American Valve, Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Jenkins Valves.
      d. Crane Co.; Crane Valve Group; Stockham Valves.
      e. Kitz Corporation.
      f. The Macomb Groups.
      g. Milwaukee Valve Company.
      h. NIBCO INC.
   2. Description:
      a. Standard: MSS SP-80, Type 3.
      b. CWP Rating: 300 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B 62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.

f. Disc: Bronze.

B. Class 250, Iron Swing Check Valves with Metal Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Valves.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-71, Type I.
b. CWP Rating: 500 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.4 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Valves.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged or threaded. See valve schedule articles.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed exterior lever and weight.

2.5 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Anvil International; a subsidiary of Mueller Water Products, Inc.
b. Shurjoint Piping Products.
c. Tyco Fire Products LP; Grinnell Mechanical Products.
d. Victaulic Company.
2. Description:
a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.

c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
1. Pump-Discharge Check Valves:
a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
   3. For Copper Tubing, NPS 5 and Larger: Flanged.
   4. For Steel Piping, NPS 2 and Smaller: Threaded.
   5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
   6. For Steel Piping, NPS 5 and Larger: Flanged.
   7. For Grooved-End Copper Tubing Grooved.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:
   1. Vertical, Upflow Applications Only: Bronze lift check valves, Class 125, bronze disc with threaded end connections.
   2. Horizontal and Vertical Applications: Bronze swing check valves, Class 150, bronze disc with threaded end connections.

3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves, Class 150, bronze disc with threaded end connections.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe positioning systems.
7. Equipment supports.

B. Related Sections:
1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.

f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Galvanized or alternate rust preventing shop coating. Paint coating with two coats primer and one coat enamel.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anvil International; a subsidiary of Mueller Water Products Inc.
b. Empire Industries, Inc.
c. ERICO International Corporation.
d. Haydon Corporation; H-Strut Division.
e. NIBCO INC.
f. PHD Manufacturing, Inc.
g. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: galvanized or alternate rust preventing shop coating.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturers. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
      b. NPS 4: 12 inches long and 0.06 inch thick.
   5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems] and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
   17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
   18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
   8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to be included in maintenance manuals.

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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
   1. Stencil Material: Aluminum .
   2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: Approximately 4 by 7 inches.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed 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 inaccessible 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 along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:
   1. Domestic Water Piping:
      a. Background Color: Green.
      b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; 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 subparagraphs:
   1. Valve-Tag Size and Shape:
      a. Cold Water: 1-1/2 inches, round.
      b. Hot Water: 1-1/2 inches, round.
      c. Low-Pressure Compressed Air: 1-1/2 inches, round.
      d. High-Pressure Compressed Air: 1-1/2 inches, round.
   2. Valve-Tag Color:
      a. Cold Water: Natural.
      b. Hot Water: Natural.
   3. Letter Color:
      a. Cold Water: Black.
      b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 220719 - PLUMBING PIPING INSULATION

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. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
   1. Section "Plumbing Equipment Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pittsburgh Corning Corporation; Foamglas.
      b. Cell-U-Foam Insulation.
      c. Manville.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.

6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Aeroflex USA, Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; SoftTouch Duct Wrap.
      b. Johns Manville; Microlite.
      c. Knauf Insulation; Friendly Feel Duct Wrap.
      d. Manson Insulation Inc.; Alley Wrap.
      e. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fibrex Insulations Inc.; Coreplus 1200.
      b. Johns Manville; Micro-Lok.
      c. Knauf Insulation; 1000-Degree Pipe Insulation.
      d. Manson Insulation Inc.; Alley-K.
      e. Owens Corning; Fiberglas Pipe Insulation.
   2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
   1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive 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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Aeroflex USA, Inc.; Aeroseal.
      b. Armacell LLC; Armaflex 520 Adhesive.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
      d. K-Flex USA; R-373 Contact Adhesive.
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive 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."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
      b. Eagle Bridges - Marathon Industries; 225.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
      d. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive 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."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
      b. Eagle Bridges - Marathon Industries; 225.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
      d. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive 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."

F. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Dow Corning Corporation; 739, Dow Silicone.
      b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
      c. P.I.C. Plastics, Inc.; Welding Adhesive.
      d. Speedline Corporation; Polyco VP Adhesive.
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive 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."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
      b. Eagle Bridges - Marathon Industries; 501.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
      d. Mon-Eco Industries, Inc.; 55-10.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
   3. Service Temperature Range: 0 to 180 deg F.
   4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
   5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
      b. Eagle Bridges - Marathon Industries; 570.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
   2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
   3. Service Temperature Range: Minus 50 to plus 220 deg F.
   4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
   5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
      b. Eagle Bridges - Marathon Industries; 550.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
      d. Mon-Eco Industries, Inc.; 55-50.
      e. Vimasco Corporation; WC-1/WC-5.
   2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg F.
   4. Solids Content: 60 percent by volume and 66 percent by weight.
   5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
   1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
      b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
      c. Vimasco Corporation; 713 and 714.
   3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
   4. Service Temperature Range: 0 to plus 180 deg F.
   5. Color: White.

2.6 SEALANTS

A. Joint Sealants:
   1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following :
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
      b. Eagle Bridges - Marathon Industries; 405.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Pittsburgh Corning Corporation; Pittseal 444.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Permanently flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 100 to plus 300 deg F.
   5. Color: White or gray.
   6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   7. Sealants 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."

B. FSK and Metal Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
      b. Eagle Bridges - Marathon Industries; 405.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
      d. Mon-Eco Industries, Inc.; 44-05.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 40 to plus 250 deg F.
   5. Color: Aluminum.
   6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants 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. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants 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."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper; fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

2.11 SECUREMENTS

A. Bands:
1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy; 0.062-inch soft-annealed, stainless steel; or 0.062-inch soft-annealed, galvanized steel.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
   1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
   1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

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.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install 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 2 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of cellular-glass insulation to valve body.
   2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of 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 same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of 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. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch 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 o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section "Exterior Painting" and Section "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 1 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1/2 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 3/4 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
   2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Domestic Chilled Water (Potable):
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: [**1/2 inch**] [**3/4 inch**] [**1 inch**] thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: [**1/2 inch**] [**1 inch**] thick.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: [**3/4 inch**] [**1 inch**] thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: [**1/2 inch**] [**1 inch**] thick.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 2 inches thick.
      b. Flexible Elastomeric: 2 inches thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Cellular Glass: 2 inches thick.
      b. Flexible Elastomeric: 2 inches thick.
      c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:
   1. Aluminum, Smooth: 0.016 inch thick.

END OF SECTION

SECTION 221116 - DOMESTIC WATER PIPING

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. Section Includes:
1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:
1. Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's/Engineer written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:
   1. MSS SP-123.
   2. Cast-copper-alloy, hexagonal-stock body.
   3. Ball-and-socket, metal-to-metal seating surfaces.
   4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Elkhart Products Corporation.
      b. NIBCO Inc.
      c. Viega.
   2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
   3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:
   1. Description:
      a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
      b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

I. Copper-Tube, Extruded-Tee Connections:
   1. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.
   1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
   2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
   2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
   1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Solvent cement and adhesive primer 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."

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Solvent cement and adhesive primer 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."

2.5 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Cascade Waterworks Manufacturing.
      b. Dresser, Inc.; Piping Specialties Products.
      c. Ford Meter Box Company, Inc. (The).
      d. JCM Industries.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc.; a Sensus company.
      g. Viking Johnson.

D. Plastic-to-Metal Transition Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Charlotte Pipe and Foundry Company.
      b. Harvel Plastics, Inc.
      c. Spears Manufacturing Company.
   2. Description:
      a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
      b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Colonial Engineering, Inc.
      b. NIBCO Inc.
      c. Spears Manufacturing Company.

2. Description:
   a. CPVC four-part union.
   b. Brass threaded end.
   c. Solvent-cement-joint plastic end.
   d. Rubber O-ring.
   e. Union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
      b. Central Plastics Company.
      c. Hart Industries International, Inc.
      d. Jomar International.
      e. Matco-Norca.
      f. McDonald, A. Y. Mfg. Co.
      g. Watts; a division of Watts Water Technologies, Inc.
      h. Wilkins; a Zurn company.
   2. Standard: ASSE 1079.
   3. Pressure Rating: 150 psig.
   4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
      b. Central Plastics Company.
      c. Matco-Norca.
      d. Watts; a division of Watts Water Technologies, Inc.
      e. Wilkins; a Zurn company.
   2. Standard: ASSE 1079.
   3. Factory-fabricated, bolted, companion-flange assembly.
   4. Pressure Rating: 150 psig.
   5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Central Plastics Company.
      d. Pipeline Seal and Insulator, Inc.
   2. Nonconducting materials for field assembly of companion flanges.
   3. Pressure Rating: 150 psig.
   4. Gasket: Neoprene or phenolic.
   5. Bolt Sleeves: Phenolic or polyethylene.
   6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Elster Perfection Corporation.

b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Matco-Norca.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section "Meters and Gages for Plumbing Piping."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. 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:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut or Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
   2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

N. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
   1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section "Hangers and Supports for Plumbing Piping and Equipment."
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   4. NPS 2-1/2: 108 inches with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
   2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
   3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.

H. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

I. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
   2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
   3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
   4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
   5. NPS 6: 48 inches with 3/4-inch rod.
   6. NPS 8: 48 inches with 7/8-inch rod.

J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Piping Inspections:
      a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
      b. During installation, notify authorities having jurisdiction at least one day 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 authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
      c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
      d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
   2. Piping Tests:
      a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
      b. 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 a separate report for each test, complete with diagram of portion of piping tested.
      c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
      d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
      e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
      f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Repeat procedures if biological examination shows contamination.
      e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
   1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
   2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
   2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
   3. Hard copper tube, ASTM B 88, Type L; copper push-on-joint fittings; and push-on joints.
   4. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
   5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

6. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.
7. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
4. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
6. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Vacuum breakers.
2. Strainers.
3. Hose bibbs.
4. Wall hydrants.
5. Drain valves.
6. Water-hammer arresters.
7. Flexible connectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.
1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61Annex G and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Cash Acme; a division of Reliance Worldwide Corporation.
    c. Conbraco Industries, Inc.
    d. FEBCO; a division of Watts Water Technologies, Inc.
    e. Rain Bird Corporation.
    f. Toro Company (The); Irrigation Div.
    g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Arrowhead Brass Products.
    b. Cash Acme; a division of Reliance Worldwide Corporation.
    c. Conbraco Industries, Inc.
    d. Legend Valve.
    e. MIFAB, Inc.
    f. Prier Products, Inc.
    g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    h. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    i. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
    j. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Conbraco Industries, Inc.
    c. FEBCO; a division of Watts Water Technologies, Inc.
    d. Flomatic Corporation.
    e. Toro Company (The); Irrigation Div.
    f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Size: Match pipe size.
6. Accessories:
    a. Valves: Ball type, on inlet and outlet.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum unless otherwise indicated.
   2. Body: Bronze for NPS 2 and smaller; cast iron[with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
   3. Screen: Stainless steel with round perforations unless otherwise indicated.
   4. Perforation Size:
      a. Strainers NPS 2 and Smaller: 0.020 inch.
      b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   5. Drain: Factory-installed, hose-end drain valve.

2.5 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company.
      b. MIFAB, Inc.
      c. Prier Products, Inc.
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products.
      g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
      h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
      i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
   2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
   3. Pressure Rating: 125 psig.
   4. Operation: Loose key.
   5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   6. Inlet: NPS 3/4 or NPS 1.
   7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   8. Box: Deep, flush mounted with cover.
   9. Box and Cover Finish: Chrome plated.
   10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
   11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
   12. Operating Keys(s): Two with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Arrowhead Brass Products.
      b. Mansfield Plumbing Products LLC.
      c. McDonald, A. Y. Mfg. Co.
      d. Prier Products, Inc.
      e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
      f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
      h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
   2. Standard: ASSE 1019, Type A or Type B.
   3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.

4. Classification: B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.6 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Precision Plumbing Products, Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products.
   i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F..

B. Welded-Construction Automatic Air Vents:
1. Body: Stainless steel.
2. Pressure Rating: 150-psig minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

C. CPVC Union Ball Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer LLC; GF Piping Systems.
   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
   f. NIBCO Inc.
   g. Spears Manufacturing Company.
   h.
2. Description:
   a. Standard: MSS SP-122.
   b. Pressure Rating and Temperature: 125 psig at 73 deg F.
   c. Body Material: CPVC.
   d. Body Design: Union type.
   e. End Connections for Valves NPS 2 and Smaller: Detachable threaded.
   f. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, threaded.
   g. Ball: CPVC; full port.

h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

D. CPVC Non-Union Ball Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Asahi/America.
c. KBI Company.
d. Legend Valve.
e. NIBCO Inc.
f. Spears Manufacturing Company.
g. Thermoplastic Valves Inc.
2. Description:
a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 125 psig at 73 deg F.
c. Body Material: CPVC.
d. Body Design: Non-union type.
e. End Connections: Socket or threaded.
f. Ball: CPVC; full or reduced port.
g. Seals: PTFE or EPDM-rubber O-rings.
h. Handle: Tee shaped.

E. PVC Non-Union Ball Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. Jomar International.
h. KBI Company.
i. Legend Valve.
j. McDonald, A. Y. Mfg. Co.
k. NIBCO Inc.
l. Spears Manufacturing Company.
m. Thermoplastic Valves Inc.
2. Description:
a. Standard: MSS SP-122.
b. Pressure Rating and Temperature: 125 psig at 73 deg F.
c. Body Material: PVC.
d. Body Design: Non-union type.
e. End Connections: Socket or threaded.
f. Ball: PVC; full or reduced port.
g. Seals: PTFE or EPDM-rubber O-rings.
h. Handle: Tee shaped..

F. CPVC Ball Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.

b. Asahi/America.
c. Colonial Engineering, Inc.
d. Georg Fischer LLC; GF Piping Systems.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX.
g. NIBCO Inc.
h. Spears Manufacturing Company.
i. Thermoplastic Valves Inc.

2. Description:
   a. Pressure Rating and Temperature: 150 psig at 73 deg F.
   b. Body Material: CPVC.
   c. Body Design: Union-type ball check.
   d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
   e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
   f. Ball: CPVC.
   g. Seals: EPDM- or FKM-rubber O-rings.

G. PVC Ball Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Asahi/America.
   c. Colonial Engineering, Inc.
   d. Georg Fischer LLC; GF Piping Systems.
   e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
   f. IPEX.
   g. Legend Valve.
   h. NIBCO Inc.
   i. Spears Manufacturing Company.
   j. Thermoplastic Valves Inc.
2. Description:
   a. Pressure Rating and Temperature: 150 psig at 73 deg F.
   b. Body Material: PVC.
   c. Body Design: Union-type ball check.
   d. End Connections for Valves NPS 2 and Smaller: Detachable, socket or threaded.
   e. End Connections for Valves NPS 2-1/2 to NPS 4: Detachable, socket or threaded.
   f. Ball: PVC.
   g. Seals: EPDM- or FKM-rubber O-rings.

H. CPVC Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Georg Fischer LLC; GF Piping Systems.
   b. Spears Manufacturing Company.
   c. Nibco
2. Description:
   a. Pressure Rating and Temperature: 150 psig at 73 deg F.
   b. Body Material: CPVC.
   c. Body Design: Nonrising stem.
   d. End Connections for Valves NPS 2 and Smaller: Socket] or threaded.
   e. End Connections for Valves NPS 2-1/2 to NPS 4: Socket or threaded.
   f. Gate and Stem: Plastic.

g. Seals: EPDM rubber.
h. Handle: Wheel.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

B. Install water-control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install Y-pattern strainers for water on supply side of each control valve water pressure-reducing valve solenoid valve and pump.

D. Install water-hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Pressure vacuum breakers.
   2. Water pressure-reducing valves.
   3. Primary, thermostatic, water mixing valves.
   4. Photographic-process, thermostatic, water mixing-valve assemblies.
   5. Primary water tempering valves.
   6. Outlet boxes.
   7. Hose stations.
   8. Supply-type, trap-seal primer valves.
   9. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section "Identification for Plumbing Piping and Equipment."

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221316 - SANITARY WASTE AND VENT PIPING

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 sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated including the following:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.
   3. Encasement for underground metal piping.

B. Related Sections:
   1. Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 DEFINITIONS

A. Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.

B. Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.

C. Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.

D. Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.

E. The following are industry abbreviations for plastic and other piping materials:
   1. EPDM: Ethylene-propylene-diene polymer, rubber.
   2. PVC: Polyvinyl chloride.
   3. CPVC: Chlorinated polyvinyl chloride.
   4. PVDF: Polyvinylidene Fluoride

F. Underground Piping: Piping located below slab or grade and to within 6-inches above slab or grade.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
   2. Do not proceed with interruption of sanitary waste service without Architect's or or Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:
   1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
   2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
   1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent. ***NO FOAM CORE PIPING ALLOWED***

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.
   1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer 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."

D. Solvent Cement: ASTM D 2564.
   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Solvent cement 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."

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

   1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   3. Unshielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Dallas Specialty & Mfg. Co.
         2) Fernco Inc.
         3) Mission Rubber Company; a division of MCP Industries, Inc.
         4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
      b. Standard: ASTM C 1173.
      c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
      d. Sleeve Materials:
         1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
         2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
         3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
   4. Shielded, Nonpressure Transition Couplings:
      a. Standard: ASTM C 1460.

b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

5. Pressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cascade Waterworks Mfg. Co.
      2) Dresser, Inc.
      3) EBAA Iron, Inc.
      4) JCM Industries, Inc.
      5) Romac Industries, Inc.
      6) Smith-Blair, Inc.; a Sensus company.
      7) The Ford Meter Box Company, Inc.
      8) Viking Johnson.
   b. Standard: AWWA C219.
   c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
   d. Gasket Material: Natural or synthetic rubber.
   e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:
   1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
   2. Dielectric Unions:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Capitol Manufacturing Company.
         2) Central Plastics Company.
         3) Hart Industries International, Inc.
         4) Jomar International Ltd.
         5) Matco-Norca, Inc.
         6) McDonald, A. Y. Mfg. Co.
         7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
         8) Wilkins; a Zurn company.
      b. Description:
         1) Standard: ASSE 1079.
         2) Pressure Rating: 150 psig.
         3) End Connections: Solder-joint copper alloy and threaded ferrous.
   3. Dielectric Flanges:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Capitol Manufacturing Company.
         2) Central Plastics Company.
         3) Matco-Norca, Inc.
         4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
         5) Wilkins; a Zurn company.
      b. Description:
         1) Standard: ASSE 1079.
         2) Factory-fabricated, bolted, companion-flange assembly.
         3) Pressure Rating: 150 psig.
         4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Advance Products & Systems, Inc.
      2) Calpico, Inc.
      3) Central Plastics Company.
      4) Pipeline Seal and Insulator, Inc.
   b. Description:
      1) Nonconducting materials for field assembly of companion flanges.
      2) Pressure Rating: 150 psig.
      3) Gasket: Neoprene or phenolic.
      4) Bolt Sleeves: Phenolic or polyethylene.
      5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Elster Perfection.
      2) Grinnell Mechanical Products.
      3) Matco-Norca, Inc.
      4) Precision Plumbing Products, Inc.
      5) Victaulic Company.
   b. Description:
      1) Standard: IAPMO PS 66
      2) Electroplated steel nipple.
      3) Pressure Rating: 300 psig at 225 deg F.
      4) End Connections: Male threaded or grooved.
      5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. 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.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. 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 1/4 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 two fixtures 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.

K. 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.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or up toward vent stack.

M. Install aboveground PVC piping according to ASTM D 2665.

N. Install underground PVC piping according to ASTM D 2321.

O. Install engineered soil and waste drainage and vent piping systems as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
   2. Solvent Drainage System: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
   3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

P. Plumbing Specialties:
   1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section "Sanitary Waste Piping Specialties."
   2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section "Sanitary Waste Piping Specialties."
   3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section "Sanitary Waste Piping Specialties."

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. 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:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. 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.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Non-Pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
   3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

F. Dielectric Fittings:
   1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
   2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
   3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
   4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.3 VALVE INSTALLATION

A. General valve installation requirements are specified in Section "Ball Valves for Plumbing Piping," Section "Butterfly Valves for Plumbing Piping," Section "Check Valves for Plumbing Piping," and Section "Gate Valves for Plumbing Piping."

B. Shutoff Valves:
   1. Install shutoff valve on each sewage pump discharge.
   2. Install gate or full-port ball valve for piping NPS 2 and smaller.
   3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section "Hangers and Supports for Plumbing Piping and Equipment."
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.

2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 72 inches with 3/8-inch rod.
   2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   3. NPS 2-1/2: 108 inches with 1/2-inch rod.
   4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
   2. NPS 3: 48 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

I. Install supports for vertical PVC piping every 48 inches.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 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.
   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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. 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 and larger.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. 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.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. 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. 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. 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 require corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during the 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.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
   1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

D. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
   1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

END OF SECTION

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

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. Section Includes:
1. Cleanouts.
2. Floor drains.
3. Through-penetration firestop assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PVC: Polyvinyl chloride plastic

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified 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 NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section "Cast-in-Place Concrete." or Section "Miscellaneous Cast-in-Place Concrete."

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:
   1. ASME A112.36.2M, Cast-Iron Cleanouts:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Josam Company.
         2) MIFAB, Inc.
         3) Smith, Jay R. Mfg. Co.
         4) Tyler Pipe.
         5) Watts Drainage Products.
         6) Zurn Plumbing Products Group.
   2. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:
   1. ASME A112.36.2M, Cast-Iron Cleanouts:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Josam Company.
         2) Oatey.
         3) Sioux Chief Manufacturing Co., Inc.
         4) Smith, Jay R. Mfg. Co.
         5) Tyler Pipe.
         6) Watts Drainage Products.
         7) Zurn Plumbing Products Group.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Commercial Enameling Co.
      b. Josam Company; Josam Div.
      c. MIFAB, Inc.
      d. Prier Products, Inc.
      e. Smith, Jay R. Mfg. Co.
      f. Tyler Pipe; Wade Div.
      g. Watts Drainage Products.
      h. Zurn Plumbing Products Group
   2. Pattern: Floor drain.
   3. Body Material: Gray iron.
   4. Seepage Flange: Not required.
   5. Anchor Flange: Not required.
   6. Clamping Device: Not required.
   7. Outlet: Bottom.
   8. Sediment Bucket: Not required.
   9. Top or Strainer Material: Nickel bronze.
   10. Top of Body and Strainer Finish: Nickel bronze.
   11. Top Shape: Square.
   12. Top Loading Classification: Medium Duty.
   13. Inlet Fitting: Not required.

14. Trap Material: Cast iron.
15. Trap Pattern: Standard P-trap.

B. Stainless-Steel Floor Drains:
1. ASME A112.3.1, Stainless-Steel Floor Drains:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Josam Company.
2) Smith J.R.
3) Zurn manufacturer

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:
1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. 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.
4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

B. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

C. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

D. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Frost-Resistant Vent Terminals:
1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.

2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

F. Expansion Joints:
1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.5 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: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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. Use NPS 4 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 for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. 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 or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch 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.

E. Install through-penetration firestop assemblies in plastic conductors at floor penetrations.

F. Assemble open drain fittings and install with top of hub 1 inch] above floor.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

M. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

N. Install wood-blocking reinforcement for wall-mounting-type specialties.

O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

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 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.

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, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches 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 Section "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.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during the remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

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. Section Includes:
1. Commercial, electric, storage, domestic-water heaters.
2. Commercial, light-duty, storage, electric, domestic-water heaters.
3. Flow-control, electric, tankless, domestic-water heaters.
4. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial] and residential, electric, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Periods: From date of Substantial Completion.
      a. Commercial, Electric, Domestic-Water Booster Heaters:
         1) Controls and Other Components: Five years.
      b. Commercial, Electric, Storage, Domestic-Water Heaters:
         1) Storage Tank: Five years.
         2) Controls and Other Components: Three years.
      c. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
         1) Storage Tank: Five years.
         2) Controls and Other Components: Three years.
      d. Residential, Electric, Storage, Domestic-Water Heaters:
         1) Storage Tank: Five] years.
         2) Controls and Other Components: Two years.
      e. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Water Heaters.
      b. Bradford White Corporation.
      c. A.O. Smith
      d. Lochinvar Corporation.
      e. PVI Industries, LLC.
      f. Rheem Manufacturing Company.
      g. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
      h. State Industries.
      i. Vaughn Manufacturing Corporation.
   2. Standard: UL 1453.
   3. Storage-Tank Construction: ASME-code, steel vertical arrangement.

a. Tappings: Factory fabricated materials compatible with tank and piping connections. Attach tappings to tank before testing.
   1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

B. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Water Heaters.
   b. Bradford White Corporation.
   c. Electric Heater Company (The).
   d. Lochinvar Corporation.
   e. Rheem Manufacturing Company.
   f. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   g. State Industries.
2. Standard: UL 174.
3. Storage-Tank Construction: Steel, vertical arrangement.
   a. Tappings: ASME B1.20.1 pipe thread.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
   e. Jacket: Steel with enameled finish.
   f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
   h. Temperature Control: Adjustable thermostat.
   i. Safety Control: High-temperature-limit cutoff device or system.
   j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting

less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction with legs for off-floor installation.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL Inc.
   b. Flexcon Industries.
   c. Honeywell International Inc.
   d. Pentair Pump Group (The); Myers.
   e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   f. State Industries.
   g. Taco, Inc.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air pre-charge to minimum system-operating pressure at tank.
3. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

F. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

G. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

H. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

I. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimensions that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

J. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial] domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section "Quality Requirements" for retesting and reinspecting requirements and Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section "Cast-in-Place Concrete." Or Section "Miscellaneous Cast-in-Place Concrete."
   1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
   2. Maintain manufacturer's recommended clearances.
   3. Arrange units so controls and devices that require servicing are accessible.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Install anchor bolts to elevations required for proper attachment to supported equipment.
   8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section "Ball Valves for Plumbing Piping," .

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as

domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."

H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section "Ball Valves for Plumbing Piping," Section Section "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section "Meters and Gages for Plumbing Piping."

J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill electric, domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section "Quality Requirements" for retesting and reinspecting requirements and Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train] Owner's maintenance personnel to adjust, operate, and maintain commercial], electric, water heaters over 100 gallon and that serving kitchen equipment.

END OF SECTION

SECTION 224600 - SECURITY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Water closets.
2. Lavatories.
3. Drinking fountains.

1.3 DEFINITIONS

A. Accessible Service Space: Service area in secure space behind wall-mounted fixtures.

B. Back-Access Fixture: Security plumbing fixture designed to mount on wall sleeve built into wall or on wall, so installation and removal of fixture, piping, and other components are accessible only from service space behind wall.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for security plumbing fixtures.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For security plumbing fixtures and components to include in maintenance manuals.

1.6 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. Flushometer-Valve Repair Kits: Equal to 10 percent of quantity of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 STAINLESS-STEEL WATER CLOSETS

A. Water Closets: Back access, off floor, back outlet, extended bowl.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Acorn Engineering Company.
b. Bradley Corporation.
c. Metcraft Industries Inc.
d. Willoughby Industries, Inc.

2. Standard: IAPMO PS 61.
3. Material: 0.078-inch-minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
4. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
5. Bowl:
   a. Type: Elongated, with back inlet, integral trap, and siphon-jet design with back outlet and contoured seat.
   b. Type: Elongated, with back inlet, integral trap, and siphon-jet design with bottom outlet and contoured seat.
   c. Length to Wall: Minimum of 25 inches.
   d. Back-Outlet Connection: NPS 4, horizontal with cleanout and slip joint.
   e. Seat Surface: ASTM A 480/A 480M, No. 7 polished finish.
   f. Punching: Two holes for installation of separate toilet seat.
6. Mounting: Bolts through wall sleeve into accessible pipe space.
7. Flushometer Valve: Manual Flushometer 1.28 gpm.
8. Toilet Seat: Integral.
9. Wall Sleeve: Galvanized-steel frame of dimensions required to match fixture. Include steel bars or other design to prevent escape if fixture is removed.
   a. Configuration: Modify wall sleeve for water-closet mounting height according to ICC A117.1.

2.2 FLUSHOMETER VALVES

A. Flushometer Valves: Push button, diaphragm.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Delany Flush Valves.
   b. Sloan Valve Company.
   c. Zurn Industries, LLC; Commercial Brass and Fixtures.
   d. Acorn Engineering.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Integral check stops and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Concealed.
9. Consumption: 1.2 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.3 STAINLESS-STEEL LAVATORIES

A. Lavatories: Back access.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Acorn Engineering Company.
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.
2. Fixture:
   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Material: 0.078-inch-minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.

d. Receptor: Oval bowl with integral soap depression and backsplash.
e. Hot- and Cold-Water and Bubbler Supply Valves: Mechanical-metering type with push-button actuation, individual check stops, and backsplash-mounted filler spouts complying with ASME A112.18.1/CSA B125.1.
f. Drain: Integral punched grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2/CSA B125.2.

3. Mounting: Bolts through wall into accessible service space.

2.4 DRINKING FOUNTAINS

A. Drinking Fountains: Front access.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Acorn Engineering Company.
   b. Bradley Corporation.
   c. Metcraft Industries Inc.
   d. Willoughby Industries, Inc.
   e. Elkay Manufacturing Company
2. Fixture:
   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Material: 0.078-inch-minimum-thick stainless steel; corrosion-resistant metal for internal piping and bracing.
   c. Finish: ASTM A 480/A 480M, No. 4 polished finish on exposed surfaces.
   d. Receptor: Bowl with backsplash.
   e. Bubbler Supply Valve: Push-button actuation and filler spouts complying with ASME A112.18.1/CSA B125.1.
   f. Drain: Integral punched grid with NPS 1-1/4 tailpiece.
3. Waste Fittings: NPS 1-1/4 minimum waste and trap complying with ASME A112.18.2/CSA B125.2.
4. Mounting: Bolts from fixture-mounted flanges into wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install security plumbing fixtures level and plumb according to roughing-in drawings.

B. Install back-access, stainless-steel fixtures as follows:
1. Install wall sleeve in wall if indicated.
2. Install fixture on wall sleeve or wall, as indicated, with access from accessible service space.
3. Extend supply piping from service space to fixture.
4. Install soil and waste piping from fixture and extend into service space.
5. Install fixture trap in service space instead of below fixture drain.

C. Install front-access, stainless-steel fixtures as follows:
   1. Install fixture support or mounting bracket.
   2. Install fixture on support; mount components inside of or attached to fixture.
   3. Extend supply piping from pipe space to fixture.
   4. Install trap below fixture and extend soil and waste piping into pipe space.

D. Install fixture outlets with gasket seals.

E. Install fixtures designated "accessible" according to ICC A117.1 for heights, dimensions, and clearances.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible fixtures. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

G. Seal joints between fixtures, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with requirements for water piping specified in Section 221116 "Domestic Water Piping."

C. Comply with requirements for soil and waste drainage piping specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust flushometer valves and flow-control valves on fixtures.

3.5 CLEANING AND PROTECTION

A. After installing fixtures, inspect and repair damaged finishes.

B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230000 - GENERAL MECHANICAL PROVISIONS

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. Section includes general provisions covering the contract documents for HVAC Systems.

1.3 DEFINITIONS

A. Provide shall mean "Furnish, install and connect."

B. Piping shall mean "pipe installed with all specified fittings, valves and accessories, and forming a complete system."

C. HVAC shall mean "Heating, Ventilation and Air Conditioning."

1.4 INFORMATIONAL SUBMITTALS

A. Electrical Coordination Drawings: In addition to submittal requirements of other Division 23 Sections, submit a document approved by the project Electrical Contractor certifying that all mechanical equipment being furnished under Division 23 complies with the electrical characteristics of the source power which will be furnished under Division 26.

B. Model numbers listed on the Mechanical Contract Documents shall not be construed to indicate electrical characteristics. Electrical characteristics of mechanical equipment shall be as indicated on the Electrical Contract Documents.

C. Review of Submittals does not relieve the Contractor of any of the requirements of the Contract Documents. Failure by the Engineer to document errors and omissions in the Contractor's submittals during the Engineer's submittal review does not constitute a waiver of any of the requirements of the original Contract Documents.

1.5 CLOSEOUT SUBMITTALS

A. Installation Instructions: Two binders containing manufacturer's installation instructions for all equipment furnished under Division 23 shall be furnished by the Contractor. One binder shall be kept in the General Contractor's office at the job site. The other binder shall be delivered to the Engineer upon acceptance by the Architect of the Submittals.

B. Operation and Maintenance Instructions: Three copies of equipment O&M manuals contained in rigid 3-ring binders shall be submitted to the Owner a minimum of 15 days prior to equipment/systems training. Binders shall have permanent labels on the spine and front cover indicating project name, project number, building name and contents. Model and serial numbers of equipment shall be shown on the cover of their respective O&M manual(s).

1.6 QUALITY ASSURANCE

A. HVAC Installer Qualifications:
   1. HVAC Subcontractor shall have a current Class II Conditioned Air Contractors License for the state in which the project is being constructed. The Subcontractor shall have as part of the Firm a Service Department qualified to service all systems installed in the project, or have a written agreement with a Service Agency qualified to provide such service. The Service Department or Agency shall be on call at all hours.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Material storage
   1. All materials and equipment stored on the jobsite shall be elevated above the ground and stored under suitable weather cover. Materials and equipment shall not be stored in areas subjected to localized flooding.
   2. Manufacturer's original shipping packaging and protective coverings shall be left in place until the equipment is prepared for installation.

B. Electrical enclosure protection
   1. During construction, all protective covers and other devices shall be left in place that protect against inadvertent contact with live electrical circuits.
   2. All warning labels related to electrical and rotating equipment hazards shall be in place prior to energizing mechanical equipment circuits.

C. Protection of ductwork and piping
   1. Maintain temporary closures on the ends of all ductwork and piping as the installation work progresses. Temporary closures include plastic sheeting, tape and appropriate caps and covers.
   2. Where debris enters piping during installation, steps shall be taken to clean the interior of the pipe prior to placing in service.
   3. Where debris enters ductwork during installation the duct interior shall be cleaned prior to placing in service.
   4. All lined ductwork shall be kept clean and dry. Any lined duct must be removed from the job site if moisture is discovered in installed or stored ductwork.

D. Roof protection: All penetrations through roofs, including roof curbs, piping curbs and roof drainage system elements shall be properly protected during construction to prevent water intrusion into the building. Protective measures could include temporary covers and plugs, as well as other appropriate temporary elements.

1.8 PRIOR APPROVALS

A. Manufacturers References: When reference is made in the Contract Documents to trade names or specific manufacturers and/or models, such reference, unless noted otherwise, is made to designate and identify the quality of materials or equipment to be furnished and is not intended to restrict competitive bidding. If it is desired to use materials or equipment different from those indicated on the Contract Documents, written request for approval must be received by the Architect at least TEN DAYS prior to the date set for the opening of bids. A copy of the request should also be sent directly to the Engineer. Requests for prior approval of a proposed substitute shall be accompanied by complete technical data supporting the request.

B. Request for Prior Approval by facsimile transmission (fax) will not be considered. Prior approval requests shall be submitted in hard copy or email format only.

1.9 PERMITS AND FEES

A. Obtain all necessary Permits and Inspections required for the installation of this work and pay all charges incident thereto. Deliver to the Architect all certificates of inspection issued by authorities having jurisdiction.

1.10 SAFETY

A. OSHA Requirements applicable to the project shall be complied with at all times.

B. Manufacturer's Safety Instructions shall be followed in all instances.

C. Asbestos Containing Materials (ACM) shall not be used on this project.

D. Refrigerants containing CFC's or HCFS's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

E. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch diameter sphere and shall comply with the loading requirements for guards specified in the International Building Code.

1.11 ENVIRONMENT

A. Refrigerants containing CFC's or HCFS's shall not be used on this project, nor shall any equipment using such refrigerants be incorporated into this project.

1.12 FIELD CONDITIONS

A. Electrical Equipment Clearances: Piping, equipment and other mechanical installations shall not be located within 42" of the front or 36" of the side of any electrical switchboards, panelboards, power panels, motor control centers, electrical transformers or similar electrical equipment. Piping and ductwork shall not pass through or above electrical equipment rooms except as required to serve those rooms.

B. Layout:
   1. The equipment listed on the Drawings is considered basis of design equipment and has been used for the physical arrangement of the mechanical systems. When other equipment listed in the specifications as acceptable, equal or equipment which has received "prior approval" is used, it shall be the Contractor's responsibility to provide structural, ductwork, electrical, service clearances, or other changes required to accommodate the substituted equipment. Changes to use non basis of design equipment shall be made at no additional cost to the Owner. Submit a list of required changes along with all prior approval requests and shop drawing submittals.
   2. The Contract Drawings are intended to show the general arrangement of all mechanical work. They do not show in detail all offsets, fittings and transitions. Examine Drawings, investigate site conditions to be encountered and arrange work accordingly. Furnish all offsets and transitions required for a complete and functional installation.
   3. Drawings do not indicate in detail exact configuration of connections for fixtures, equipment and accessories. Final connection shall be as shown on approved Manufacturer's Submittal

Drawings. Where Manufacturer's Submittal Drawings conflict with the Contract Documents, consult with the Architect for resolution.

C. Measurement of Drawings by scale shall not be used as dimensions for fabrication. Measurements for locating fixtures, equipment, ductwork, piping and other mechanical items shall be made on the site and shall be based on actual job site conditions.

D. Check spatial limitations and verify electrical requirements before ordering any mechanical equipment or materials. Before ordering materials or fabricating ductwork and piping, notify Architect if conflicts are detected with other building components. Place large equipment inside the building prior to the erection of exterior walls where equipment cannot enter finished building openings.

E. Coordination: Mechanical work shall be coordinated with that of other trades to avoid conflict. The Contractor shall study all plans and specifications for this project and shall notify the Architect of any conflict between work under Division 23 and work under other divisions of the Project. Particular attention shall be given to interference between piping, electrical installations, structural systems, building openings and ductwork.

F. Failure to accurately and timely coordinate with other trades for installation of mechanical systems shall not result in additional charges to the owner, architect or engineer.

1.13 CODES AND STANDARDS

A. Mechanical installations shall conform to the latest edition or the addition approved by the authority having jurisdiction of the following, in addition to any other mentioned Codes and Standards.
   1. The International Building Code.
   2. The International Mechanical Code.
   3. The International Plumbing Code
   4. The State Energy Code
   5. The International Fire Protection Code
   6. NFPA Standard 13, Installation of Sprinkler Systems.
   7. NFPA Standard 70, National Electric Code.
   8. NFPA Standard 90A, Installation of Air Conditioning and Ventilation Systems.
   9. NFPA Standard 101, Code for Safety to Life for Fire in Buildings and Structures.

1.14 USE OF MEHCANICAL SYSTEMS DURING CONSTRUCTION

A. The operation of the permanent HVAC systems during the construction process is strongly discouraged. However, the Contractor may take measures to protect the systems from contamination if they are operated.

B. Under no circumstances shall the HVAC system be operated while sanding of any kind is taking place on the jobsite.

C. When placed in operation during the construction period, all HVAC systems shall have MERV 8 filtration in all standard filter racks throughout the systems. Where so equipped, final filter banks do not have to be in place.

D. All return openings and outdoor air intake openings shall be protected with MERV 8 filter material at all points of entry into the duct system. These protections shall be maintained and remain in place until the building is prepared for final inspection. Failure to comply will result in contractor being required to clean ductwork prior to final acceptance.

E. The interior of all HVAC units shall be thoroughly cleaned to "like-new" condition prior to final acceptance of the building HVAC systems. New, clean filters shall be furnished in all new equipment.

PART 2 - PRODUCTS (Not applicable for this section.)

PART 3 - EXECUTION (Not applicable for this section.)

END OF SECTION

SECTION 230500 - BASIC MECHANICAL MATERIALS AND METHODS

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. Section includes the following basic mechanical materials and methods to complement other mechanical sections.
   1. Non-shrink grout for equipment installations.
   2. Fire stopping.
   3. Installation requirements common to equipment specification sections.
   4. Touchup painting and finishing.
   5. Concrete equipment base construction requirements.
   6. Cutting and Patching.

B. See individual piping sections for pipe and pipe fitting materials.

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, crawlspaces, 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.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

1.5 QUALITY ASSURANCE

A. Equipment Selection: Equipment of greater or larger power, 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. No additional costs will be approved for these increases, if larger equipment is approved. If

minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

B. Coordinate all electrical service requirements for mechanical equipment prior to the submittal of shop drawings. Confirm the compatibility of all power services with the equipment being furnished. Confirm compatibility of electrical lugs being provided by the equipment manufacturer with the power wiring being furnished under Division 26. Furnish written documentation that all characteristics have been coordinated with and confirmed by the electrical subcontractor.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate the 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 prior to closing in the building.

E. Coordinate connection of electrical services.

F. 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.

G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 GROUT

A. Nonshrink, 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-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory-packaged.

2.2 FIRE STOPPING

A. Fire-Resistant Sealant: Provide UL Listed firestopping system for filling openings around penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, provide products by one of the following:
   1. Dow Corning Corp.
   2. 3M Corporation
   3. General Electric Co.
   4. Standard Oil Engineered Materials Co.
   5. Hilti, Inc.
   6. Tremco Corp.

PART 3 - EXECUTION

3.1 GROUTING

A. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.2 FIRESTOPPING

A. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.3 COMMON INSTALLATION REQUIREMENTS

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of mechanical systems. Indicated locations and arrangements were used to size ductwork and pipe; and calculate friction loss, expansion, pump sizing, and other design considerations. Install ductwork and piping as indicated, except where deviations to layout are approved on coordination drawings.

B. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.

C. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

D. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

E. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

F. Install equipment giving right-of-way to piping systems installed at a required slope.

3.4 PAINTING AND FINISHING

A. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. Paint all exposed steel surfaces of piping and supports with one coat of primer and two coats of enamel.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
   3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.
   6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   7. Use 3000-psi, 28-day compressive strength concrete with 6 x 6 x #10 reinforcing wire mesh.
   8. Outdoor concrete bases shall extend a minimum of 4" above grade and be a minimum thickness of 6".

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS 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, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. Related Sections:
1. Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section "Vibration Controls for HVAC" for vibration isolation devices.
4. Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Metal framing systems.

3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. Flex-Strut Inc.
   d. Thomas & Betts Corporation, A Member of the ABB Group.
   e. Unistrut; an Atkore International company.
   f. Wesanco, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: galvanized or alternate rust preventing shop coating.
8. Paint Coating: two coats primer and one coat enamel.

B. Non-MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anvil International.
      b. Empire Industries, Inc.
      c. ERICO International Corporation.
      d. Haydon Corporation.
      e. NIBCO INC.
      f. PHD Manufacturing, Inc.
      g. PHS Industries, Inc.
   2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4.
   4. Channels: Continuous slotted steel channel with inturned lips.
   5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
   7. Coating: galvanized or alternate rust preventing shop coating.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carpenter & Paterson, Inc.
   2. Clement Support Services.
   3. ERICO International Corporation.
   4. National Pipe Hanger Corporation.
   5. PHS Industries, Inc.
   6. Pipe Shields Inc.
   7. Piping Technology & Products, Inc.
   8. Rilco Manufacturing Co., Inc.
   9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches minimum or 2 ½ times the pipe diameter beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
   17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
   18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
   19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
   20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
   9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
   10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
   11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
   12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb.
      b. Medium (MSS Type 32): 1500 lb.
      c. Heavy (MSS Type 33): 3000 lb.
   13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
   15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
   8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230553 - 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, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

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 locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content.
6. Minimum Letter Size: 1/4 inch
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Testing, Adjusting, and Balancing Equipment:
      a. Motors.
      b. Heat-transfer coils.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article in Part 3.

D. Sample report forms.

E. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.

5. Dates of calibration.

F. Certified TAB reports: as specified in "Final Report" Article in Part 3.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.

B. Certify TAB field data reports and perform the following:
1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms certified by the test and balance agent.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contract Document Review:
1. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment. Notify Architect of any such conditions.
2. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify

that locations of these balancing devices are accessible. Notify Architect if any devices are found to be in inaccessible locations.

3. Examine the approved submittals for HVAC systems and equipment. Notify Architect of any discrepancies found between design contract documents and approved submittals.

B. Examine 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.

C. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section "Metal Ducts" and/ or Section "Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

D. Examine equipment performance data including fan and pump curves.

1. 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.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

I. Examine operating safety interlocks and controls on HVAC equipment.

J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. General:
   a. Permanent electrical-power wiring is complete.
   b. Automatic temperature-control systems are operational.
   c. Equipment and duct access doors are securely closed.
   d. Windows and doors can be closed so indicated conditions for system operations can be met.

2. Airside:
   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
   b. Duct systems are complete with terminals installed.
   c. Volume, smoke, and fire dampers are open and functional.
   d. Clean filters are installed.
   e. Fans are operating, free of vibration, and rotating in correct direction.
   f. Automatic temperature-control systems are operational.
   g. Ceilings are installed.
   h. Windows and doors are installed.
   i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section "Air Duct Accessories."
   3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section "Duct Insulation," Section "HVAC Equipment Insulation," and Section "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

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. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-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.

K. Verify that air duct system is sealed as specified in Section "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
      d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical 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 the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
      a. Report the cleanliness status of filters and the time static pressures are measured.
   4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
   5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   7. 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 that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
      a. Where sufficient space in submain 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. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

3.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.8 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to 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; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   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 TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans and pump performance forms including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Fan drive settings including settings and percentage of maximum pitch diameter.
      e. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Duct, outlet, and inlet sizes.
   3. Position of balancing devices.

E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
   1. Fan Data:
      a. System identification.
      b. Location.
      c. Make and type.
      d. Model number and size.
      e. Manufacturer's serial number.
      f. Arrangement and class.
      g. Sheave make, size in inches, and bore.
      h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
   2. Motor Data:
      a. Motor make, and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.

d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

F. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.10 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 233113 - METAL DUCTS

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. Section Includes:
1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:
1. Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this section, the following definitions apply:

B. Longitudinal Seams: Joints oriented in the direction of airflow.

C. Transverse joints: Connections of the two duct sections oriented perpendicular to airflow.

D. Duct wall penetrations: Openings made by any screw, fastener, pipe, rod or wire.

E. SMACNA Seal Classes are defined as follows:
1. A - All transverse joints, longitudinal seams, and duct wall penetrations.
2. B – All transverse joints and longitudinal seams.
3. C – Transverse joints only.

F. Conditioned Spaces: a cooled space, heated space, or indirectly conditioned space. An indirectly conditioned space includes return air plenums.

1.4 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
1. Adhesives.
2. Sealants and gaskets.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
   2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilation Systems"

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Lindab Inc.
      b. McGill AirFlow LLC.
      c. SEMCO Incorporated.
      d. Sheet Metal Connectors, Inc.
      e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 or G90 for use in concealed, interior ductwork, G90 for all exterior and exposed ductwork.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Water resistant.
4. Mold and mildew resistant.
5. VOC: Maximum 75 g/L (less water).
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor or outdoor.
8. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

C. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Water resistant.
6. Mold and mildew resistant.
7. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. VOC: Maximum 395 g/L.
9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
10. Service: Indoor or outdoor.
11. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article below, and according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Solvent based sealant shall only be used in applications where freezing may occur before sealant is cured. Water based sealant shall be used in all other applications.

C. Prepare duct surface in accordance with duct sealant manufacturer's printed instructions.

D. Seal externally insulated ducts prior to installation of insulation.

E. All duct sealing shall be in accordance with ASHRAE standard 90.1.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section "Exterior Painting" and Section "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Inspections and Leakage Tests:
1. All ductwork shall be approved by Architect prior to the application of external insulation. Smoke testing, pressure testing, or other leakage testing will be required if inspection is not performed.

3.8 CLEANING

A. Vacuum ducts prior to final acceptance to remove construction dust and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
a. Pressure Class: Negative 1-inch wg.

b. Minimum SMACNA Seal Class: C for ducts located outdoors and in unconditioned spaces, and B for ducts located in conditioned spaces.

C. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
   a. Pressure Class: Positive or negative 1-inch wg.
   b. Minimum SMACNA Seal Class: C.

D. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.
2. PVC-Coated Ducts: Match duct material.
3. Stainless-Steel Ducts: Match duct material.

E. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Velocity 1000 fpm or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.
   b. Velocity 1000 to 1500 fpm:
      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
   c. Velocity 1500 fpm or Higher:
      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Adjustable takeoff fitting.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

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. Section Includes:
1. Manual volume dampers.
2. Fire dampers.
3. Turning vanes.
4. Duct-mounted access doors.
5. Flexible connectors.
6. Duct accessory hardware.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings.
b. Manual volume damper installations.
c. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 3 finish for exposed ducts.

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 minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   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. American Warming and Ventilating.
      b. Flexmaster U.S.A., Inc.
      c. Greenheck
      d. Louvers and Dampers, Inc.
      e. McGill AirFlow LLC.
      f. Metalaire
      g. Nailor Industries Inc.
      h. Pottorff.
      i. Ruskin Company.
      j. Vent Products Co., Inc.
   2. Standard leakage rating, with linkage outside airstream.
   3. Suitable for horizontal or vertical applications.
   4. Frames:
      a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized-steel, 0.064 inch thick.
   6. Blade Axles: Galvanized steel.
   7. Bearings:
      a. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:
   1. Size: 1-inch diameter.
   2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:
   1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
   2. Include center hole to suit damper operating-rod size.
   3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. 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:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. Arrow United Industries; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Greenheck Fan Corporation.
   5. Louvers and Dampers, Inc.
   6. Metalaire
   7. Nailor Industries Inc.
   8. NCA Manufacturing, Inc.
   9. Pottorff.
   10. Prefco; Perfect Air Control, Inc.
   11. Ruskin Company.
   12. Vent Products Company, Inc.
   13. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 or 3 hours as indicated by the wall ratings on the architectural plans.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
   1. Minimum Thickness: 0.05 or 0.138 inch] thick, as indicated, and of length to suit application.
   2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch-0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Nexus PDQ; Division of Shilco Holdings Inc.
   3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. 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:
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. Elgen Manufacturing.
   4. METALAIRE, Inc.
   5. SEMCO Incorporated.
   6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 incheswide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

A. 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:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Cesco Products; a division of Mestek, Inc.
   3. Ductmate Industries, Inc.
   4. Elgen Manufacturing.
   5. Flexmaster U.S.A., Inc.
   6. Greenheck Fan Corporation.
   7. McGill AirFlow LLC.
   8. Nailor Industries Inc.
   9. Pottorff.
   10. Ventfabrics, Inc.
   11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel where indicated.
   d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

2.8 FLEXIBLE CONNECTORS

A. 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:
   1. Ductmate Industries, Inc.
   2. Duro Dyne Inc.
   3. Elgen Manufacturing.
   4. Ventfabrics, Inc.
   5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd..
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
   1. Minimum Weight: 24 oz./sq. yd..
   2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F.

2.9 DUCT 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 of length to suit duct-insulation thickness.

B. 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 in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire and smoke dampers according to UL listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Upstream from duct filters.
   3. At outdoor-air intakes and mixed-air plenums.
   4. At drain pans and seals.
   5. Downstream from, control dampers, backdraft dampers, and equipment.
   6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   7. At each change in direction and at maximum 50-foot spacing.
   8. Upstream or downstream from duct silencers.
   9. Control devices requiring inspection.
   10. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Label access doors according to Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. Install duct test holes where required for testing and balancing purposes.

L. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
   4. Inspect turning vanes for proper and secure installation.
   5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

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. Section Includes:
1. Ceiling-mounted ventilators.
2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also 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 thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 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. Belts: One set(s) for each belt-driven unit.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.8 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acme
2. Barry Blower
3. Breidert Air Products.
4. Broan-NuTone LLC.
5. Carnes Company.
6. Cincinnati Fan & Ventilator Co.
7. Greenheck Fan Corporation.
8. Loren Cook Company.
9. PennBarry.
10. Twin City

B. Housing: Steel, lined with acoustical insulation. Furnish inline configuration where indicated on the drawings.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Isolation: Rubber-in-shear vibration isolators.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acme Engineering & Manufacturing Corporation.
2. Barry Blower.
3. Breidert Air Products.
4. Carnes Company.
5. Cincinnati Fan & Ventilator Co.
6. Greenheck Fan Corporation.

7. Hartzell Fan Incorporated.
8. Loren Cook Company.
9. PennBarry.
10. Twin City.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
6. Vibration Isolators:
   a. Type: Hanging spring isolator.
   b. Static Deflection: 1 inch.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:
   1. Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section "Cast-in-Place Concrete." and/or Section "Miscellaneous Cast-in-Place Concrete."
   2. Comply with requirements for vibration isolation and seismic control devices specified in Section "Vibration Controls for HVAC."

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch deflection.

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:
   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. Adjust belt tension.
   6. Adjust damper linkages for proper damper operation.
   7. Verify lubrication for bearings and other moving parts.
   8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   10. Shut unit down and reconnect automatic temperature-control operators.
   11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling and wall mounted diffusers, registers, grilles and exterior louvers.

B. Related Sections:
1. Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS, REGISTERS AND GRILLES
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anemostat Products; a Mestek company.
b. Carnes.
c. Hart & Cooley Inc.
d. Krueger
e. METALAIRE, Inc.
f. Nailor Industries Inc.
g. Price Industries.
h. Titus.
i. Tuttle & Bailey.

2.2 EXTERIOR LOUVERS
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Arrow
b. Greenheck
c. Louvers & Dampers, Inc.
d. United Enertech
e. Vent Products
f. Ruskin

2. Depth: 6 inches.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

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 practical. For units installed in lay-in ceiling panels, locate units in the center of panel. 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 connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. After installation of diffusers, registers, grilles and louvers, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 238239.16 - PROPELLER UNIT HEATERS

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. Section includes propeller unit heaters with [**hot-water**] [**steam**] [**electric-resistance heating**] coils.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CWP: Cold working pressure.

C. PTFE: Polytetrafluoroethylene plastic.

D. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:
   1. Include plans, elevations, sections, and details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include location and size of each field connection.
   4. Include details of anchorages and attachments to structure and to supported equipment.
   5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
   6. Indicate location and arrangement of piping valves and specialties.
   7. Indicate location and arrangement of integral controls.
   8. Wiring Diagrams: Power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Airtherm.
2. Berko
3. Indeeco
4. Raywall
5. Redd-i
6. Reznor
7. Trane.
8. Q Mark, A Marley Engineered Products Brand.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in vertical or horizontal discharge configuration with adjustable discharge louvers as indicated on the drawings.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

D. Comply with UL 823.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.
   1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
   2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated. Comply with requirements in Section "Common Motor Requirements for HVAC Equipment."

2.7 CONTROLS

A. Control Devices:
1. Wall-mounted thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and. Hanger rods and attachments to structure are specified in Section "Hangers and Supports for HVAC Piping and Equipment."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Comply with safety requirements in UL 1995.

B. Ground equipment according to Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION

SECTION 260100 - GENERAL PROVISIONS – ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 IMPOSED REGULATIONS:

A. Applicable provisions of the State and Local Codes and of the following codes and standards are hereby imposed on a general basis for electrical work:
1. NEC, National Electrical Code (NFPA No. 70), with Georgia Amendments.
2. The Life Safety Code (NFPA No. 101), with Georgia Amendments.
3. State of Georgia ADA Accessibility Guidelines for Building and Facilities.
4. The International Building Code, with Georgia Amendments.
5. U.L. Fire Resistance Directory.
6. U.L. Electrical Construction Materials Directory.
7. U.L. Electrical Appliance and Utilization Equipment Directory.

1.3 SCOPE OF WORK:

A. Provide all labor, materials, equipment and supervision to construct complete and operable electrical systems as indicated on the drawings and specified herein. All materials and equipment used shall be new, undamaged and free from any defects.

1.4 COORDINATION:

A. Coordinate work provided under this division of the specifications with work provided under other divisions of the specifications and work provided by owner, where applicable.

1.5 PROJECT STAFFING:

A. Superintendent:
1. Provide a superintendent to plan, layout, supervise and coordinate the work provided by all organizations providing work under Division 26. The superintendent shall be at the job site at any time work is being performed.

2. The superintendent shall have a minimum of 5 years' experience in projects of similar size and scope. The superintendent shall have a State of Georgia unrestricted electrical contractor's license.

B. Organizations Furnishing and Installing Electrical Systems:
1. Traditional electrical systems work shall be furnished and installed by organizations who have successfully completed work of similar size and scope, and who have been in business for at least 3 years.
2. Electricians, 600V and below:
a. Electricians assigned to the project shall have proof of having completed a formal training program which certifies that they are qualified to perform electrical work of the type encountered on this project and are familiar with the building codes which apply to this project. For the purposes of this project, workers not possessing these qualifications shall be considered helpers and shall not be allowed to perform electrical work.

1.6 UTILITY CONNECTIONS:

A. The approximate point of origination for electric, telephone and television utilities is shown on the drawings. However, the contractor shall confirm the location with the respective utility prior to ordering materials or beginning any trenching. The Contractor's bid shall allow for the service point to be shifted by the utility, 25 feet in any direction from that shown.

1.7 PERMITS AND TEST; ELECTRICAL WORK:

A. Submit a record copy (for Owner's records) of electrical work notices, permits, licenses, inspection or test reports, and similar items obtained in response to governing and imposed codes, regulations and standards.

1.8 ELECTRICAL DRAWINGS:

A. Do not scale the electrical drawings. Obtain all dimensions from the Architect's dimensioned drawings, field measurements and shop drawings.

B. Electrical contract drawings are diagrammatic and indicate the general arrangement and connection of equipment and devices. Review product data sheets, wiring diagrams, manufacturer's installation instructions, etc. and provide the connections required to place equipment into service. Do not rely solely on the conductor counts shown on the drawings.

C. Discrepancies shown on different drawings, between drawings and specifications or between documents and field conditions shall be brought to the attention of the Architect. The specifications do not override the drawings or vice-versa.

1.9 EQUIPMENT REQUIRING ELECTRICAL SERVICE:

A. Provide connections for all electrically driven equipment, in accordance with the electrical drawings and the Division of the specifications in which the equipment is specified.
   1. Connection shall include circuit breaker, wiring, control and disconnecting means (where applicable) and final connection.
   2. Prior to ordering materials, review approved shop drawings of equipment that will be ordered and verify the connections shown. Fill out and submit the Coordination Affidavit required by Section 260120.
   3. Where connection is required by other Divisions, but no connection is shown on the electrical drawings, provide connection to nearest panel of same voltage and phase based on the characteristics shown on other drawings. All added connections shall be brought to the attention of the Architect.
   4. Provide 120 volt, 1 phase, 20 ampere power connection for all Division 23 control panels, whether indicated on the project drawings or not. Circuit from nearest 120/208 volt, 3 phase, 4 wire panelboard from available 20 amp, single-pole spares. Revise panelboard schedules accordingly. Document and coordinate control panel requirements and locations during preparation of the Coordination Affidavit, Attachment No. 1.

1.10 SYSTEMS REQUIRING ROUGH-IN:

A. Rough-in shall consist of all outlet boxes and covers/raceway systems/supports and sleeves required for the installation of cables/devices specified by other Divisions and by the Using Agency.

B. Review shop drawings to determine rough-in requirements; do not rely solely on the information shown on the drawings. Keep a copy of these shop drawings at the project site throughout the course of construction.

C. Systems requiring rough-in shall include, but not be limited to the following:
   1. Mechanical equipment as shown in Divisions 22 and 23
   2. Building equipment as shown
   3. Equipment furnished by the Using Agency as shown on plans
   4. Telephone service entrance
   5. Voice / data / video cabling systems.

D. Rough-in requirements are further defined in Section 261010. Prior to performing any rough-in, meet with the designated representative of the trade involved to confirm device locations, mounting heights, trim ring type and orientation.

1.11 RECORD DOCUMENTS:

A. The electrical superintendent shall maintain a white set (blue-line or black-line) of contract documents in clean, undamaged condition, for mark-up of actual installations which vary substantially from the work as shown. Mark-up whatever drawings are most capable of showing installed conditions accurately. These documents shall be used for no other purpose. As a minimum, record the following:
   1. Post all addenda prior to beginning work.
   2. Post all changes in the work.
   3. Document actual feeder conduit routes, both interior and exterior. For lines run below grade or slab, dimension lines off of fixed surfaces.
   4. Scope of each change order (C.O.), noting C.O. number.
   5. Mark up all branch circuit connections.

1.12 RECORD MANUALS: (CLOSEOUT REQUIREMENTS)

A. Record manuals shall include the following:

B. Manufacturer's operation and maintenance manuals for:
   1. Lighting Fixtures
   2. Panelboards and circuit breakers
   3. Dry Type Transformers

C. Shop drawings, revised to reflect all review comments, *supplemented with the installation instructions shipped with equipment.*

D. One copy of all panelboard directories plus CD/RW with electronic spreadsheets containing directories.

E. Submit record manuals in quantities and in the format prescribed in the Division specifications, plus one copy for the Engineer.

1.13 REVIEW OF THE WORK BY THE ARCHITECT:

A. During the course of the project, the work will be reviewed by a representative of the Architect. Upon each visit, the Contractor shall also demonstrate that the record documents and shop drawing files are being kept current. The Division 26 Superintendent shall accompany the Architect on all reviews and shall provide all personnel, tools, ladders, etc. necessary to conduct the review.

B. Prior to reviewing of work in progress, or at the final inspection, the Contractor shall submit a letter describing the specific work to be reviewed, along with a punch-list of items that are incomplete or which require correction, based on observations made by the supervisor of the given trade. Reviews will not be scheduled until this information is submitted. The Contractor shall bear the burden of any resulting delays.

C. Construction review reports will be issued by the Architect for every review trip. Within five working days from the date of review, the Contractor shall submit a letter which addresses when corrections will be made for each deficiency in the report. Prior to subsequent review of the work, the Contractor shall submit a letter confirming that the work required by all comments on the report has been completed.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Refer to the drawings and individual specification sections for requirements.

B. All equipment shall be suitable for the environment in which it is installed. Such considerations shall include, but not be limited to characteristics of this specific project such as wet/damp/dry locations, ambient temperature / humidity, spaces used as air plenums and hazardous locations. It shall be the responsibility of the contractor to review the contract documents and order equipment based on intended use.

2.2 MATERIALS:

A. All materials and equipment used shall be new, undamaged and free from any defects.

B. Provide materials and equipment that are U.L. listed, unless listing is unavailable.

C. All equipment of the same type or of the same product category shall be the product of a single manufacturer.

D. It is the responsibility of the Contractor to determine the shipping splits for large equipment.

E. Where product is specified by catalog number, such specification is intended only to convey general characteristics. Actual product selection shall be based on catalog number, other references on the drawings / specifications and intended use. Products not listed in these specifications or shown on drawings shall not be used.

2.3 ACCEPTABLE MANUFACTURERS:

A. Provide equipment and materials which are products of the manufacturers listed on the drawings and in the specifications. Requests for substitution of other manufacturers shall comply with Division 1 and the paragraph "B" below.

B. Requests for prior approval (i.e. before the bid opening) must contain all information listed for the specific item in Section 260120, including any applicable dimensioned layout drawings. Requests must be sent by mail or express delivery such that they are received in the Architect's office no later than ten working days prior to the opening of bids. Requests that are incomplete or are sent by facsimile will not be reviewed.

PART 3 - EXECUTION

3.1 ROLE OF THE SUPERINTENDENT:

A. The Division 26 Superintendent's duties shall include, but not be limited to the following:
   1. Preparation of submittals.
   2. Planning and layout of the work.
   3. Coordination with other trades and the local utility company.
   4. Posting addenda and changes in the work to maintain the Record Documents and to ensure that Division 26 personnel are working from up-to-date drawings and specifications.
   5. Supervision of all Division 26 personnel.
   6. Ongoing review of work in place to ensure compliance with the Contract Documents.
   7. Administrative duties as required to fulfill the requirements of the General Conditions, Special Conditions and Division 1 specifications.
   8. Training of the Owner's personnel.

3.2 PROTECTION OF THE WORK:

A. Protect the work during the course of construction. Do not install any equipment or materials until the proper environmental conditions have been established.

B. Store materials in the manner recommended by the manufacturer until materials are installed. Materials rated for indoor use shall not be stored outdoors regardless of the packaging in which the materials are shipped.

C. Prior to the building being "dried-in", protect incomplete conduit runs, outlet boxes, equipment enclosures, etc. from the entry of water or construction debris, by installing and maintaining temporary protective covers.

D. Do not install wiring devices, equipment or panel interiors until the building is dried-in. For the purposes of this specification "dried in" shall mean the roof has been installed, all exterior openings are covered and the interior of the building is dry.

E. Maintain temporary protective covers over equipment enclosures, outlet boxes and similar items after interiors, conductors, devices, etc. are installed, to prevent the entry of construction debris and to protect the installation during finish work performed by others. Do not install device plates, equipment covers or trims until finish work is complete.

F. Install temporary protective covers over equipment mounted on the building exterior to prevent corrosion damage during cleaning of the building exterior, by others.

G. Clean all equipment, inside and out, upon completion of the work. Scratched or marred surfaces shall be touched-up with touch-up paint furnished by the equipment manufacturer.

H. Equipment or materials that are improperly stored or are installed before the proper environmental conditions are achieved will be removed and replaced with new, at no cost to the Owner. The Contractor shall bear all consequences from any resulting delays.

I. All equipment and materials that become damaged will be removed and replaced with new, at no additional cost to the Owner.

3.3 CUTTING AND PATCHING:

A. Structural Limitations: Do not cut structural framing, walls, floors, decks, and other members intended to withstand stress, except with the Architect's written authorization. Authorization will be granted only when there is no other reasonable method for completing the electrical work, and where the proposed cutting clearly does not materially weaken the structure.

B. Cutting Concrete: Where authorized, cut openings through concrete (for conduit penetrations and similar services) by core drilling or sawing. Do not cut by hammer-driven chisel or drill.

C. Other Work: Do not endanger or damage other work through the procedures and process of cutting to accommodate electrical work. Review the proposed cutting with the Installer of the work to be cut, and comply with his recommendations to minimize damage. Where necessary, engage the original Installer or other specialists to execute the cutting in the recommended manner.

D. Patching: Where patching is required to restore other work, because of cutting or other damage inflicted during the installation of electrical work, execute the patching in the manner recommended by the original Installer. Restore the other work in every respect, including the elimination of visual defects in exposed finished, as judged by the Architect. Engage the original Installer to complete patching of various categories of work including: concrete and masonry finishing, waterproofing and roofing, exposed wall finishes, etc.

3.4 INTERFACE OF ELECTRICAL WORK WITH OTHER TRADES:

A. Where electrical work must connect to or be incorporated into work installed by other trades, engage the services of the other trade to interface the work. Under no circumstances shall the installer performing work under this Division of the specifications modify or alter work installed by others. Such work includes, but is not limited to:
   1. Roof Penetrations.
   2. Any attachments to roofing system.
   3. Penetrations in Vapor Barriers.
   4. Exterior Insulation and Finish Systems (EIFS).

END OF SECTION

SECTION 260120 - ELECTRICAL SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 GENERAL:

A. Submit for review by the Architect a schedule with engineering data of materials and equipment to be incorporated in the work.
   1. Submittals shall be supported by descriptive materials, i.e., catalog sheets, product data sheets, diagrams, performance curves and charts published by the manufacturer, to show conformance to Specifications and Plan requirements; model numbers alone shall not be acceptable.
   2. Data submitted for review shall contain all information to indicate compliance with Contract Documents. Complete electrical characteristics shall be provided for all equipment.
   3. Submittals for lighting fixtures shall include Photometric Data.
   4. The Architect reserves the rights to require samples of any equipment to be submitted for review.

B. Prepare submittals, including the necessary inter-division planning and coordination in accordance with the approved project schedule. Note that certain Division 26 submittals cannot be prepared until approved submittals are available from other Divisions of the work.

C. Submittal material shall be assembled and checked by the Division 26 superintendent.

D. All layout drawings shall be prepared under the supervision of, and checked by the Division 26 superintendent.

E. The fault current calculation required by Section 262042-Panelboards and 262044-Separately Enclosed Circuit Breakers shall be provided after service has been installed and inspected by the Authority Having Jurisdiction.

1.3 RESPONSE TO SUBMITTALS:

A. Shop drawings shall be evaluated by the Architect in accordance with the following classifications:
   1. "No Exceptions Taken": No corrections, no marks. Items may be ordered.
   2. "Make Corrections Noted": A few minor corrections. Items may be ordered as marked up without further resubmission.
   3. "Revise and Resubmit": Minor correction. Item may be ordered at the Contractor's option. Contractor shall resubmit drawings with corrections noted.
   4. "Rejected": Major corrections or not in accordance with the contract documents. No items shall be ordered. Contractor shall correct and resubmit drawings.

B. Whether resubmittals are required or not, all shop drawings shall be corrected for the record manuals specified in Section 260100.

1.4 FORMAT:

A. Submittals shall be made by specification section. Submittal data shall be placed in one or more hard-back 3-ring binders arranged and labeled according to specification section.

1. Each binder shall contain a title page and table of contents. Provide separator tabs, and label by specification section. Make note in the table of contents, any drawings that accompany the submittal.
2. Title page shall contain Project Name, Contractor's Name, Division 26 Superintendent's name, Suppliers and point of contact for each, and date.

1.5 SUBMITTAL GROUPING:

A. All submittals for a given system shall be submitted at the same time.

B. Submittals that do not comply with these requirements or that are deemed by the Architect to be incorrect shall be returned without review. The Contractor shall bear the burden of any resulting delays.

1.6 EQUIPMENT AND MATERIALS REQUIRING SUBMITTALS:

A. Section 260100 - General Provisions
   1. Superintendent's resume
   2. Electricians' qualifications

B. Section 260120 - Electrical Submittals
   1. Equipment Layout Drawings
   2. Attachment 1

C. Section 261010 - Raceway Systems
   1. Raceways and Fittings
   2. Expansion Fittings
   3. Wall Boxes and Covers
   4. Ceiling Boxes and Covers
   5. Floor Boxes and plates
   6. Surface Mounted Raceway System components
   7. Pull Boxes
   8. Troughs
   9. Firestopping Materials and Installation Drawings
   10. Letter advising Architect when firestop site demonstration will be conducted.
   11. Corrosion Protection

D. Section 262010 - Wires and Cables
   1. Conductors
   2. Connectors
   3. Splices

E. Section 262020 - Wiring Devices
   1. Receptacles
   2. Switches
   3. Photo-sensors
   4. Weatherproof Covers
   5. Device Plates
   6. Protective Covers

F. Section 262021 - Safety and Disconnect Switches
   1. Safety Switches
   2. Motor Rated Switches

3. Equipment List
4. Arc Flash Warning Labels
5. Nameplates

G. Section 262030 - Lighting Fixtures
1. Lighting Fixtures
2. Drivers
3. Emergency Ballasts

H. Section 262042 - Panelboards
1. Enclosures
2. Dimensional Data
3. Locks
4. Directory
5. Circuit Breakers
6. Bussing Diagrams
7. Metering
8. Arc Flash Warning Labels
9. Nameplates

I. Section 262044 - Separately Enclosed Circuit Breakers
1. Circuit Breakers
2. Enclosures
3. Dimensional Data
4. Control Wiring Diagrams
5. Arc Flash Warning Labels
6. Nameplates

J. Section 262047 - Dry Type Transformers, 600V and Below
1. Enclosures
2. Dimensional Data
3. % Impedance
4. Temperature Rating
5. Winding Material
6. Taps
7. Sound Ratings
8. Efficiency Ratings at 25%, 50%, 75% and 100% load.
9. Wiring Diagram (including grounding and bonding)
10. Suspension components
11. Arc Flash Warning Labels
12. Nameplates

K. Section 262049 - Surge Suppression / EHF Filter System
1. Data sheets
2. Dimensions for each suppressor type indicating mounting arrangement and required accessory hardware. Statement that maximum lead length required to connect suppressor will not increase clamping voltages from published values.
3. Manufacturer's letter certifying compliance with listed guidelines and standards.

L. Section 262080 - Electrical Grounding, 600V and Below
1. Ground Rods
2. Conductors
3. Connectors

4. Bonding Bushings
5. Ground Rod Enclosures

M. Section 266010 - Emergency Power Systems
1. Certification of site for service / warranty
2. Compliance / Labels (including EPA emissions compliance letter)
3. Maintenance Agreement
4. Rating
5. Engine
6. Generator
7. Controller
8. Instrument Panel
9. Mounting Base
10. Fuel Tank
11. Accessories
12. Automatic Transfer Switch
13. Automatic Transfer Switch Arc Flash Warning Label
14. Automatic Transfer Switch Nameplate

PART 2 - PRODUCTS

2.1 NOT APPLICABLE:

PART 3 - EXECUTION

3.1 MANUFACTURER'S DATA:

A. Include the manufacturer's comprehensive product data sheet and installation instructions.

B. Where operating ranges are shown, mark data to show portion of range required for project application.

C. Where pre-printed data sheet covers more than one distinct product-size, type, material, trim, accessory group or other variations, delete or mark-out portions of the pre-printed data which are not applicable.

3.2 EQUIPMENT LIST:

A. Where more than one type of a product is being used (i.e. starters, disconnects, breakers, etc.) provide a list with each submittal correlating the type and size of product to the load served.

3.3 TEST REPORTS:

A. Submit test reports which have been signed and dated by the firm performing the tests, and prepare in the manner specified in the standard or regulation governing the tests procedure as indicated.

3.4 ELECTRICAL LAYOUT AND COORDINATION DRAWINGS:

A. Electrical Rooms: Provide layouts of all electrical rooms, using the dimensions of equipment actually furnished. Locate all ducts and piping entering or crossing these spaces.

B. Mechanical Rooms and Mechanical Equipment Yards: Provide layouts showing all mechanical equipment based on dimensions of the actual equipment provided. Show the location of all motor controls, disconnect switches, control power junction boxes and conduit stub-ups at equipment. Location of stub-ups shall be based on manufacturer's installation drawings.

C. Panel and Equipment Feeders, 60A or more: The routing of feeders is not shown on the drawings. Actual routing shall be determined by the contractor in accordance with the specifications and shall be coordinated with work by other trades. For feeders of 60A or higher rating, provide layout drawings showing proposed routes.

3.5 ATTACHMENT NO. 1:

A. The intent of Attachment Number 1 is to ensure that the electrical requirements for equipment have been reviewed and coordinated by the Contractor. No electrical equipment shall be ordered, nor shall rough-in begin, before this coordination has taken place. This document shall be returned appropriately marked whether or not any changes are deemed to be necessary by the contractor.

ATTACHMENT NO. 1

SHOP DRAWING COORDINATION AFFIDAVIT

I, the Division 26 Superintendent, certify that I have reviewed the equipment shop drawings for electrically driven equipment and that the accompanying electrical shop drawings reflect the requirements of the actual equipment to be furnished for use on this project. The following deviations from design drawings were required to serve the furnished equipment:

ITEM	CKT. DESIG.		BKR.SIZE		CONDUIT/WIRE		DISC.SIZE		STARTER
	a. New	Old	New	Old	New	Old	New	Old	

NOTE: If no deviations are required, please indicate by circling the appropriate answer above your signature.

PROJECT: _____ DEVIATIONS: Yes / No

COMPANY: _____

TITLE: _____ SIGNATURE: _____

TELEPHONE: _____ DATE: _____

FAILURE TO PERFORM THE WORK REQUIRED BY THIS AFFIDAVIT, PRIOR TO ORDERING MATERIALS OR ROUGHING-IN, MAY RESULT IN IMPROPER CONNECTIONS BEING PROVIDED. THE EXPENSE OF CORRECTIVE MEASURES, IF REQUIRED, SHALL BE BORNE BY THE CONTRACTOR.

END OF SECTION

SECTION 261010 - RACEWAY SYSTEMS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK:

A. The requirements of this section apply to all electrical raceway systems and supporting devices, installed under this contract, except for concrete encased duct banks. Electrical raceway system is defined to include, but not be limited to, all electrical raceways, boxes, fittings and similar components necessary for a continuous pathway for the installation of cables or conductors. Supports are any devices or components used to support raceways or electrical equipment.

1.3 QUALITY ASSURANCE:

A. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT):

A. Uses permitted:
1. Indoors concealed in walls or ceiling.
2. Concealed in slabs above grade.
3. Exposed horizontal runs installed at least 7' above finished floor.

2.2 INTERMEDIATE METAL CONDUIT (IMC) OR RIGID GALVANIZED STEEL CONDUIT (RGS):

A. Uses permitted:
1. Indoors concealed or exposed.
2. Transition from below grade nonmetallic raceway system to above grade metallic raceway system.
3. Refrigerated spaces.
4. Vertical drops serving equipment.

2.3 RIGID NON-METALLIC CONDUIT (SCHEDULE 40 PVC):

A. Uses permitted:
1. Below grade installations.
2. Grounding electrode conductor raceway.
3. Lightning protection system down conductor raceway.

2.4 FLEXIBLE METAL CONDUIT:

A. Uses permitted:
1. Final connection to lighting fixtures.
2. Final connection to other than Division 23 equipment located in indoor, dry locations.

2.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT:

A. Uses permitted:
   1. Final connection to equipment in indoor or outdoor locations.

2.6 CONNECTORS/COUPLINGS:

A. Connectors/couplings for use with EMT conduit shall be steel compression type, except that steel, set screw type will be acceptable for EMT conduits sizes 2-1/2" and larger.

B. Connectors/couplings for use with IMC and RGS conduit shall be threaded type.

C. All connectors shall be insulated throat type.

D. Locknuts shall be of the same material as connectors.

E. All fittings shall be raintight. Fittings encased in concrete shall be concrete-tight.

2.7 CONDUIT BODIES:

A. Provide galvanized steel or cast metal conduit bodies constructed with threaded conduit ends, removable cover, and corrosion resistant screws.

2.8 CEILING OUTLET BOXES:

A. Provide 4" octagon, galvanized steel interior outlet boxes constructed with stamped knockouts in back and sides and with threaded holes with screws for securing box covers or wiring devices.

B. Boxes used to support ceiling paddle fans shall be listed for the purpose.

2.9 WALL OUTLET BOXES:

A. Recessed:
   1. Boxes shall be galvanized steel constructed with stamped knockouts in back and sides and with threaded holes with screws for securing box covers or wiring devices.
   2. Minimum box size shall be 4" square by 1-1/2" deep.
   3. Boxes for GFCI outlets, Division 22, Division 23, and Division 27 devices and other locations deemed necessary, shall be 4-11/16" square by 2 1/8" deep.
   4. Boxes shall have square edge tile type covers.
   5. Where devices are ganged, use gang-type boxes with gang box covers.
   6. The use of gangable type outlet or switchboxes is not acceptable unless required by specific device manufacturer.
   7. Use masonry type boxes of equal or greater volume to those specified above, in masonry walls.

B. Surface:
   1. Use cast aluminum box with threaded hubs in conjunction with metallic conduit systems.

C. Special Conditions:
   1. Where box type specified herein conflicts with requirements of equipment to be installed, equipment manufacturer's requirements shall govern.

2.10 INTERIOR PULL BOXES:

A. Provide galvanized sheet steel boxes without knockouts. Provide surface boxes with screw-held covers in unfinished areas. In finished areas, including storage rooms, provide recessed boxes with screw-held cover, finished to match panelboards.

2.11 WIRING TROUGHS:

A. Troughs shall be made of code gauge galvanized steel, without knock-outs, and shall be suitable for surface mounting. Provide screw-held, removable front cover. Trough and cover shall be finished the same as panelboards. Dimensions shall be as indicated on the drawings. Provide knock-outs as required.

2.12 SUPPORTS:

A. Supporting devices shall be the products of manufacturers' specifically intended for supporting electrical raceways, devices and equipment. Makeshift supports are not acceptable. Where channel type supports are used, select complete assemblies such as those illustrated in the B-Line Strut Systems Engineering Catalog, based on the weight of the raceway(s) or equipment being supported.

B. The use of tie wire or tie wraps as a means of support for electrical raceways, devices and equipment is not permitted.

C. Plywood backboards shown in Communications Rooms or otherwise for the support of low-voltage cabling systems and/or mounting of equipment shall be fire resistant, Type AC rated. The plywood shall be painted with gray, fire resistant coating. Ensure that the plywood rating seal is left exposed after painting.

2.13 FIRESTOPPING:

A. A through-penetration firestop system shall be used to seal penetrations of electrical conduits and cables through fire-rated partitions per NEC 300-21 and NEC 800-3. The firestop system shall be qualified by formal performance testing in accordance with ASTM E-814, or UL 1479.

B. The firestop system shall consist of a fire-rated caulk type substance and a high temperature fiber insulation. It shall be permanently flexible, waterproof, non-toxic, smoke and gas tight and have a high adhesion to all solids so damming is not required. Only metal conduit shall be used in conjunction with this system to penetrate fire rated partitions. Install in strict compliance with manufacturer's recommendations. 3M, Metacaulk or Nelson.

C. Submit installation drawings for conduit penetration, cable in metal sleeve penetration and blank metal sleeve penetration for each type of wall/floor construction encountered. Schedule a representative of the manufacturer to conduct a product demonstration / training session for each through-penetration firestop system to be used on this project. The session shall be held at the project site. Submit a letter to the Architect stating when the demonstration will be conducted.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL:

A. Wherever possible, install horizontal raceway runs above water and drain piping. Give the right-of-way in confined spaces to piping which must slope for drainage and to larger HVAC duct work and

similar services which are less conformable than electrical services. *However, ensure that all junction boxes and other points of access in raceway systems are located such that they are not rendered inaccessible.*

B. Complete the installation of electrical raceways before starting installation of cables within raceways.

C. All above grade conduits shall be routed parallel or perpendicular to the building structure.

D. Raceways shall not be installed exposed in finished spaces or on the exterior of the building. Install concealed in walls, ceilings, below slab-on-grade or embedded in slabs above grade. *Where raceway system serves surface mounted* equipment (i.e. safety switch), mount equipment over recessed outlet box.

E. All exposed raceway systems shall be painted to match the surface to which it is attached. All components of the raceway system shall be painted, i.e. conduits, boxes, supports, etc. Painting is specified under other divisions of the work.

F. Provide 200 lb. nylon pull cord in all conduits installed for cable systems specified under Division 23 and Division 27; and where conduits will be left empty for future use. Cap open ends and mark location of opposite end with black indelible marker pen.

G. Seal the inside of all conduits entering the building from outside, whether they connect to enclosures or not.

H. Do not run raceways atop the roof deck, through stairwells or elevator shafts.

3.2 BELOW SLAB AND IN-SLAB INSTALLATIONS: (within the building footprint)

A. *Do not install conduits in slabs on-grade.* Raceways shall be routed under the first floor building slab. Conduits shall be routed such that the top of the conduit is a minimum of six inches below the slab.

B. All 90 degree elbows and all stub-ups through the floor slab for all size conduits shall be corrosion protected RGS or corrosion protected IMC.

C. Raceways in slabs above grade shall be totally embedded in the slab. They shall be placed above the lower reinforcing and below the upper reinforcing. The outer edge in no case shall be less than 1" from the surface of the slab. The corners of raceways at turnups into walls shall not be exposed at the wall/floor junction.

D. Raceways for Division 27 systems shall not be installed in or below slabs unless specifically indicated.

3.3 BELOW GRADE INSTALLATIONS: (outside the building footprint)

A. Perform all excavating, trenching and backfilling to install work of this project in accordance with applicable sections of Division 2 of the specifications and ANSI C2. Bottom of trenches shall be smooth and level to provide uniform bearing for conduits.

B. Secure conduits in trench to eliminate unnecessary curvature and to prevent movement of conduits while backfilling.

C. Maintain 6" vertical separation between conduits installed one above the other. Backfill and compact each layer separately. The minimum cover requirements specified herein shall be referenced to the uppermost layer of conduits.

D. Maintain minimum 12" horizontal and 6" vertical separation between conduits of different systems and between other underground utilities.

E. Do not backfill until installed electrical work has been tested and accepted, wherever testing is indicated.

F. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen soil materials.

G. Backfill simultaneously on opposite sides of electrical work, and compact simultaneously; do not dislocate the work from installed positions.

H. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM Standard Proctor), using power-driven hand-operated compaction equipment.

1.	Lawn/Landscaped Areas:	90%
2.	Roadways:	95%
3.	Paved Area, Other than Roadways:	95%

I. Backfill to elevations matching adjacent grades, at the time of backfilling excavations for mechanical work.

J. Where compaction tests indicate lower densities of backfill than specified, continue compaction (and re-excavation and backfilling where necessary) and provide additional testing as directed by the Architect/Engineer.

K. Minimum cover requirements:
1. Exterior lighting branch circuits: 18".
2. Telephone / TV service conduits: 24".
3. Service entrance and feeder conduits, 600V and below: 24".

L. Secondary service entrance conduits:
1. Install conduits using base, intermediate and top spacers specifically intended for non-concrete encasement. Install spacers every 5'.
2. Backfill to top of conduits with river sand to ensure that compaction around spacers is achieved.

3.4 GRADE LEVEL PULL BOXES:

A. Top of boxes shall be set flush with finished grade and shall be aligned parallel or perpendicular to predominant site features (i.e. sidewalks, etc.)

B. The exact location of boxes shall be field determined based on existing conditions and coordination with other underground utilities.

C. Conduits shall enter boxes through field-made openings in the sides of box. Conduits shall not enter the bottom of box. Make and seal all openings in accordance with the box manufacturer's recommendations.

D. Provide a 6" layer of crushed rocks beneath open-bottom type boxes.

3.5 MOISTURE PROTECTION:

A. Conduits entering refrigerated spaces - Provide sealing fitting at accessible location outside the refrigerated space. Seal raceway to prevent the entry of moisture.

B. Where conduits pass from a conditioned space to a non-conditioned space, apply insulating electrical putty inside conduit, at an accessible location, to prevent the entry of moisture.

C. Conduits and boxes installed in exterior walls shall not penetrate the vapor barrier.

D. Boxes installed on the building exterior shall have gasketed covers. All conduits entering box shall be sealed with insulating electrical putty.

3.6 CORROSION PROTECTION:

A. Corrosion protection for conduits passing through concrete slabs shall be by one of the following means:
   1. Field-wrap conduits with tape, using with a 50 percent overlay. Tape shall be premium 7-mil, flame retardant, weather resistant tape. Resists temperature and moisture for splicing. Meets requirements of UL 510, HHI-595, and CSA 22.2.
   2. Conduits shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating.

B. All supporting materials installed exposed on the building exterior shall be hot-dipped galvanized after fabrication or provide an equivalent level of corrosion protection. Protect exterior raceway systems from damage while the building exterior is cleaned. Replace any portions of the system showing signs of rust at the time of final inspection.

3.7 GROUNDING:

A. Metallic raceway systems shall be made electrically continuous to provide a low impedance path to ground for faults, as required by the NEC.

3.8 RACEWAY BENDS:

A. Bend radius shall comply with the NEC and the requirements of the specific cabling system installed. For television and telephone service entrance conduits, consult with the local utility.

B. All field bends shall be made with a tool specifically intended for the purpose.

C. Tools using open flames are not acceptable for bending PVC conduit. Any section of conduit discolored or deformed in any way shall be cut out and replaced.

3.9 FLEXIBLE CONNECTIONS:

A. Final connections to light fixtures may be made using 3/8" diameter flexible metal conduit not exceeding 6 feet in length.

B. ½" diameter flexible metallic conduit may be used to fish existing walls, within the limits of NFPA 70.

C. Final connections to motors and to other electrical equipment subject to movement and vibration shall be made using Liquid-tight flexible metal conduit not more than 24" long.

3.10 SLEEVES:

A. Provide sleeves of the size and quantity required to install cabling systems specified under Division 23 and Division 27. Where multiple sleeves are required, install in a rectangular array.

B. Make and seal all penetrations to maintain fire rating of member penetrated. Pay particular attention to the annular space required around the inside and outside of the penetrating item. Sealing compounds shall be re-enterable type.

C. Coordinate the exact placement of sleeves with other trades to ensure they are readily accessible and are not obstructed by pipes, ductwork, etc.

D. Sleeves shall be flush with both sides of the member penetrated unless otherwise required by the through penetration firestop system selected.

3.11 RACEWAY LAYOUT:

A. Unless noted otherwise, the layout of all raceway systems is the responsibility of the Contractor.

B. Provide pull points as required by the NEC and ensure that all such points are readily accessible and not blocked by ducts, pipes, etc.

3.12 WALL OUTLET LAYOUT:

A. The location of devices shown on the drawings is schematic. Prior to roughing-in, review the Architectural interior elevations and millwork shop drawings, to ensure that outlets will not be installed behind cabinets or otherwise inaccessible. Ensure that there is sufficient space from door jamb, cabinets, etc. to install without trimming device cover.

B. Outlets installed below countertops shall be centered in the kneespace.

C. All outlets shall be installed vertically except where space above counter back splash and other features does not permit, and when installed in baseboards. In such cases, outlets shall be installed horizontally.

D. Maintain uniform spacing of outlets shown to be side-by-side on the plans. Spacing shall not exceed 2" in framed walls. For masonry walls, install outlets in adjacent cells.

E. Gang mount switches shown in the same location, unless noted otherwise. Provide metal barrier in boxes between switches, when switches are connected to opposite phases of systems exceeding 150V to ground.

F. Mark the branch circuit identification on the cover of all outlet boxes.

G. Provide separate outlet boxes and flexible final connections for fixtures provided with both normal and emergency power connections.

3.13 SUPPORTS:

A. Raceways:
   1. Support all components of the electrical raceway system using wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws, welded threaded studs, or spring-tension clamps on steel work.
   2. Support individual raceways with conduit straps or clips. Support multiple runs using trapeze-type hangers. Trapeze hangers shall consist of 1-1/2" x 1-1/2" gage steel channels, 1/2" diameter threaded steel rods and conduit clamps. Attach rods to the building structure or to 1-1/2" x 1-1/2" gage steel channels span between adjacent structural members.
   3. Support conduits at distances required by the National Electrical Code. *Additional supports shall be provided at the points of tangency of all bends.*
   4. Joints in conduit systems shall coincide with point of support.
   5. Provide expansion joints in all raceway systems in either of the following conditions:
      a. In accordance with manufacturer's literature, based on length of run and temperature differential that will be encountered.
      b. When raceways cross expansion joints.

B. Outlet Boxes:
   1. Ceiling outlet boxes shall be supported by lightweight channel attached to structure with (2)-1/4" threaded rods and braced to prevent lateral movement. Boxes used to support ceiling paddle fans shall be listed for the purpose.
   2. Masonry walls:
      a. Install outlet boxes in sawcut openings.
      b. Outlet boxes shall be grouted in place, back and sides. There shall no reveals around the perimeter of the box.
   3. Framed walls:
      a. Non-rated walls - Outlet boxes shall be attached to intermediate horizontal supports between vertical framing members. *Do not attach boxes to vertical members.*
      b. Framed walls rated 1-hr or 2-hr, boxes 16 square inches or less - Compartmentalize each outlet box (top, bottom and sides) using same material as wall framing. All penetrations in framing members shall be sealed. Where penetrations exceed 100 square inches per 100 square feet of wall space, install in accordance with subparagraph "c" below.
      c. Framed walls rated 1-hr or 2-hr, boxes exceeding 16 square inches - Compartmentalize boxes as specified above. Additionally, Boxes shall be covered back, top, bottom and all sides with drywall such that the rating is carried around the box. All penetrations in this envelope shall be sealed.
   4. Boxes shall not be installed in walls rated more than 2-hr.
   5. Do not install outlets back-to-back. Maintain 24" offset in rated walls and with no overlap in non-rated walls. Where groups of outlets are shown back-to-back, each group of outlets shall be shifted to accommodate the installation. *Exceptions: (1- Outlet boxes in non-rated masonry walls, may be installed back-to-back. Do not break webbing or connect boxes back-to-back. The use of thru-wall outlet boxes is not permitted. 2- The 24" offset may be eliminated in 1-hr and 2-hr walls when U.L. listed moldable putty is installed around box, in accordance with the U.L. Fire Resistance Directory.)*
   6. Outlet boxes mounted in STC rated walls shall be sealed in accordance with Gypsum Association Document GA-600 "Fire Resistance Design Manual, Sound Control".
   7. Cover of outlets installed flush mounted in walls shall be set back no more than 1/8" from face of wall.

3.14 ROUGH-IN FOR DIVISION 27 SYSTEMS AND USING AGENCY PROVIDED TELECOMMUNICATIONS SYSTEMS:

A. Provide all outlet and junction boxes, sleeves and raceways to form an accessible pathway from each wall or floor mounted device, and ceiling mounted devices to the communications backboard or headend equipment location in which the cable terminates, as specified herein and as indicated on the drawings.

B. Conduit sizes shall conform to the following:

1.	Voice / Data / Video outlet:	2-1"
2.	Voice / Data outlet:	2-1"
3.	Video outlet:	3/4"
4.	Fire alarm outlet:	3/4"
5.	Other:	3/4"

C. Raceways shall be labeled to the extent necessary to allow easy identification by the cable system installers.

D. Outlet box mounting height, cover type, and alignment shall be governed by Division 27.

E. Refer to Section 27 90 10 for additional requirements. Pay particular attention to the requirement that the fire alarm system wiring shall be installed in a complete raceway system.

3.15 ROUGH-IN FOR DIVISION 23 CONTROL WIRING:

A. Provide all outlet and junction boxes, sleeves and raceways to form an accessible pathway from each wall mounted device to the associated control equipment. Rough-in details shall be similar to that shown for Division 27 devices.

3.16 ROUGH-IN FOR DIVISION 22 PLUMBING FIXTURE SENSORS:

A. Provide outlet boxes for sensors and transformers furnished with the plumbing fixtures. Provide ½" conduit from each sensor location to a point within 6" of transformer outlet box, and terminate with insulated throat bushing.

B. Provide wiring as described in the mechanical equipment connection schedule.

3.17 FIRESTOPPING:

A. Do not proceed with firestopping until the field demonstration has been conducted.

B. Seal all penetrations based on rating / element being penetrated. Penetrations in non-rated walls shall be rated 1–hour.

END OF SECTION

SECTION 262010 - WIRES AND CABLES, 600V AND BELOW

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK:

A. The requirements of this section apply to the wire and cable work installed under this contract.

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturers: Provide wires and cables from manufacturers who have been in business for a minimum of five years.

B. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be used.

B. Color Coding
1. Color shall be green for grounding conductors and green with yellow stripe for isolated grounding conductors.
2. The color of the circuit conductors shall be as follows:
3. 120/208 volt, 3-phase Phase A - Black
Phase B -Red
Phase C - Blue
Neutrals – White (with stripes as specified below)
4. 277/480 volt, 3-phase: Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutrals – Gray (with stripes as specified below)
5. 120/208 volt, single phase: Phase A - Black
Phase B – Red
Neutrals – White (with stripes as specified below)

C. All conductors shall be 600V copper, with 75 degrees C, THWN/THHN insulation. Minimum size shall be No. 12 AWG. Conductors within three inches of fixture ballasts shall be rated 90 degrees C. Sizes up to No. 10 AWG may be stranded; sizes No. 8 AWG and larger shall be concentric-lay-stranded. All control conductors shall be concentric-lay-stranded.

PART 3 – EXECUTION

3.1 INSTALLATION GENERAL:

A. No more than three phase conductors, each of opposite phases for a three phase WYE system, shall be combined in a single raceway without written permission from the Architect.

B. For each ungrounded conductor, provide a dedicated neutral conductor, with stripe color to match ungrounded conductor insulation color.

C. No more than two phase conductors, each of opposite phases for a single phase, delta system, shall be combined in a single raceway without written permission from the Architect.

D. For each electrical connection/termination, provide a complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other materials necessary to complete splices and terminations. Torque all connections according to installation instructions.

E. Motor connections shall be made with compression connectors forming a bolted in-line or stub-type connection. Connections shall be insulated with Raychem MCK motor connection kit.

F. Splicing of feeder conductors shall not be acceptable, unless specifically indicated on the drawing. Where splicing of feeder conductors is indicated, splices shall be made using Raychem RVS splice kit and compression type butt splice.

G. Numbers 10 and 12 AWG stranded conductors shall not be directly terminated to screw-type terminals. The use of Stacon type compression connectors is required.

H. All conductors shall be installed in raceways.

I. Make connections to wiring devices using "pigtails" within outlet boxes. *Direct connection (loop) to devices is not acceptable.*

3.2 DISTANCE LIMITATIONS FOR 20A BRANCH CIRCUITS:

A. All 120 volt, 20 amp branch circuits exceeding 90 feet in length shall consist of No. 10 AWG circuit conductors. Increase conduit size accordingly.

B. All 277 volt, 20 amp branch circuits exceeding 150 feet in length shall consist of No. 10 AWG circuit conductors. Increase conduit size accordingly.

END OF SECTION

SECTION 262020 - WIRING DEVICES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK:

A. The requirements of this section apply to all wiring devices installed under this contract.

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturers:
   1. Provide devices by manufacturers listed for each item.

B. Occupancy/Vacancy sensor catalog numbers and locations shown on plans and specifications are for representation purposes only. Exact models and mounting locations shall be provided by sensor manufacturer. System drawings including device layout, device type, and wiring details shall be submitted for review in shop drawing phase prior to ordering. All sensors shall be dual technology.

C. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide factory-fabricated wiring devices, in type, color and electrical rating for the service indicated. Where type and grade are not indicated, provide proper selection as determined by Installer to fulfill the wiring requirements, and complying with NEC and NEMA standards for wiring devices.

B. Device colors shall be selected by the Architect on an area-by-area basis.

2.2 GENERAL USE RECEPTACLES:

A. Standard: Hubbell 5352, Cooper 5352, Pass & Seymour 5362, or Leviton 5362.

B. Ground-Fault Receptacles and Devices: Hubbell: GF5352, Pass & Seymour 2095, or Leviton 6899.

C. Receptacles shall be 2-pole, 3-wire, grounding type, rated 20A/125V.

D. Provide weather resistant receptacles in all outdoor locations.

2.3 SPECIAL PURPOSE RECEPTACLES:

A. Provide heavy-duty type of the NEMA configuration indicated on the drawings, as manufactured by Hubbell, Pass & Seymour or Leviton. Contractor shall verify plug type with equipment plug prior to ordering.

2.4 SWITCHES:

A. Toggle: Hubbell HBL1221, Leviton 1221, or Pass & Seymour 20AC1. Provide single-pole, three-way and four-way switches as indicated. Catalog numbers listed herein are for single pole units. Other configurations shall be from the same product family.

B. Switches installed adjacent to dimmers shall be of the same type and style as dimmer.

C. Narrow-body switches for installation in door-jambs shall not be used.

D. Switches shall have ground screw.

2.5 WALL-BOX DIMMERS: By Leviton, Watt-Stopper or equal. Dimmer ratings shall be at least 125% of circuit load. Derate ganged installations as recommended by the Manufacturer. Dimmers shall be preset with slide-to-off type. Provide single or three-pole, as indicated.

2.6 OCCUPANCY/VACANCY SENSORS:

A. Corner Mounted: Dual technology (Ultrasonic & Infrared), ceiling or wall bracket mounted. Select based on size of space. Provide power pack and mounting hardware; suitable for switching 120 and/or 277 volt loads. Watt-Stopper DT-200 series, Hubbell LODT series, or equivalent by Cooper and Leviton.

B. Ceiling Mounted: Dual technology (Ultrasonic & Infrared), ceiling mounted. Select based on size of space. Provide power pack and mounting hardware; suitable for switching 120 and/or 277 volt loads. Watt-Stopper DT-300 series, Hubbell OMNIDT series, or equivalent by Cooper and Leviton.

C. Wall Mounted: Dual technology (Ultrasonic & Infrared), wall bracket mounted. Select based on size of space. Suitable for switching 120 and/or 277 volt loads. Watt-Stopper DW-100 series, Hubbell LHMTS1 series, or equivalent by Cooper and Leviton.

D. The triggering of only one technology shall keep the fixtures on.

E. Power packs for sensors shall be rated for control of fractional horsepower motor loads in conjunction with the respective lighting load. Low-voltage multi-conductor cable between sensors and power packs shall be plenum rated, 22 AWG.

F. Provide low voltage momentary switch(es) for manual control in configuration shown on plans.

G. Provide auxiliary contacts in sensors where shown on shown on the project drawings, or as otherwise required for the functionality specified in the particular building space.

2.7 WIRING DEVICE ACCESSORIES:

A. Wall Plates: Provide one piece wall plates for wiring devices, with ganging and cutouts as indicated. Provide blank plates for all unused outlet boxes. Provide with metal screws for securing plates to devices, screw heads colored to match finish of plate, and wall plates possessing the following additional construction features:
   1. Material and Finish: Type 302 stainless steel in finished spaces and stamped steel in unfinished spaces
   2. Wall plates for surface raceway boxes shall be of the same width as the surface raceway boxes.
   3. All plates shall be mid-size size.

B. Weatherproof Covers: All devices installed outdoors shall be provided with weatherproof covers. Covers shall be Intermatic die-cast WP series (or equivalent), single or two gang type. The assembly shall be U.L. listed for wet locations, when in use.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

A. General:
1. Devices of the same type shown side-by-side shall be gang-mounted and installed under a common plate unless specifically noted.
2. Do not install receptacles within 6" of the edge of sinks.
3. Provide weatherproof covers for all devices installed outdoors.
4. All receptacles installed outdoors, all kitchen receptacles, and receptacles within six feet of sinks and other interior receptacles specifically indicated shall be GFCI type.
5. Coordinate location of electric water cooler receptacles with cooler manufacturer's recommendations.

B. Connections:
1. Make connections to side terminals only. Wrap side of device with two complete turns of 600V electrical tape, to cover the exposed terminals.
2. See Section 262010 for conductor requirements.

C. Labeling:
1. Provide engraved device plates where indicated. Use 1/8" high black letters.
2. Device plates for receptacles in patient care areas shall have circuit designation engraved in 1/8" high black letters.
3. Mark the branch circuit to which the device is connected on the back of each device plate, using an indelible marker pen.

3.2 DIMMERS:

A. In multi-circuit homeruns, provide separate neutrals for each circuit. Do not use a common neutral.

3.3 OCCUPANCY/VACANCY SENSORS:

A. Corner mounted sensors shall be ceiling bracket mounted where ceiling is present and no higher than 12' AFF. Where space has no ceiling or ceiling is higher than 12' AFF, the corner mounted sensor shall be mounted 10' AFF on a manufacturer-supplied wall bracket.

B. Sensors shall be installed in locations shown on manufacturer submitted shop drawings.

C. Connect low voltage momentary switch(es) to sensor power-pack to achieve manual-on/automatic-off operation in the configuration shown on plans. Switch(es) shall allow manual-off operation as well.

D. Wall mounted sensors shall also be configured to operate manual-on/automatic-off, in configuration shown on plans.

E. Manual switches are not required in corridors, stairwells or, multiple occupant restrooms. Sensors shall be automatic-on/automatic-off in these spaces.

F. Low-voltage sensor cable shall be supported by j-hooks attached to structural members, and shall be run at right angles with respect to building structure.

G. Adjust time-off delay to a minimum of fifteen minutes.

H. Prior to project closeout, the Manufacturer and/or his designated Representative shall test and adjust ALL occupancy sensors on a space by space basis. Adequate personnel shall be provided to perform this work in a timely fashion. Delay times shall be coordinated with the Owner's Representative. Sensor sensitivities shall be adjusted as necessary for optimum performance and to minimize false activations from movement in adjacent spaces. If optimum performance of occupancy sensors cannot be achieved with installed device quantities and locations, adjustments to the quantity and/or location of the occupancy sensors shall be performed at no additional cost to the Owner. Retest and adjust occupancy sensors as appropriate. At the conclusion of commissioning, the Manufacturer and/or his Designated Representative shall submit a comprehensive and detailed testing report as part of the as-built submittal package. Changes to the original manufacturer's layout submitted as part of the Division 26 submittal package shall be annotated on the as-built layout drawings.

3.4 TESTING:

A. Test all devices to ensure proper polarity and grounding.

3.5 PROTECTION:

A. If painting and other finish work occurs after device installation, protect device and conductors by installing and maintaining temporary cover:

END OF SECTION

SECTION 262021 - SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK:

A. The requirements of this section apply to all safety and disconnect switches installed under this contract.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide products produced by one of the following (for each type of switch):
   1. General Electric Company
   2. Square D Company
   3. Westinghouse/Cutler Hammer
   4. Siemens

B. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 SAFETY AND DISCONNECT SWITCHES:

A. Switches shall be 600V heavy duty type, sheet steel enclosed safety switches, incorporating quick-break type switches, constructed so switch blades are visible in "OFF" position with the door open. Switches shall be equipped with operating handles which are an integral part of the enclosure base and whose positions are easily recognizable. Switches shall be pad-lockable in the "OFF" position. All current carrying parts shall be constructed of high-conductivity copper and silver-tungsten type switch contact. All switches shall be UL listed. Switches shall have engraved plastic nameplates indicating the load served, load rating and the branch circuit number.
   1. Example – (not actual disconnect on project): HP-1
      35.5A, 1ph, 208V
      Fed from HA-2

B. Switches shall be non-fused type unless indicated otherwise or unless required by the manufacturer of the driven equipment. Where fuses are required, provide fuses of the type recommended by the equipment manufacturer.

C. Nameplates shall be screwed and glued to the enclosure.

2.2 MOTOR RATED SWITCHES:

A. Switches shall be toggle-type, without overload protection, rated for the applied voltage and motor load.

B. Label same as specified for disconnect switches, except install label on wall adjacent to switch.

2.3 ARC FLASH WARNING LABELS:

A. All safety and disconnect switches shall have arc flash warning labels field affixed to their enclosures that comply with the requirements of NFPA 70 and NFPA 70E.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Coordinate safety and disconnect switch installation with surrounding equipment to provide clearance and workspace based on the voltage encountered, and to insure that the switch is within sight of the controller or driven equipment.

B. Group and lace conductors within enclosure with nylon tie straps.

C. Location of safety switches shall be coordinated with the equipment installer. Do not proceed with rough-in until location has been established.

D. All switches associated with outdoor equipment shall be located as close to the equipment as possible (when equipment is in a service yard, switches shall also be in the service yard) and mounted such that the top of the switch is no more than 3'-0" above grade. All switches associated with equipment mounted above a lay-in ceiling shall also be located above the lay-in ceiling.

END OF SECTION

SECTION 262030 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION:

A. This section of the specifications is applicable to all lighting fixtures and fixture accessories.

B. Fixtures shall be LED style, LM70 compliant.

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturers:
   1. Lighting fixtures - see fixture schedule on drawings.

B. Submittals: Refer to Paragraph 3.05 and Section 260120.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES:

A. Provide lighting fixture assemblies complete with all hardware and accessories needed to install and connect, as indicated on the drawings and this section of the specifications.

B. The Contractor shall select the voltage, frame type, driver temperature rating based on the use shown, on an area-by-area basis. These modifiers are not included in catalog numbers. (i.e. A given fixture may be required for use on more than one voltage. Determine voltage by circuit to which fixture is connected.)

C. Any fixtures that are defective or damaged shall be replaced with new. This includes, but is not limited to scratches, dents, inconsistent finishes, etc. The Architect's opinion shall be final in making the determination.

2.2 EMERGENCY BALLASTS:

A. Fixtures shown to have integral backup power shall be provided with emergency type battery intended for LED fixtures.

B. Emergency ballasts shall be self-testing/self-diagnostics capability. Ballast shall perform tests once every 30 days for minimum of 30 seconds and annually for a minimum of 90 minutes. Test failures shall emit a flashing light "ONLY". The flashing light and test switch shall be integral to fixture body and visible from floor below.

C. Emergency ballasts shall be factory installed.

D. Ballasts installed in fixtures located outdoors or unheated spaces shall be suitable for the ambient temperatures encountered.

2.3 FRAMES AND HOUSINGS:

A. Fixture catalog numbers indicate style of fixture required. Provide fixtures with proper frames for ceiling types indicated on the reflected ceiling plan.

B. Fixtures installed in inaccessible ceilings shall be U.L. approved for through wiring and all components shall be accessible from below.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General:
1. Do not use permanent fixtures to provide temporary construction lighting. No fixture shall be installed until the interior of the building is enclosed, conditioned, clean and free of dust.
2. Install lighting fixtures in accordance with the fixture manufacturer's written instructions
3. Fasten fixtures securely to the indicated structural support members of the building; and check to ensure that solid pendant fixtures are plumb.
4. Lay-in fixtures shall be supported independently of the suspended ceiling framing members by at least two tie wires located on opposite corners of each fixture.
5. Fixtures other than lay-in type shall be securely fastened in accordance with NEC Article No. 410-36 (B).
6. Fixtures installed in rated ceilings shall comply with the U.L. Fire Resistance Directory for the ceiling design encountered.

B. Layout:
1. Locate fixtures as indicated on the reflected ceiling plans.

C. Recessed Fixtures:
1. It is anticipated that piping and ductwork systems will be installed prior to the installation of ceiling systems and lighting fixtures. Coordinate recess depth of fixtures, on an area-by-area basis, with other trades, to ensure that sufficient recess depth is maintained.
2. Maintain clearance from thermal insulation and combustible materials as required by the NEC.

D. Emergency fixtures:
1. Where emergency fixtures with integral emergency ballasts are shown to be switched, pull an unswitched phase conductor to emergency ballast.
2. Do not switch exit lights.

3.2 CLEANING:

A. Prior to final inspection, clean lighting fixtures in a manner recommended and approved by the manufacturer.

B. Replace any components that are damaged.

C. Specific attention is directed to the appearance of pendant mounted fixtures. Field touch-up of the finish will only be acceptable when:
1. The level of damage to the finish does not require replacement of the product, in the sole opinion of the Architect.

AND

2. The Contractor ordered and took delivery of touch-up paint, as well as the manufacturer's recommendations on touch-up, at the time the product was ordered.

AND

3. The touch-up is acceptable to the Architect.

D. TESTING:

1. Test all fixtures for proper operation. Replace lamps and ballasts that are not working properly.
2. Test the emergency lighting system by opening the main circuit breaker serving the facility.
3. Schedule the test with all trades to ensure the tests will not have adverse effects on other equipment and to make sure that other systems properly shutdown and restart.
4. The test shall be conducted at night, the presence of the Architect, Using Agency and State Fire Marshal.
5. The assembled persons will walk the project to:
   a. Verify operation of equipment installed.
   b. Review lighting levels on an area-by-area basis.

END OF SECTION

SECTION 262042 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SCOPE OF WORK:

A. Provide panelboards as indicated on the drawings and as specified herein.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Provide products by one of the following (for each type of panelboard and enclosure).
   1. General Electric Company
   2. Square D Co.
   3. Westinghouse/Cutler Hammer
   4. Siemens

B. Compliance / Labels:
   1. Equipment shall comply with the latest applicable standards of NEMA PB-1 and UL 67.
   2. Where panelboards are used as service entrance equipment, they shall comply with all NEC and UL requirements for service entrance and a UL service entrance label shall be provided.

C. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 ENCLOSURES:

A. Enclosure shall be constructed of code gauge steel constructed without knock-outs. Provide manufacturer's standard light gray finish.

B. Provide double hinged door with flush metal latch/lock on inner door. Inner door shall provide access to circuit breaker operating handles only, not to energized parts. Outer continuous piano hinged door shall be mounted to the panelboard box with factory screws and shall provide access to energized parts; metal latch/lock is not permissible on outer door. Both inner and outer doors shall open in same direction. EZ Trim doors are not permitted.

C. All locks shall be keyed alike.

D. Provide metal or lexan interior circuit directory frame with card and clear plastic covering.

E. Panelboard enclosures shall be NEMA 1 unless shown to be installed in damp or wet locations. In such locations, enclosures shall be NEMA 3R or 4X.

2.2 CONSTRUCTION:

A. Provide dead-front safety type panelboards of either Power and Distribution type or Lighting and Appliance type as defined by the NEC.
   1. Power and Distribution type panelboards shall be a minimum of 32" wide by 9" deep and a maximum of 44" wide by 12" deep.
   2. Lighting and Appliance type panelboards shall be a maximum of 20 inches wide by 5-3/4 inches deep.

B. Panels shall be equipped with copper bus bars, full-sized neutral bar, and an equipment ground bus.

C. Each panel shall be equipped with main lugs or main breaker, as indicated.

D. Two section panels shall be through-feed type and shall be installed with cans abutting. *Cans and covers shall be of same size, for both sections.* Divide circuits as evenly between the two sections as possible.

E. Provide with laminated plastic nameplate engraved with name of panel, voltage, ampere rating/type fault current rating, date, and feeder origination. Nameplate shall be screwed and glued to panel. Nameplates shall be black in color with white lettering. Nameplates shall have beveled edges.
   1. Example (not actual panel on project): Panelboard HA
      277/480V, 3 phase, 4W
      225A Main Lugs
      14,000 AIC
      Fed from SWBD
      9/2008

2.3 CIRCUIT BREAKERS:

A. Provide bolt-in type, heavy duty, quick-make, quick-break, thermal, magnetic molded case circuit breakers. Multi-pole breakers shall be common trip, with a single handle.

B. Main circuit breakers shall be large frame type, individually mounted, connected directly to the bus. The use of backfed breakers is not acceptable.

C. Provisions for future breakers shall be fully bussed complete with all necessary mounting hardware.

D. Devices which achieve the level of fault protection indicated by means of "series" or "integrated" rating shall not be acceptable unless specifically indicated on the drawings.

E. Breakers serving HVAC equipment shall be HACR type.

F. Circuit breakers serving fire alarm equipment shall be provided with a lock tab, red in color.

2.4 BRANCH CIRCUIT IDENTIFICATION:

A. All panelboards shall have a legend permanently posted to their exterior frontal enclosure identifying phasing and the color scheme of all ungrounded conductors in accordance with NFPA 70, Article 210.5.

2.5 METERING:

A. On panelboards used as service equipment, provide Siemens 9330, complete with current transformers and interconnecting wiring, all rated for 1% accuracy. Unit shall be factory installed and tested. Flush mount meter in termination compartment. Equivalent metering by Westinghouse, G.E. or Square D is acceptable.

2.6 WARNING LABELS:

A. All panelboards shall have arc flash warning labels field affixed to their enclosures that comply with the requirements of NFPA 70 and NFPA 70E.

B. Where panelboards are used as service equipment, provide separate label to show the maximum available fault current. Label shall have blank fields to handwrite the calculated available fault current and the date calculated. After service is installed and ready to be inspected by the Authority Having Jurisdiction, Contractor shall submit to the Electrical Engineer the fault calculation (at the service entrance only).

PART 3 - EXECUTION

3.1 GENERAL:

A. Provide circuit directory upon completion of work. Identify load served and location (by room name and number) assigned by user, not by room numbers on floor plans. Note spares and spaces as such. Create directory using electronic spreadsheet and print in 8-1/2" x 11" format using as many pages as necessary. Fold and place in directory holder.

B. Do not splice conductors in panelboard enclosure.

C. Only one conductor shall be connected to each terminal or lug.

D. Connect circuits 1 and 2 to phase A; 3 and 4 to phase B; 5 and 6 to phase C., etc. Conductors shall be color coded in accordance with Section 262010.

E. Group and lace conductors within panel enclosure with nylon tie straps.

F. Each section of two section panels shall contain only those conductors which originate in that section. Do not use panel as a wireway.

3.2 GROUNDING:

A. Ground all panels in accordance with details on the drawings and Section 262080.

B. Do not bond neutral and equipment grounding conductors within panelboard unless panel is used as service equipment or are a separately derived system.

3.3 ADJUST AND CLEAN:

A. Adjust operating mechanism for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

C. Clean all debris from panel interiors.

D. Clearance and Workspace: Maintain workspace and clearances as required by the NEC for the voltage encountered. No pipes or ducts shall pass above the outline of the panelboard. It shall be the responsibility of this Contractor to make sure that other trades do not encroach on this space.

END OF SECTION

SECTION 262080 - ELECTRICAL GROUNDING, 600V AND BELOW

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK:

A. Provide grounding and bonding of systems and equipment as shown on the drawings, specified herein and as required by Article 250 of the NEC.

B. The grounding electrode system shall consist of:
1. Ground rods.
2. Underground metal water supply pipe, outside the building.
3. Concrete encased electrode
4. Ground ring - around the perimeter of the building.

C. The following items shall be bonded to the grounding system:
1. Structural steel frame of the building.
2. Interior metal piping systems.
3. Equipment enclosures.
4. Device terminals.
5. Equipment grounding conductors.

1.3 RELATED WORK:

A. Grounding and bonding for Lightning Protection Systems is specified in Section 265000.

B. Grounding of systems above 600V is specified in Section 263030.

1.4 QUALITY ASSURANCE:

A. Acceptable Manufacturers: Use products of manufacturer's regularly engaged in the production of grounding systems products.

B. Standards: IEEE Green Book - Grounding.

C. Compliance / Labels: All materials shall be U.L. listed for grounding and bonding systems.

D. Submittals: Refer to Section 260120 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Where more than one type meets indicated requirements, selection is Installer's option. Where material or component is not otherwise indicated, provide products complying with U.L., NEC, and established industry standards.

2.2 GROUND RODS:

A. Rods shall be 3/4" diameter x 10' long copper-clad steel, sectional type.

B. Couplings shall be of the type specifically intended for use with sectional rods.

2.3 CONDUCTORS:

A. Grounding Electrode conductors: Bare, stranded copper electrical grounding conductors, sized as shown. When no size is shown, select from Table 250-66 of the NEC.

B. Bonding Jumper Braid: Copper braided type, sized for application.

C. Equipment Grounding conductors: Insulated, stranded copper electrical grounding conductors complying with Section 262010, sized as shown. When no size is shown, select from Table 250-122 of the NEC.

2.4 CONNECTORS:

A. Connectors to rod or reinforcing steel bar electrodes shall be exothermic weld type. The use of wire ties to make rebar continuous is not acceptable.

B. Connections to pipe electrodes shall be pressure or clamp type.

C. Connections to items specified to be bonded to the grounding system may be by any U.L. listed product suitable for the application.

2.5 CAUTION TAGS:

A. Tags shall be weatherproof, custom-printed plastic type, 3-1/4" wide x 5-5/8" high, with stainless steel eye and nylon self-locking tie.

B. Tags shall be two-sided and shall have yellow background with black letters. The word "CAUTION" shall be machine-printed in boldface type at the top, with the custom message machine-printed below.

C. Provide the number of tags required, plus six spare.

D. Tags shall be Seton #12584, or equivalent. (Seton: 1-800-243-6624)

PART 3 - EXECUTION

3.1 GENERAL:

A. Ensure that metal-to-metal contact is made between grounding connectors and painted or coated surfaces of equipment enclosures, piping systems, etc.

B. Where concrete penetration is necessary, non-metallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground wire and the opening shall be sealed with a suitable compound after installation of the ground wire.

C. Metallic raceway systems shall be made electrically continuous to provide a low impedance path to ground for faults, as required by the NEC.

3.2 GROUNDING ROD ELECTRODES:

A. Install ground rods in the approximate location shown. Drive three, 10-feet sections into the earth such that the top of the uppermost rod is 8" below finished grade.

B. Install an enclosure for each ground rod, similar to a Quasite "PC" style, open bottom box, with nominal dimensions of 17" long x 11" wide x 12" deep. Box cover and installation method shall be suitable for light vehicular traffic (8000 lbs over a 10" square). Box cover shall be locking type and have the logo "GROUND".

C. The rod and exothermic connection to the grounding electrode conductor shall be accessible from within enclosure. Fill the lower 2" of enclosure with crushed rocks. Top of enclosure shall be flush with finished grade.

D. Install boxes in accordance with the manufacturers' instructions for the loading indicated. Note that full vehicular traffic rating requires the box to be encased in concrete and use of steel cover.

3.3 BUILDING PERIMETER GROUNDING ELECTRODE:

A. Make bottom rebar in concrete footing around the perimeter of the building electrically continuous. Ensure minimum of 2" of concrete encasement between earth and rebar. Ensure that the concrete footing is in direct contact with the earth. Where vapor barrier, insulation, films, or similar items are below footer, paragraph B below shall be followed instead.

B. Ground Ring. Install a No 4/0 AWG bare copper conductor around the perimeter of the building, with at least 30" cover. Install conductor as close to foundation wall as possible.

3.4 UNDERGROUND METAL WATER PIPE ELECTRODE:

A. Make connection to "street" side of water meter.

B. Install braided type bonding jumper between "street" side and "house" side piping such that removal of water meter will not interrupt ground path.

C. The connection shall be accessible.

3.5 EQUIPMENT GROUNDING CONDUCTORS:

A. Install an equipment grounding conductor in all branch circuit and feeder raceways, sized in accordance with Article 250 of NFPA 70.

B. Branch circuits serving isolated ground receptacles shall be provided with an isolated equipment grounding conductor in addition to the equipment grounding conductor.

3.6 BONDING:

A. Bond the structural steel frame of the building to the service equipment ground bus. The connection shall be accessible.

B. Bond column anchor bolts of structural steel building to building perimeter grounding electrode no less than every 100'.

C. Multiple buildings present under one electric service shall be bonded.

D. Bond each dry type transformer to nearest accessible structural steel member if present. Otherwise to nearest metallic water pipe.

E. Bond interior metal piping systems to the service equipment ground bus. The connections shall be accessible.

F. Bond metallic equipment enclosures to a lug installed within the enclosure, which is connected to an equipment grounding conductor.

G. Bond standard device grounding terminals to metallic outlet box and to equipment grounding conductor.

H. Bond equipment grounding conductor to metallic boxes where splices are made.

I. Bond isolated ground device grounding terminals to the *isolated* equipment grounding conductor and the metallic outlet box to the equipment grounding conductor.

3.7 SINGLE POINT GROUNDING FOR EQUIPMENT ROOMS REMOTE FROM THE SERVICE EQUIPMENT:

A. Extend a No.1/0 THWN grounding conductor from a convenient point along the "ground ring" to the each electrical room or other space where connection to a system grounding point is required. In electrical rooms, this point shall serve as the point of connection to secondary of dry type transformers, grounding point for surge arresters, and the point of a supplementary connection to the building steel. Connection to ground ring does not have to be accessible.

B. Terminate the conductor on a 1/4" thick x 3" high x 12" long copper bar. Rigidly attach bar to the wall, providing a 2" gap between wall and bar. Drill bar and install lugs to make all necessary connections.

3.8 BONDING BUSHINGS AND LOCKNUTS:

A. Bushings and locknuts shall be required:
   1. Service entrance conduit stub-ups. Interconnect with No. 3/0 AWG (bare) and bond to ground bus in the service equipment.
   2. When required by the NEC for voltages in excess of 250V. Bonding conductor shall be sized per the NEC.
   3. When terminating conduits in concentric or eccentric knockouts. Bonding conductor shall be sized per the NEC.
   4. For all connectors that are not U.L. listed as suitable for grounding.

B. Bushings shall be connected to the respective enclosure by an equipment grounding conductor sized in accordance with Article 250 of the NEC.

3.9 LABELING:

A. Provide a waterproof "CAUTION" tag at the point of connection to each grounding electrode, which reads: "ELECTRICAL SYSTEM GROUNDING ELECTRODE - DO NOT REMOVE THIS CONNECTION. NOTIFY BUILDING MANAGEMENT IF DAMAGED OR DISCONNECTED."

B. Provide a "CAUTION" tag as specified above at the single point ground connection in MDF / IDF rooms and in all equipment rooms remote from the electrical service equipment.

C. Provide a "CAUTION" tag as specified above within the electrical service equipment where the grounding electrode conductor is terminated.

3.10 TESTING:

A. Upon completion of installation of electrical grounding system, test resistance of each ground rod installation using the "Fall of Potential" method. Ground resistance shall be measured in normally dry conditions not less than 48 hours after rainfall. Where tests show resistance to ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms or less by driving additional sections of ground rods and/or by chemically treating soil encircling ground rod; then retest to demonstrate compliance. Provide forms to record the data as the tests are conducted. Forms shall be signed by the person conducting the test.

END OF SECTION

SECTION 310519.13 – GEOTEXTILES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the installation of separation/stabilization fabric as shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. The latest edition of the following standards, as referenced herein, shall be applicable.
   1. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

A. Product Data:
   1. Submit Manufacturer's material specifications, product literature and installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver sufficient materials to the site to prevent interruption of the work.
   2. All materials shall be inspected by Contractor upon delivery. Contractor shall notify Engineer of any damage. Products received at the site torn, with holes, deteriorated, or otherwise damaged will not be approved and shall be returned and replaced at no expense to the Owner.

B. Storage:
   1. All material shall be stored in strict accordance with the manufacturer's recommendations and as approved by the Engineer.
   2. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements, if stored outdoors, elevate, and protect geotextile with waterproof cover.

C. Handling:
   1. All material shall be handled in strict accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 – PRODUCTS

2.1 NONWOVEN GEOTEXTILE

A. Separation/Filtration Fabric: To be used in drainage ditches, haybale installation, culvert outfall installations, rip-rap outfall installations, and cover material separation.

B. Pervious sheet of polyester, polypropylene, or polyethylene fabricated into stable network of fibers that retain their relative position with respect to each other. Nonwoven geotextile shall be composed of continuous or discontinuous (staple) fibers held together through needle-punching, spun-bonding, thermal-bonding, or resin-bonding.

C. Geotextile Edges; selvaged or otherwise finished to prevent outer material from pulling away from geotextile.

D. Unseamed Sheet Width: Minimum 12 feet.

E. Physical Properties: Conform to the requirements noted below:

PROPERTY	DESIGN VALUE	TEST METHOD
Tensile Strength	160 pounds	ASTM D4632
Elongation	50 percent	ASTM D4632
Trapezoidal Tear	60 pounds	ASTM D4533
CBR Puncture Strength	400 pounds	ASTM D6241
A.O.S.	70 (US Sieve)	ASTM D4751
Permittivity	1.4 sec^{-1}	ASTM D4491

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for the installation and seaming of geotextile fabric in accordance with the specifications and the manufacturer's recommendations, as approved by the Engineer.

3.2 SUBGRADE PREPARATION

A. Surfaces to be covered with geotextile fabric shall be smooth and free of rocks, sticks, roots, sharp objects, and all debris that may damage the fabric. The surface to be covered shall be firm and unyielding, with no sudden changes or breaks in grade. There shall be no standing water or excessive moisture on the surface when the fabric is placed.

B. The compacted subgrade shall be maintained in a smooth, uniform, and compacted condition during installation of the fabric.

3.3 GEOTEXTILE INSTALLATION

A. The fabric shall be cleaned of all debris or other materials that may negatively affect the fabric's performance.

B. Mechanical equipment shall not be permitted to operate directly on the fabric unless authorized to do so by the manufacturer and approved by the Engineer.

C. Geotextile Placement:

1. Fabric shall be placed as recommended by the manufacturer and approved by the Engineer on surfaces which have been prepared to conform with these Specifications and found acceptable for fabric installation.
2. The fabric shall be placed as smooth and wrinkle-free as possible.
3. When installing geotextile in trenches, swales, ditches, etc., overlap geotextile in the direction of flow.
4. All areas of fabric damaged during installation as determined by the Engineer shall be repaired or replaced by the Contractor as specified at no additional cost to the Owner. Should the fabric be damaged during any step of the installation, the damaged section shall be repaired by covering it with a piece of fabric which extends at least 24 inches in all directions beyond the damaged area. The fabric shall be secured by sewing or bonding as approved by the Engineer.

5. At time of installation, fabric will be rejected if it has defects, ribs, holes, flaws, deterioration, or damage incurred during manufacture, transportation, handling, or storage. Damaged materials shall be removed and replaced at no additional cost to the Owner.
6. Fabric shall be placed with long dimension down slope.
7. Fabric shall be protected at all times during construction from contamination by surface run-off and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.

D. Seams and Overlaps of Geotextile:
1. All overlaps shall be a minimum of 18 inches (450 mm).

3.4 COVER MATERIALS OVER GEOTEXTILES

A. Granular materials shall be placed on geotextiles as shown on the Drawings. During backdumping and spreading, a minimum depth of 6 inches of granular material shall be maintained at all times between the fabric and wheels of trucks or spreading equipment. All equipment used in spreading or traveling on the cover layer for any reason shall exert low ground pressures and shall be approved by the manufacturer and Engineer. Dozer blades, etc., shall not make direct contact with the fabric; however, if tears occur in the fabric during the spreading operation, the granular material shall be cleared from the fabric and the damaged area repaired as previously described.

B. The granular material shall be spread in the direction of fabric overlap. Large fabric wrinkles which may develop during the spreading operations shall be folded and flattened in the direction of the spreading. Occasionally, large folds may reduce the fabric overlap width. Special care shall be given to maintain proper overlap and fabric continuity.

C. All equipment spreading cover material or traveling on the cover layer shall avoid making sharp turns, quick stops, or quick starts.

D. Fabric shall be covered as soon as possible after placement to minimize exposure to sunlight. Fabric shall not be exposed for more than 5 days.

3.5 DISPOSAL OF SCRAP MATERIALS

A. On completion of installation, the Contractor shall legally dispose of all trash and scrap material off-site or in a location approved by the Owner and Engineer, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner.

END OF SECTION

SECTION 311000 – SITE CLEARING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Protecting existing trees and grass to remain.
2. Removing existing grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.

1.2 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots.

1.3 MATERIAL OWNERSHIP

A. Except for excess stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, according to Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

C. Certification: Submit written certification by qualified arborist that trees indicated to remain have been protected during the course of construction in accordance with recognized standards and that where damage did occur, trees were promptly and properly treated. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.

1.5 QUALITY ASSURANCE

A. Stake limits of clearing, grubbing, and stripping, prior to commencing of work.

B. Arborist Qualifications: Engage an ISA Certified arborist who has successfully completed tree protection and trimming, to perform the following work:
   1. Remove branches from trees that are to remain, if required.
   2. Recommend procedures to compensate for loss of roots and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.
   3. Recommend procedures for excavation and grading work juxtaposed to established plants.
   4. Perform tree repair work for damage incurred by new construction.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction. Detour routes shall be identified by adequate signs in accordance with the MUTCD.

B. Protect areas outside limits of disturbance from encroachment by construction personnel or equipment, regardless of property Ownership. Access shall be by specific, written permission or easement only

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and deliver to storage location defined on the plans or specified here in.

D. Utility Locator Service: Properly notify utility locator service for area where Project is located before site clearing in accordance with local protocol.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

F. Contractor shall verify existing grades prior to performing work under this section. If existing grades are at variance with the drawings, notify the Owner and receive instructions prior to proceeding. No additional compensation will be considered resulting from grade variances once site clearing has commenced.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag, fence and protect trees and vegetation to remain or to be relocated.

C. Remove branches from trees that are to remain, if required to clear new construction and only if specifically approved by Engineer.
   1. Where directed by Engineer, extend pruning operation to restore natural shape of entire tree.
   2. Cut branches and roots, if required, with sharp pruning instruments; do not break or chop.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

A. Erect and maintain temporary fencing around tree drip line before starting site clearing. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within fenced area.
   2. Do not permit vehicles, equipment, or foot traffic within fenced area.
   3. Maintain fenced area free of weeds and trash.

B. Do not machine excavate within tree drip line.

C. Where excavation for new construction is required within tree drip line, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.
   1. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
   2. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   3. Backfill with soil as soon as possible.
   4. Where trenching for utilities is required within drip line, tunnel under or around roots by hand digging. Do not cut main lateral roots or tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.

E. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer and acceptable to the Owner.
   1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Engineer and acceptable.

3.3 UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
   1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer and owner not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Engineer's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Completely remove obstructions, trees, shrubs, stumps, roots, grass, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Use only hand methods for grubbing within tree protection zone.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations in accordance with Section"Earth Moving" unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm) and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Where trees are designated to remain, stop topsoil stripping and adequate distance from the trees to prevent damage to the main root system.

C. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

D. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
   2. Do not stockpile topsoil within tree protection zones.
   3. Dispose of excess topsoil as specified for waste material disposal.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

A. Burning of debris onsite is not permitted.

B. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
2. Debris may be buried in designated onsite disposal areas to minimum depth of 3 feet below final grade. Only the following materials are suitable for on-site disposal:

C. Dispose of all diseased Elmwood within 4 days after cutting by burning or by other methods approved by the Department of Environmental Conservation.

END OF SECTION

SECTION 312000 – EARTH MOVING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the preparation of the site, protection, excavation, embankment, drainage, dewatering, for site grading, as shown on the Drawings, and as herein specified.

B. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.

C. The Contractor shall refer to the separately provided Geotechnical Report for all earth moving and site preparation direction not provided within this specification.

D. The Engineer shall determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable.
      a. GDOT Standard Specifications for Construction of Transportation Systems.
      b. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."

B. The Contractor shall comply with the requirements for soil erosion and sedimentation control, and other requirements of governmental authorities having jurisdiction, including the State of Georgia.

C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

1.3 SUBMITTALS

A. Samples:
   1. The Contractor shall furnish earth materials to the testing laboratory for analysis and report, as directed by the Engineer, or as outlined in the specifications.

B. Test Results:
   1. The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer.

1.4 PROJECT REQUIREMENTS

A. Notify the Engineer of any unexpected subsurface condition.

B. Protection of Existing Utilities:
   1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate support and protection during earthwork operations, comply with OSHA requirements.

2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.
3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.
4. Demolish and completely remove from the site any existing underground utilities designated to be removed as shown on the Drawings.
5. Repair any damaged utilities as acceptable to the Engineer, at no additional cost to the Owner.

C. Protection of Persons and Property:
1. Barricade open excavations occurring as part of this work, and post with warning lights.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
4. Perform excavation within drip-line of any trees to remain by hand and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1-inch diameter and larger with emulsified asphalt tree paint.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Select Granular Material: Sound, durable, sand, gravel, stone or blends with these materials, free from organic, frozen, or other deleterious materials, conforming to the requirements of GDOT and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
2"	100
1/4"	30 - 65
No. 40	5 - 40
No. 200	0 - 10

B. Selected Fill: Sound, durable, sand, gravel, stone, or blends of these materials, free from organic, frozen or other deleterious materials.

SIEVE	PERCENT PASSING
4"	100
No. 40	0 - 70
No. 200	0 - 10

1. Fines passing No. 200 shall be non-plastic.
2. Particle size analysis shall show no gap grading.
3. Each soil type should be submitted to Engineer/Geotechnical Consultant for evaluation prior to placement.

PART 3 – EXECUTION

3.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. A 100-pound minimum representative sample shall be obtained from each potential borrow source. If different material gradations are known to exist in the pit, samples shall be obtained for each

material. Each sample shall be mixed thoroughly and reduced to test specimen size, in accordance with AASHTO T87. The test shall be performed in the order shown. Failure to pass any test is grounds for disqualification and shall lead to cessation of the test program for that material.

1. Particle Size Analysis:
   a. Method: ASTM D422.
   b. Number of Tests: One (1) per potential source.
   c. Acceptance Criteria: Gradation within specified limits.
2. Maximum Density Determination:
   a. Method: ASTM D1557, Modified Proctor.
   b. Number of Tests: One (1) per potential source.
3. Re-establish gradation and maximum density of fill material if source is changed during construction.

3.2 PREPARATION

A. Establish required lines, levels, contours, and datum.

B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.

C. Establish location and extent of utilities before commencement of grading operations.

3.3 EXCAVATION

A. Excavation shall consist, in general, of the excavation of whatever substance is encountered to the lines, grades, and sections shown on the Drawings including excavation as necessary for grading and other similar features.

B. All suitable materials removed in excavation shall be used in the construction of embankments, subgrade, shoulders, slopes, and at such other places as directed. The Engineer shall be the sole judge of what constitutes suitable material.

C. During construction, the grading operations shall be executed in such a manner that the excavation will be well drained at all times. All grading shall be finished on neat, regular lines conforming to the sections and contours shown on the Plans.

D. Removal of materials beyond the indicated subgrade elevations, without authorization by the Engineer, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.

E. Excavation shall be performed in proper sequence with all other associated operations.

F. Maintain the slopes of excavation in a safe condition until completion of the grading operation.

G. All excavation work shall be inspected and approved by the Engineer before proceeding with construction.

H. Any excess excavation shall be removed from the site to disposal areas at the Contractor's expense.

3.4 FILL

A. All site fill shall be "selected fill" unless otherwise shown on the Drawings or directed by the Engineer. "Select granular fill" shall be placed in lieu of selected fill only where directed by the Engineer/Geotechnical Engineer.

B. Before depositing fills, the surface of the ground shall be cleared of all refuse, brush, and large stones. Conform to Geotechnical Report and Section "Site Clearing."

C. Prior to placing fill over undistributed material, scarify to a minimum depth of 6 inches.

D. Where fills are made on hillsides or slopes, the slope of the original ground upon which the fill is to be placed shall be plowed or scarified deeply or where the slope ratio of the original ground is steeper than 2 horizontal to 1 vertical, the bank shall be stepped or benched.

E. The original ground shall be proof rolled until the underlying soil is thoroughly compacted to the satisfaction of the Engineer before any filling is begun. A steel-wheel tandem roller weighing 8 to 10 tons or equipment capable of obtaining the same effort shall be used to obtain a thoroughly compacted subgrade. Remove or recompact any soft or loose soils as determined by the Engineer prior to filling.

F. A thoroughly and satisfactorily subgrade is defined as having a minimum dry density of 95 percent of the maximum density of the material used. The subgrade material shall be compacted at a moisture content suitable for obtaining the required density.

G. Place backfill and fill materials in layers not more than 10 inches in loose depth unless shown otherwise on the Drawings. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with 10 inches as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water, or extraneous debris.

H. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced by compacted granular fill.

I. Moisture Control:

1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill. Prevent ponding or other free water on surface subsequent to, or during, compaction operations.
2. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.

J. All fill shall be thoroughly and satisfactorily compacted to 95 percent of the maximum density of material used.

3.5 GRADING

A. The present and finished grade lines are shown on the Drawings. Grade over the entire area, as shown on the drawings, shall be to the finished subgrade levels. Upon completion of this work, all debris shall be cleaned out and removed from the premises.

B. All cutting, filling, backfilling and grading necessary shall be done to bring the area to the following grade or subgrade levels:
   1. For roadway surface areas to the finished subgrade levels specified on the contract drawings.
   2. For areas to be topsoiled and seeded to within 6 inches of the finished grade.
   3. For other surface treatments as detailed on the Drawings.

C. Sufficient grading must be done during the progress of the work so that the entire site shall be well drained and free from water pockets.

D. Finish grading, including dressing swales, cleaning up excess footing excavation, dressing terraces, disposing of excess material and all other work necessary to prepare the site for topsoil and seeding shall be done after construction of structures and roadway surface areas is substantially complete.

3.6 COMPACTION EQUIPMENT

A. Compaction equipment used for the Work is subject to approval by the Engineer. Any equipment not originally manufactured for compaction purposes and equipment which is not in proper working order will not be approved. Furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification and performance characteristics.

3.7 DRAINAGE AND DEWATERING

A. Prevent surface, subsurface or ground water from flowing into excavation and from flooding project area, as well as surrounding areas.

B. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to the stability of subgrades.

C. Provide and maintain the pumps, well points, sumps, suction and discharge lines, and other dewatering components necessary to convey water away from excavations.

D. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or run-off areas.

E. Dewatering operations shall be as directed by the Engineer and performed in accordance with Section "Dewatering."

3.8 FIELD QUALITY CONTROL

A. Notify the Engineer at least one (1) working day in advance of all phases of filling and backfilling operations.

B. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
   1. In-place relative density:
      a. Method: AASHTO T310, Nuclear Method.

b. Number of Tests: One (1) per 8-inch vertical lift.

1) Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2,000 square feet or less of paved area of building slab, but in no case fewer than three (3) tests.

C. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.

D. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and retested. Subsequent test failures shall be followed by removal and replacement of the material.

3.9 CLEAN UP

A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

END OF SECTION

SECTION 312305 – STRUCTURE EXCAVATION, BACKFILLING, AND COMPACTION

PART 1 – GENERAL

1.1 SUMMARY

A. The Contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, the excavation, backfilling, compaction, protection and dewatering for placement of structures, as shown on the Drawings and as specified herein, including, but not limited to the following:

1. Excavation and placement of structural fill for foundations.
2. Placement of compacted fill, stone, or subbase courses under slabs on grade.
3. Installation of all sheeting, shoring, and bracing required to execute the work.
4. Disposal of all excavated material off site, unless satisfactory for site earthwork fill.
5. Testing and test reports.

B. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. The latest edition of the following standards, as referenced herein, shall be applicable.
   a. Georgia Department of Transportation, Standard Specifications for Construction of Transportation Systems.
   b. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."

B. The Contractor shall provide and pay for all preconstruction costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

C. The Engineer shall determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.3 SUBMITTALS

A. General: The Testing Laboratory shall submit all written reports to the Contractor and Engineer according to the Conditions of the Contract and Division 1 Specification Sections.

B. Test Reports: Prior to delivery or use of any fill material, the Testing Laboratory shall submit the following reports of each material:

1. Description of material
2. Gradation analysis
3. Modified proctor laboratory compaction tests ASTM D1557.

C. Field Reports: In-place soil density tests, calibrated from the modified proctor laboratory compaction test.

1.4 PROJECT REQUIREMENTS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and may be available to the Contractor, but for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Additional test borings and other exploratory operations may be performed by Contractor at the Contractor's option. No change in the Contract Sum will be authorized for such additional exploration.

B. Notify the Engineer of any unexpected subsurface condition.

C. Protect excavations by shoring, bracing, sheet piling, underpinning, or by other methods as required to ensure the stability of the excavation.

D. Underpin or otherwise support structures adjacent to the excavation which may be damaged by the excavation. This includes service lines.

E. Protection of Existing Utilities:

1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.
2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.
3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.
4. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified.
5. Repair any damaged utilities as acceptable to the Engineer, at no additional cost to the Owner.

F. Use of Explosives: Use of explosives is not permitted.

G. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
4. Provide planking at all walks, pavements, and curbs to be crossed by equipment.

PART 2 – PRODUCTS

2.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. A 100-pound minimum representative sample shall be obtained from each potential borrow source. If different material gradations are known to exist in the pit, samples shall be obtained for each material. Each sample shall be mixed thoroughly and reduced to test specimen size, in accordance with AASHTO T87. The tests shall be performed in the order shown. Failure to pass any test is grounds for disqualification and shall lead to cessation of the test program for that material.

1. Particle Size Analysis:
   a. Method: AASHTO D422.

b. Number of Tests: One (1) per potential source.

c. Acceptance Criteria: Gradation within specified limits.

2. Maximum Density Determination:

a. Method: ASTM D1557/AASHTO T180, Modified Proctor.

b. Number of Tests: One (1) per potential source.

3. Re-establish gradation and maximum density of fill material if source is changed during construction.

B. The Contractor shall furnish all earth materials to the testing laboratory for analysis and report as directed by the Engineer or as outlined in the specifications.

2.2 MATERIALS

A. Structural Fill and Selected Fill: sound, durable, sand, gravel, stone, or blends of these materials, free from organic, frozen or other deleterious materials[, conforming to the requirements of GDOT Section 810.

B. Crushed stone: free from organic material, elongated particles or other deleterious materials, conforming to the requirements of GDOT Section 800 and meeting the following gradation requirements :

SIEVE	PERCENT PASSING
1-1/2"	100
1"	80 - 100
No. 8	0 - 5

C. Select Granular Subbase Material: free from organic, frozen, or other deleterious materials, conforming to the requirements of GDOT Section 815.

PART 3 – EXECUTION

3.1 PREPARATION

A. Establish required lines, levels, contours, and datum.

B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.

C. Establish location and extent of utilities before commencement of excavation.

3.2 EXCAVATION

A. Excavate subsoil in accordance with the lines and levels as shown on the Drawings and as necessary for installation of the work. The excavation lines shall be such that sufficient clearance exists for proper execution of the work, including space for formwork and bracing.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations. Unauthorized excavation shall be at Contractor's expense.

1. Under footings, fill unauthorized excavation by extending indicated bottom elevation of footing or bases to excavation bottom, without altering required top elevation.

2. Elsewhere, backfill and compact unauthorized excavations as specified by authorized excavations of same classification.
3. Any excess excavation shall be removed from the site to disposal areas at the Contractor's expense.

C. Additional Excavation:
1. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material with structural fill or other material as approved by Geotechnical Engineer.
2. Removal of unsuitable material, and its replacement as directed, will be paid on basis of Contract conditions relative to changes in work.

D. Stability of Excavations: Slope sides of excavations to comply with OSHA requirements and local codes. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition and in accordance with OSHA requirements until completion of backfilling. Bracing will not be permitted against pipes or structures in trenches.

E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses. Bracing will not be permitted against pipes or structures in trenches.

F. Excavation for Structures:
1. Conform to elevations and dimensions shown on the drawings, within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services, other construction, and for inspection.
2. In excavating for footings and foundations, take care not to disturb the bottoms of the excavation. Excavate by hand to a final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave a solid base to receive concrete.
3. Sloping surfaces under footings and foundations, or other work where required, shall be cut in steps as indicated on the Drawings or as directed by the Engineer.

G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 DegF (1 DegC).

3.3 REVIEW OF SUBGRADE

A. Notify Geotechnical Engineer when excavations have reached required subgrade.

B. When Geotechnical Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted structural fill, select fill, or other approved material as directed.
1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Geotechnical Engineer.

3.4 DRAINAGE AND DEWATERING

A. Perform dewatering operations in accordance with Section "312319 - Dewatering".

B. Prevent surface, subsurface or ground water from flowing into excavation and from flooding project area, as well as surrounding areas.

C. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to the stability of subgrades.

D. Provide and maintain the pumps, well points, sumps, suction and discharge lines, and other dewatering components necessary to convey water away from excavations.

E. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or run-off areas. Do not use trench excavations as temporary drainage ditches.

3.5 STRUCTURAL FILL, BACKFILL, AND COMPACTION

A. Place fill materials in the types and thicknesses as detailed on the Drawings. All backfill shall be Select Fill unless otherwise directed by the Engineer or shown on the Drawings.

B. After approval of the subgrade by the Geotechnical Engineer, the geotextile shall be placed, where shown on the Drawings, upon the subgrade in accordance with the manufacturer's instructions and the following:

1. After acceptance of the subgrade, the fabric shall be installed prior to placement of the first course of compacted structural fill, stone or subbase.
2. Geotextile may be joined by either sewing or overlapping. Sewn seams shall be lapped a minimum of 4 inches and double sewn with nylon or polypropylene. Overlapping seams shall have a minimum overlap of 18 inches except where placed underwater where the overlap shall be a minimum of 3 feet.
3. Fabric which is torn or damaged shall be replaced or patched. The patch shall extend 3 feet beyond the perimeter of the tear of damage.
4. Traffic or construction equipment shall not be permitted directly upon the fabric. Maintain a minimum of 8 inches loose thickness of aggregate above the stabilization fabric subject to traffic.

C. Place backfill and fill materials in layers not more than 12 inches in loose depth. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with 12 inches as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water, or extraneous debris.

D. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced at the Contractor's expense.

E. Moisture Control:

1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill. Prevent ponding or other free water on surface subsequent to, or during, compaction operations.

2. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.

F. All fill shall be thoroughly and satisfactorily compacted to 95 percent of the maximum density of material used.

G. If the surface of any layer becomes contaminated by mud or unsuitable materials, the contaminated soil shall be removed.

H. Fill placement shall be suspended when wet weather prevents proper operation of compaction equipment.

I. Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to structure shall be increased at approximately the same rate on all sides of the structure.

J. No backfilling or compaction shall take place against any cast-in- place concrete footings or slabs prior to 7 days initial concrete set, or against any cast-in-place concrete walls prior to achieving the desired design strength, f'c.

K. Heavy equipment shall not be operated within 4 feet of any structure. Heavy vibratory compactors shall not be operated within 4 feet of any structure.

L. Excavated material meeting the requirements of Select Fill shall be spread and allowed to dry until obtaining the required moisture content prior to re-use.

3.6 FIELD QUALITY CONTROL

A. Notify the Engineer at least one (1) working day in advance of all phases of filling and backfilling operations.

B. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
   1. In-place relative density:
      a. Method:
         1) AASHTO T191, Sand Cone Method.
         2) AASHTO T238, Nuclear Method.

C. Foundation Subbase: Perform one (1) field density test in each compacted fill lift for the following:
   1. Each isolated spread footing.
   2. Each 20 feet or less of continuous footing, but no fewer than two (2) tests along a wall.
   3. Each 2,000 square feet of structural base slab and/or slabs on grade but in no case fewer than three (3) tests.

D. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 50 feet or less of wall length but no fewer than two (2) tests along a wall face.

E. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions at the Contractor's expense.

F. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

3.7 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.8 CLEAN UP

A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

END OF SECTION

SECTION 312316.16 – STRUCTURE EXCAVATION FOR MINOR STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the excavation, backfilling, compaction, protection and dewatering for placement of minor structures, as shown on the Drawings and as specified herein.

B. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.

C. The Engineer shall determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable.
      a. Georgia Department of Transportation, Standard Specifications for Construction of Transportation Systems.
      b. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).

B. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications, in accordance with Section 014000 "Quality Requirements."

1.3 SUBMITTALS

A. Samples:
   1. The Contractor shall furnish earth materials to the testing laboratory for analysis and report as directed by the Engineer or as outlined in the specifications.

B. Test Results:
   1. The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer.

1.4 PROJECT REQUIREMENTS

A. Notify the Engineer of any unexpected subsurface condition.

B. Protect excavations by shoring, bracing, sheet, piling, underpinning, or by other methods as required to ensure the stability of the excavation.

C. Underpin or otherwise support structure adjacent to the excavation which may be damaged by the excavation. This includes service lines.

D. Protection of Existing Utilities:

1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.
2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.
3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.
4. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified in Section "Clearing."
5. Repair any damaged utilities as acceptable to the Engineer at no additional cost to the Owner.

E. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 – PRODUCTS

2.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. A 100-pound minimum representative sample shall be obtained from each potential borrow source. If different material gradations are known to exist in the pit, samples shall be obtained for each material. Each sample shall be mixed thoroughly and reduced to test specimen size, in accordance with AASHTO T87. The tests shall be performed in the order shown. Failure to pass any test is grounds for disqualification and shall lead to cessation of the test program for that material.

1. Particle Size Analysis:
   a. Method: AASHTO D422.
   b. Number of Tests: One (1) per potential source.
   c. Acceptance Criteria: Gradation within specified limits.
2. Maximum Density Determination:
   a. Method: ASTM D1557, Modified Proctor.
   b. Number of Tests: One (1) per potential source.
3. Re-establish gradation and maximum density of fill material if source is changed during construction.

2.2 MATERIALS

A. Select Structural Fill : sound, durable, sand, gravel, stone, or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of GDOT Section 810.

B. Crushed stone: free from organic material, elongated particles or other deleterious materials, conforming to the requirements of GDOT Section 800. and meeting the following gradation requirements (NYSDOT, Size 2):

SIEVE	PERCENT PASSING
1-1/2"	100
1"	80 - 100
No. 8	0 - 5

C. Select Granular Material: sound, durable, sand, gravel, stone or blends with these materials, free from organic, frozen, or other deleterious materials, conforming to the requirements of GDOT 815.

DURABILITY: Provide material having a soundness loss ≤ 15% (Magnesium Sulfate for Class A or B stone.

D. Geotextile: In accordance with Section "Geotextiles."

E. Select granular material shall be used in lieu of selected fill as directed by the Engineer based upon job conditions.

PART 3 – EXECUTION

3.1 PREPARATION

A. Establish required lines, levels, contours, and datum.

B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the Owner.

C. Establish location and extent of utilities before commencement of excavation.

3.2 EXCAVATION

A. Excavate subsoil as necessary for installation of the work and a minimum of 2 feet from the perimeter of the structure footing. The excavation lines shall be such that sufficient clearance exist for the proper execution of the work, including space for formwork and bracing.

B. Maintain the slopes of excavation in safe condition until completion of the backfilling operation, in accordance with OSHA requirements.

C. Trim the bottom of all excavation to the required levels, and leave free from loose or organic matter. Fill over-excavated areas under structure bearing surfaces with concrete as specified for foundations, or other material as approved by the Engineer.

D. When the excavation has been carried to the required depth, the Contractor shall await inspection of the bearing surface by the Engineer and authorization to proceed with the work.

E. Sloping surfaces under footings and foundations, or other work where required, shall be cut in steps as indicated on the Drawings or as directed by the Engineer.

F. Any excess excavation shall be removed from the site to disposal areas at the Contractor's expense.

3.3 DRAINAGE AND DEWATERING

A. Perform dewatering operations in accordance with Section "Dewatering" and in Section "Earth Moving."

B. Prevent surface, subsurface or ground water from flowing into excavation and from flooding project area, as well as surrounding areas.

C. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to the stability of subgrades.

D. Provide and maintain the pumps, well points, sumps, suction and discharge lines, and other dewatering components necessary to convey water away from excavations.

E. Provide and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations by dewatering, to collection or run-off areas.

3.4 STRUCTURAL FILL, BACKFILL, AND COMPACTION

A. All backfill shall be Select Structural Fill unless otherwise directed by the Engineer or shown on the Drawings.

B. Place backfill and fill materials in layers not more than 12 inches in loose depth. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with 12 inches as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water, or extraneous debris.

C. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced at the Contractor's expense.

D. Moisture Control:

1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill. Prevent ponding or other free water on surface subsequent to, or during, compaction operations.
2. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing, until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.

E. All fill shall be thoroughly and satisfactorily compacted to 95 percent of the maximum density of material used.

F. If the surface of any layer becomes contaminated by mud or unsuitable materials, the contaminated soil shall be removed.

G. Fill placement shall be suspended when wet weather prevents proper operation of compaction equipment.

H. Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to structure shall be increased at approximately the same rate on all sides of the structure.

I. No backfilling or compaction shall take place against any cast-in-place concrete footings or slabs prior to 7 days initial concrete set or against any cast-in-place concrete walls prior to achieving the desired design strength, f=c.

J. Heavy equipment shall not be operated within 4 feet of any structure. Heavy vibratory compactors shall not be operated within 4 feet of any structure. Furnish and use equipment capable of compacting in restricted areas next to structures, around piping and underground facilities.

K. Excavated material meeting the requirements of Select Structural Fill shall be spread and allowed to dry until obtaining the required moisture content prior to re-use.

3.5 FIELD QUALITY CONTROL

A. Notify the Engineer at least 1 working day in advance of all phases of filling and backfilling operations.

B. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:

1. In-place relative density:
   a. Method:
      1) AASHTO T310, Nuclear Method.
   b. Number of Tests:
      1) One (1) per 8-inch vertical lift, at least one (1) test for every 100 feet or less of wall length, but no fewer than two (2) tests.

C. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.

D. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

3.6 CLEAN UP

A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.

B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.

C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

END OF SECTION

SECTION 312319 – DEWATERING

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes provisions for a dewatering system to continuously lower and control groundwater levels and hydrostatic pressures in order to maintain near-dry conditions for construction of the work as shown on the plans and specified herein.

1.2 SUBMITTALS

A. Submit the following:
   1. Description: of proposed dewatering system.
   2. Layout: of dewatering system, including location of sumps, deep wells, well points, header pipes, pumps, discharge lines, and observation wells.
   3. Details: of dewatering system, including installation methods for deep wells, well points and observation wells, depths of wells, material descriptions, pipe sizes, intake screen sizes, and pump capacities.
   4. Estimate: of time required to lower groundwater levels after start of pumping

1.3 JOB CONDITIONS

A. Site soil boring data and samples, soil laboratory testing, and any soil reports shall be made available to prospective bidders for study and review. Bidders must make their own interpretation of subsurface conditions that may affect methods or the cost of construction of the Work.

PART 2 – PRODUCTS

2.1 DEWATERING SYSTEM

A. Provide a dewatering system of adequate size and capacity to lower and maintain the groundwater at the specified level. The system shall include standby pumps and power source for continuous operation.
   1. Dewatering system shall consist of wellpoints, deep wells, cut-off walls, riser pipes, swing joints, header lines, valves, pumps, discharge lines, and all other necessary fittings, accessories and equipment for a complete operating system. Provide hole punches, sand backfill, and clay plugs as required by soil conditions.

B. Observation Wellpoints: Provide groundwater reading wells or piezometers to monitor the groundwater level, as indicated on the approved Shop Drawings or as directed by the Engineer.

C. Sand: Clean concrete sand conforming to ASTM C33.

PART 3 – EXECUTION

3.1 PREPARATION

A. Install the observation well points at locations indicated on approved Shop Drawings or where directed by the Engineer. Install observation wellpoints in accordance with manufacturer's printed

instructions and in accordance with approved Shop Drawings. Provide sand backfill around wellpoint. Test each observation wellpoint to verify that the installation is performing properly.

B. Protect observation well standpipes from damage by construction operations and maintain accessibility to them. Maintain reading wells until groundwater is allowed to return to its normal level.

3.2 INSTALLATION

A. Install the dewatering system in accordance with approved Shop Drawings and as required by site conditions. Locate elements of the system to allow a continuous dewatering operation without interfering with the installation of any permanent project Work.

3.3 OPERATION

A. Keep the system in continuous operation from the time excavation is started in the dewatering area (or before if required by site conditions to lower the groundwater to the elevations specified) until the time backfilling is completed at least 2 feet above the normal groundwater level.

1. Do not discontinue dewatering operations without specific approval from the Engineer.
2. Rates of groundwater withdrawal during dewatering operations, shall at all times be below the rate at which soil particles are removed from the existing soils.

B. In the event excavation proceeds subsequent to dewatering as specified above, and the groundwater level is found to be within two feet of the excavation, the dewatering Contractor shall immediately continue to dewater as specified herein, including, but not limited to, additional dewatering and monitoring facilities, at no additional cost to the Owner. The excavation shall not be allowed to proceed below groundwater.

3.4 FIELD CONTROL

A. Maintain a careful check to detect any settlement in existing adjacent Work. Notify the Engineer of any signs of settlement. Establish settlement point bench marks and take periodic readings as directed. The Contractor shall take all such precautions and do any and all Work necessary to protect the stability and integrity of adjacent lands. Pavements, buildings, and utilities from settlement or other movement that may be caused by his dewatering operations. The Contractor shall be solely responsible for any damage or injury to adjacent lands, pavements, buildings, or utilities caused by his dewatering or other operations or his failure to use corrective or preventive procedures or methods.

B. Take and record measurements of the groundwater in each reading and pumping well periodically and when directed by the Engineer.

3.5 DISCHARGE

A. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the Work under construction or completed.

B. Dispose of water in such a manner as to cause no inconvenience to others on or adjacent to the site.

C. Convey water from the excavation in a closed conduit. Do not use trench excavations as temporary drainage ditches.

D. Disposal of water shall be approved by the Engineer and shall not cause erosion or sedimentation to occur in existing drainage systems. All sedimentation or blocking of existing systems shall be thoroughly cleaned and returned to original condition by the Contractor at his own expense.

E. Provide approved sediment traps when water is conveyed into water courses.

3.6 REMOVAL

A. When system is no longer required, gradually decrease the pumping rate until the water table resumes its natural position so that the velocity of the returning groundwater will be low enough as not to carry fines with it.

B. When the dewatering system is no longer required and when directed by the Engineer, dismantle and remove the system and all appurtenances from the site.

END OF SECTION

SECTION 312333 – TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the excavation of trenching, backfilling, compacting, dewatering, excavation support and disposal, as shown on the Contract Drawings, and as herein specified.

B. The Engineer will determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable.
      a. Standard Specifications for Construction of Transportation Systems, Georgia Department of Transportation.
      b. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
      c. American Society for Testing and Materials (ASTM).
      d. National Electric Code (NEC).

B. The Contractor shall comply with the requirements for soil erosion and sedimentation control and other requirements of governmental authorities having jurisdiction, including the State.

C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications in accordance with Section "Quality Requirements."

1.3 SUBMITTALS

A. Samples:
   1. The Contractor shall furnish representative earth materials to the testing laboratory for analysis and report, as directed by the Engineer, or as outlined in the specifications.

B. Test Results:
   1. The testing laboratory shall submit written reports of all tests, investigations, findings, and recommendations to the Contractor and the Engineer.

1.4 PROJECT REQUIREMENTS

A. Notify the Engineer of any unexpected subsurface condition.

B. Protect excavations by shoring, bracing, sheet piling, or by other methods, as required to ensure the stability of the excavation. Comply with OSHA requirements.

C. Underpin or otherwise support structures adjacent to the excavation, which may be damaged by the excavation. This includes service lines.

D. Protection of Existing Utilities:

1. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations. Comply with OSHA requirements.
2. Coordinate interruption and/or termination of utilities with the utility companies and the Owner.
3. Provide a minimum of 48 hours' notice to the Owner and receive written notice to proceed before interrupting any utility.

E. Demolish and completely remove from the site any existing underground utilities designated to be removed, as shown on the Drawings or as specified.

F. Repair any damaged utilities as acceptable to the Owner, Engineer, and utility company at no additional cost to the Owner.

G. Contractor shall comply with maintenance and protection requirements as approved by the authority having jurisdiction.

H. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights, if required.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
4. Perform excavation within drip-line of trees to remain by hand and protect the root system from damage or dryout to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint cut roots of 1-inch diameter and larger with emulsified asphalt tree paint.

PART 2 – PRODUCTS

2.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

A. General:

1. Sufficient size samples shall be obtained from the potential borrow source to allow completion of tests listed in paragraph B below. Samples may be obtained from test borings, test pits, or from borrow pit faces provided that surficial dry or wet soil is removed to expose undisturbed earth. Tests listed below shall be performed on each sample obtained. A minimum of 3 representative samples from each potential borrow source shall be furnished to the testing laboratory for prequalification testing. Test data shall be provided to the Engineer a minimum of 2 weeks prior to construction for approval of borrow source. Three test reports completed within three months prior to construction may be submitted for commercial earth borrow sources or suppliers of stone products (crushed stone or graded stone products) in lieu of prequalification tests as approved by the Engineer.

B. Material Tests:

1. Particle Size Analysis:
   a. Method: ASTM D422.
   b. Number of Tests: One (1) per sample; three (3) per potential source.
   c. Acceptance Criteria: Gradation within specified limits.

2. Maximum Density Determination:
   a. Method: ASTM D1557 - Modified Proctor.
   b. Number of Tests: One (1) per sample; three (3) per potential source.
3. Re-establish gradation and maximum density of fill material if source is changed during construction.

2.2 MATERIALS

A. Pipe Zone Bedding: Select mixture of graded crushed stone, free from organic, frozen or other deleterious materials, conforming to the requirements of GDOT and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
1-1/2"	100
1"	90 – 100
1/2"	0 – 15

B. Pipe Zone Backfill: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of GDOT and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
2"	100
1/4"	30 – 65
No. 40	5 – 40
No. 200	0 – 10

C. Suitable Material: Sound, durable sand, gravel, stone or blends of these materials, free from organic, frozen or other deleterious materials, conforming to the requirements of GDOT and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
4"	100
No. 40	0 – 70
No. 200	0 – 15

1. Run-of-trench material, meeting the above criteria, shall be considered suitable material and shall be used for trench backfill only after tested in accordance with Section "Quality Requirements" and approved by the Engineer. The Contractor shall pay for all additional testing required to determine the conformance of run-of-trench material, if at any time during the Work this material appears to be in non-conformance in the opinion of the Engineer.

PART 3 – EXECUTION

3.1 PREPARATION

A. Establish required lines, levels, contours, and datum.

B. Maintain benchmarks and other elevation control points; re-establish if disturbed or destroyed at no additional cost to the Owner.

C. Establish location and extent of existing utilities prior to commencement of excavation.

3.2 EXCAVATION

A. All excavation shall be made to such depth as required and of the width shown on the Drawings to provide suitable room for building the structures and laying the pipe(s) they are to contain and for sheeting, shoring, pumping and draining as necessary, and for removing peat, silt, or any other materials which the Engineer may deem unsuitable. Hand trench excavation may be required to protect existing trees, utilities and structures.

B. Trench excavation for pipes shall be made by open cut to accommodate the pipe or structure at the depths indicated on the Drawings. Excavation shall be made to such a depth and to the width indicated on the Drawings so as to allow a minimum of 8 inches of pipe zone bedding to be placed beneath the bottom of all structures and barrels, bells or couplings of all pipes installed unless otherwise specified on the Drawings.

C. The bottom of the trench shall be accurately graded to provide a uniform layer of bedding material as required for each section of pipe. Trim and shape trench bottoms and leave free of irregularities, lumps, and projections.

D. Stockpile excavated subsoil for reuse where directed or approved.

E. Over excavation/undercut: If, in the opinion of the Engineer, existing material below the trench grade is unsuitable for properly placing bedding material and laying pipe, the Contractor shall excavate and remove the unsuitable material and replace the same with an approved pipe zone bedding material properly compacted.

F. Stability of Excavation: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavation in safe condition until completion of backfilling.

G. Removal of materials beyond the indicated subgrade elevations, without authorization by the Engineer, shall be classified as unauthorized excavation and shall be performed at no additional cost to the Owner.

3.3 DEWATERING

A. The Contractor shall remove all water from the excavation promptly and continuously throughout the progress of the work and shall keep the excavation dry at all times until the work is completed and excavation is backfilled or have sufficient weight to resist uplift pressures. Groundwater levels shall be depressed to a minimum of 2 feet below excavation subgrade. No pipe or structure is to be laid in water and water shall not be allowed to rise on or flow over any pipe or structure until such time as approved by the Engineer.

B. Provide a suitable point of discharge from dewatering operations shall be conveyed in a non-erosive manner satisfactory to the Engineer.

C. Precautions shall be taken to protect uncompleted work from flooding during storms or from other causes. All pipe lines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced or otherwise protected.

3.4 BEDDING AND BACKFILLING

A. All pipe trenches backfill (pipe zone bedding, pipe zone backfill and trench backfill) shall be compacted by tamping or rolling to achieve a minimum dry density of 90 percent of the modified

Proctor maximum dry density of the material used (ASTM D1557). Backfill in pipe trenches to be covered with pavement shall be compacted to a minimum of 95 percent of modified Proctor maximum dry density. Backfill materials shall be placed with water content within plus or minus 4 percent of optimum moisture content per the modified Proctor method (ASTM D1557). Any water used for compaction shall be provided by the Contractor at his own expense. The Contractor is responsible for the repair of any trench settlement at no expense to the owner.

B. Bedding and backfilling shall be accomplished in three stages unless otherwise specified on the Contract Drawings. The first stage shall involve placement of "pipe zone bedding" as a layer(s) of selected material required to support, or to stabilize unsound or unsatisfactory foundation conditions. The second stage shall involve placement of "pipe zone backfill" from the top of the bedding material up to 1 foot above the pipe. The third stage involves the placement of "trench backfill" in the remainder of the trench up to the surface of the ground or the bottom of any special surface treatment subgrade elevation.

C. The bedding material shall be placed in the trench after the trench has been excavated a minimum of 8 inches below the bell of the pipe to permit the placing of not less than 8 inches of bedding material unless otherwise specified on the Drawings. Where, in the opinion of the Engineer, more than 8 inches of bedding material shall be required, the excavation shall be performed and bedding placed to the depth ordered by the Engineer.

D. Provide uniform bearing and support for each section of pipe at every point along the entire length except where necessary to excavate for bell holes, pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make the joint connection properly.

E. The bedding material shall be placed to the full width of trench. The bedding material shall be placed in loose lifts not exceeding 6 inches to the elevation shown on the Drawings or directed by the Engineer. The bedding material shall be tamped and compacted to form a firm and even bearing surface.

F. Pipe zone backfill shall be placed to the elevation shown on the Drawings in loose lifts not-to-exceed 6 inches in thickness, before compaction. The backfill shall be placed on both sides of the pipe at the same time and to approximately the same elevation. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense. Each layer shall be thoroughly compacted by hand-tamping or mechanical means being careful not to damage the pipe. When the pipe zone backfill reaches 1 foot over the top of the pipe, the entire surface shall be compacted by mechanical means.

G. The remainder, if any, of the trench above the pipe zone backfill shall be backfilled with suitable material in loose lifts not exceeding 6 inches in thickness before compaction. Each layer shall be thoroughly compacted by mechanical means.

3.5 BACKFILLING AROUND STRUCTURES

A. The Contractor shall not place backfill against any structure without obtaining the approval of the Engineer. No dumping shall be allowed where materials would flow against or around such structures. Backfill material shall be deposited in horizontal layers not exceeding 6 inches in loose thickness or as shown on the Drawings and thoroughly compacted by hand or by mechanical means to the satisfaction of the Engineer.

3.6 SUSPENSION OF WORK

A. Whenever the work is suspended, excavations shall be protected and the roadways, if any, left unobstructed. Within or adjacent to private property, material shall be stored at such locations as will not unduly interfere with traffic of any nature and in no case shall materials be stored in locations which will cause damage to existing improvements.

3.7 DISPOSAL OF MATERIAL

A. Excess and unsuitable materials shall be disposed of by the Contractor on the site in an area approved by the Engineer or legally disposed of off- site at the Contractor's expense.

3.8 FIELD QUALITY CONTROL

A. Notify the Engineer at least 3 working days in advance of all phases of filling and backfilling operations.

B. In-place density testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
   1. In-place relative density:
      a. Method: AASHTO T310, Nuclear Method.

C. Perform initial density testing to verify that contractors proposed compaction effort will obtain the minimum required densities.

D. In-place density tests on trench backfills shall be provided for every 500 cubic yards of fill or in vertical lifts not exceeding 2 feet and at least once daily.

E. One particle size analysis (ASTM D422) and one modified Proctor compaction test (ASTM D1557) shall be competed for every 5,000 cubic yards of material placed.

F. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense.

G. Acceptance Criteria: The criteria for acceptability of in-place fill shall be in-situ dry density and moisture content. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

END OF SECTION

SECTION 312500 – EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. This Section covers work necessary for stabilization of soil to prevent erosion and sedimentation during and after construction and land disturbing activities. The work shall include the furnishing of all labor, materials, tools, and equipment to perform the work and services necessary as herein specified and as indicated on the Drawings. This shall include installation, maintenance, and final removal of all temporary soil erosion and sediment control measures. All erosion and sediment control methods and devices used shall conform to the latest requirements imposed by federal, state, and local authorities.

B. Comply with Georgia Environmental Protection Division (EPD) under the federal NPDES program for stormwater discharges from construction activities and the Stormwater Pollution Prevention Plan prepared for the project.

C. Comply with the latest version of Georgia Soil and Water Conservation Commission (GSWCC) Manual for Erosion and Sediment Control.

D. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings. The right is reserved to modify the use, location, and quantities of soil erosion and sediment control measures based on activities of the Contractor and as the Engineer considers to be the best interest of the Owner.

E. The Contractor shall be responsible for repair of any damage caused and shall be financially responsible for any penalties imposed.

1.2 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Method of Measurement:

1. Erosion and Sediment Control measured on a lump sum basis for work satisfactorily completed. Payments will be proportion on the amount of work complete as determined by the Engineer.
2. Erosion Control Blanket will be measured on a square yard (SY) (square meter (SM)) from the payment lines in the plans. No additional measurement will be made for repairs, defective material, seams, or overlap.
3. Turf Reinforcement Mats will be measured on a SY (SM) from the payment lines in the plans. No additional measurement will be made for repairs, defective material, seams, or overlap.
4. Hay bales measured by the number of hay bales installed as shown on the plans. No additional measurement will be made for repairs, or replacement of defective material.
5. Check dam measured by the number of check dams installed as shown on the plans. No additional measurement will be made for repairs.
6. Silt fence measured by the number of linear foot (LF) (linear meter (LM)) of silt fence installed as shown on the plans. No additional measurement will be made for repairs, defective material, seams, or overlap.
7. Filter Socks measured by the number of linear foot (LF) (linear meter (LM)) of filter socks and diameter(s) of filter socks installed as shown on the plans. No additional measurement will be made for repairs, replacement of defective material, or overlap.

B. Basis of Payment:

1. The Erosion and Sediment Control unit price per lump sum (LS) shall include the cost of furnishing all labor, equipment, and materials necessary to complete the work.
2. Erosion Control Blanket will be paid for at the contract unit price per SY (SM) including the cost of furnishing all labor, materials and equipment necessary to complete the work. No additional costs to the Owner for any repairs or replacement of damaged or defective erosion control blanket.
3. Turf Reinforcement Mats will be paid for at the contract unit price per SY (SM) including the cost of furnishing all labor, materials and equipment necessary to complete the work. No additional costs to the Owner for any repairs or replacement of damaged or defective turf reinforcement mat.
4. Hay Bales of the kind and size specified will be paid for at the contract unit price each (EA) complete in place including the cost of furnishing all labor, materials equipment and all appurtenances maintaining the hay bales, and removing the hay bales.
5. Check Dams of the kind and size specified will be paid for at the contract unit price each (EA) complete in place including the cost of furnishing all labor, materials equipment and all appurtenances maintaining the check dams, and removing the check dams.
6. Silt Fence will be paid for at the contract unit price per linear foot (linear meter) of the kind, type, and size specified complete in place, including the cost of furnishing all labor, materials and equipment necessary to complete the work including maintaining the silt fence, and removing the silt fence. Any repair or replacement of damaged or defective silt fence shall be done at no cost to the Owner.
7. Filter Socks will be paid for at the contract unit price per liner foot (linear meter) of the kind, type, and size specified complete in place, including the cost of furnishing all labor, materials and equipment necessary to complete the work including maintaining the filter sock, and removing the filter sock. Any repair or replacement of damaged or defective filter sock shall be done at no cost to the Owner.

1.3 QUALITY ASSURANCE

A. Soil erosion and sediment control measures shall be implemented in accordance with the requirements and procedures outlined in this Specification, Contract Drawings and documents, state standards or guidelines for soil erosion and sediment control, and all regulatory authorities having jurisdiction. Where conflicts between requirements exist, the more restrictive rules shall govern.

B. The Contractor shall provide all temporary control measures shown on the Drawings, or as directed by the Owner, Owner's representative, or soil conservation district for the duration of the contract. Erosion and sediment control Drawings are intended to be a guide to address the stages of work shown. Additional measures not specified on the Drawings may be necessary and shall be implemented to address intermediary stages of work and any conditions that may develop during construction at no cost to the Owner..

C. Temporary control provisions shall be coordinated with permanent erosion control features to the extent practical to assure economical, effective, and continuous erosion and sediment control throughout the construction and post-construction period.

D. Soil erosion and sediment control measures shall at all times be satisfactory to the Owner's Representative. Owner's Representative will inform the Contractor of unsatisfactory construction procedures and operations if observed. If the unsatisfactory construction procedures and operations are not responded to and corrected within 48 hours, the Owner's Representative may suspend the performance of any or all other construction until the unsatisfactory condition has been corrected. Such suspension shall not be the basis of any claim by the Contractor for additional compensation nor

for an extension of time to complete the work. Any complaints, fines, etc. relating to ineffective erosion control, shall be the sole responsibility of the Contractor.

E. The Contractor shall inspect all soil erosion and sediment control measures at least at the beginning and end of each day to ascertain that all devices are functioning properly during construction. Maintenance of all soil erosion and sediment control measures on the project site shall be the responsibility of the Contractor until final stabilization is complete, and until the permanent soil erosion controls are established and in proper working condition.

F. The Contractor shall protect adjacent properties and watercourses from soil erosion and sediment damage throughout construction.

1.4 GENERAL

A. Soil erosion stabilization and sediment control measures consist of but not limited to the following elements:

1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
2. Installation and maintenance of stabilized construction entrance(s).
3. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.
4. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
5. Topsoil and Seeding: Placement and maintenance of Temporary Seeding on all areas disturbed by construction. Placement of permanent topsoil, fertilizer, and seed, etc., in all areas not occupied by structures or pavement unless shown otherwise.
6. Soil Stabilization Seeding: Placement of fertilizer and seed, etc., in areas as Specified hereinafter.

B. The Contractor shall he responsible for phasing Work in areas allocated for his exclusive use during this Project, including any proposed stockpile areas, to restrict sediment transport. This will include installation of any temporary erosion control devices, ditches, or other facilities.

C. The areas set aside for the Contractor's use during the Project may be temporarily developed to provide satisfactory working, staging, and administrative areas for his exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall he done in a manner to both control all sediment transport away from the area.

D. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.

E. All permanent stockpiles shall be seeded with soil stabilization seed and protected by construction of silt fences completely surrounding stockpiles and located within 10 feet of the toes of the stockpile slopes.

F. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by construction of temporary toe-of-slope ditches and accompanying silt fences as necessary. The Contractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance.

G. The Contractor shall maintain all elements of the Soil Erosion Stabilization and Sedimentation Control systems and facilities to be constructed during this Project for the duration of his activities on this Project.

H. Formal inspections made jointly by the Contractor and the Engineer shall be conducted every 2 weeks to evaluate the Contractor's conformance to the requirements of these Specifications.

I. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by the Contractor within 24 hours after receiving written notice from the Engineer.

J. If the Contractor has not complied with any of the above maintenance efforts to the satisfaction of the Engineer within 2 working days after receiving written notification from the Engineer, the Owner shall have the prerogative of engaging others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from the Contractor's monthly partial payment the costs for such efforts in accordance with the General Conditions of the Contract.

1.5 SUBMITTALS

A. Submittals shall he made in accordance with Section 013300 "Submittal Procedures."

B. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

C. Results of all tests and investigations, including recommendations.

D. Submit product data, samples, specifications and manufacturer's installation procedures for approval as directed by Engineer prior to use.

PART 2 – PRODUCTS

2.1 GENERAL

A. Contractor shall provide all materials necessary to perform the work in accordance with the SWPPP or as shown on the Drawings or specified herein.

2.2 PERMANENT SEED

A. Refer to Section "Turf and Grasses."

2.3 SOIL STABILIZATION AND TEMPORARY SEED

A. Temporary Seed: Rye grass, cereal grasses, or other quick growing species suitable to the area as a temporary cover, which will not compete with the grasses specified for permanent cover or as specified in the SWPPP or on the Drawings.

2.4 TOPSOIL

A. Topsoil shall be as specified under Section "Soil Preparation."

2.5 FERTILIZER

A. Refer to Section "Turf and Grasses."

2.6 LIME

A. Ground dolomite limestone not less than 85 percent total carbonates and magnesium, ground so that 50 percent passes through a No. 100 mesh sieve and 90 percent passes a No. 20-mesh sieve. Coarser material will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing the No. 100-mesh sieve.

2.7 STRAW MULCH

A. Threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds or clean salt hay.

2.8 EROSION CONTROL BLANKET

A. Erosion Control Blanket (ECB) shall be constructed with a layer of 70 percent straw and 30 percent coconut fiber stitched with degradable thread between a heavyweight UV stabilized polypropylene top net (3 pounds) and a lightweight photodegradable polypropylene bottom net (1.50 pounds). Both the netting and fiber material shall be green in color. Acceptable products shall include SC150 Double Net Straw-Coconut Blanket as manufactured by North American Green; Curlex Double Net (Curlex II) as manufactured by American Excelsior Company or an approved equal.

2.9 TURF REINFORCEMENT MATS

A. Permanent Synthetic Turf Reinforcement Mat (TRM) shall be constructed of UV stabilized polypropylene fiber (0.70 pounds per square yard) stitched with permanent polypropylene thread between heavyweight UV stabilized polypropylene top net (5 pounds per 1000 square feet approximate weight) and bottom net (3 pounds per 1000 square feet approximate weight). Both the netting and fiber material shall be green in color.

B. Acceptable products shall include P300 Permanent Turf Reinforcement Mat as manufactured by North American Green; Recyclex TRM by American Excelsior Company or an approved equal.

2.10 HAY BALE

A. Bales shall be tightly bound, staked with 1 inch by 1 inch hardwood stakes. Hay shall be from mowings of acceptable herbaceous growth free from noxious weeds.

2.11 STONE CHECK DAM

A. The gradation of stone check dam material identified on the plans shall meet the following requirements:

NCSA ROCK SIZE*	PERCENT PASSING BY WEIGHT
12"	100
6"	15 – 50
3"	0 – 15

*National Crushed Stone Association

B. Geotextile fabric for stone check dam shall meet the requirements non-woven fabric found in Section "Geotextiles."

2.12 SILT FENCE

A. Silt Fence (SF) shall consist of woven geotextile fabric, posts, wire mesh backing, and fasteners meeting the requirements shown on the Drawings.

B. The woven geotextile fabric shall meet the following specifications.

Fabric Properties	Minimum Acceptable Value	Test Method
Grab Tensile Strength (lbs.)	110	ASTM D 4632
Elongation at Failure (%)	20	ASTM D 4632
Mullen Burst Strength (PSI)	300	ASTM D 3786
Puncture Strength (lbs)	60	ASTM D 4833
Minimum Trapezoidal Tear Strength (lbs)	50	ASTM D 4533
Flow Through Rate (gal/min/sf)	25	ASTM D 4491
Equivalent Opening Size	40-80	ASTM D 4751
Minimum UV Residual (%)	70	ASTM D 4355

2.13 COMPOST FILTER SOCK

A. Compost infill shall consist of decomposed (matured at least 3 months), weed-free, organic material that is aerobically composted, possess no odors, and contain less than 1%, by dry weight, of man-made material. The compost infill should meet the following specifications. All biosolids compost produced in New York State must meet NYS DEC's 6 NYCRR Part 360 (Solid Waste Management Facilities) requirements or more stringent than 40 CFR Part 503 to ensure safe standards for pathogen reduction and heavy metal content.

Organic Matter Content	25% - 100% (dry weight)
Organic Portion	Fibrous and elongated
pH	6.0 – 8.0
Moisture Content	30% - 60%
Particle Size	100% passing a 1" screen and 10-50% passing a 3/8" screen
Soluble Salt Concentration	5.0 dS/m (mmhos/cm) maximum

B. Compost filter sock fabric material shall meet the minimum requirements and specifications listed in the following tables.

Material Type	3 mil HDPE	5 mil HDPE	5 mil HDPE	Multi-Filament Polypropylene (MFPP)	Heavy Duty Multi-Filament Polypropylene (HDMFPP)
Material Characteristics	Photodegradable	Photodegradable	Biodegradable	Photodegradable	Photodegradable
Sock Diameters	12",18"	12", 18",24", 32"	12", 18",24", 32"	12", 18",24", 32"	12", 18",24", 32"
Mesh Opening	3/8"	3/8"	3/8"	3/8"	1/8"
Tensile Strength		26 psi	26 psi	44 psi	202 psi
Ultraviolet Stability % Original Strength (ASTM G-155)	23% at 1000 hr.	23% at 1000 hr.		100% at 1000 hr.	100% at 1000 hr.
Minimum Functional Longevity	6 months	9 months	6 months	1 year	2 years

2.14 MANUFACTURED INSERT INLET PROTECTION

A. The sack structure shall consist of woven geotextile fabric equal to or exceeding the performance standard for the silt fence fabric.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall comply with and implement the Stormwater Pollution Plan provided in the contract documents.

B. Review the soil erosion and sediment control Drawings as they apply to current conditions. Any deviation from the Drawings must be submitted for approval to the site Engineer in writing at least 72 hours prior to commencing that work.

C. Initial soil sediment and erosion control devices shall be in place prior to any land disturbing activity in their proper sequence and maintained until permanent protection is established.

D. The limit of the area of any earthwork operations in progress shall be commensurate with the Contractor's capability and progress in keeping the finished grading, mulching, seeding, and other such permanent control measures current and in accordance with the accepted schedule for construction phasing. Should seasonal limitations make such coordination unrealistic, as determined by the Owner's Representative, temporary erosion control measures shall be provided immediately by the Contractor at no expense of the Owner.

E. Temporary erosion control measures shall be used to correct conditions which develop during construction that are needed prior to installation of permanent control features, or that are temporarily needed to control erosion that develops during normal construction practices but are not associated with permanent control features on the project.

F. The Contractor shall incorporate all permanent erosion control features (stabilization) into the project at the earliest practical time to minimize the need for temporary controls.

G. A stabilized construction entrance (SCE) shall be installed and maintained at any point where construction vehicles enter a public right-to-way, street, or parking area. The SCE shall be used to eliminate mud from the construction area onto public right-of-way. The SCE shall be constructed as shown on the Drawings. Any mud or debris tracked on streets shall be cleaned up immediately.

H. Dust Control: The Contractor shall provide a commercial grade; enclosed broom mechanical street sweeper to control sediment and/or dust that is tracked on to the adjacent streets. The street sweeper shall be equipped with a water storage tank to wet the area prior to sweeping. Where on site controls do not prevent material from being tracked on to adjacent streets, the street sweeper shall be used to clean the adjacent streets immediately. In addition, at a minimum, the adjacent streets shall be swept at the end of each week or as directed by the Engineer.

I. Any disturbed or stockpiled areas that will be left exposed more than 14 days or less according to State NPDES General Stormwater Permits shall immediately receive temporary or permanent seeding. Mulch/straw shall be used if the season prevents the establishment of a temporary cover. Disturbed areas shall be limed and fertilized prior to temporary seeding.

J. Permanent vegetation shall be established as specified on all exposed areas within 7 days or less according to State NPDES General Stormwater Permits after final grading. Mulch as necessary for seed protection and establishment. Lime and fertilize seedbed prior to permanent seeding.

K. Slopes shall be permanently seeded and mulched. Any slopes that erode easily shall be temporarily seeded and mulched. Any slopes deeper than 3:1 or steeper or as indicated on Drawings shall be protected with Erosion Control Blanket per specifications.

L. All storm drainage outlets must be stabilized, as specified, before the discharge points become operational. Equip all inlets with inlet protection immediately upon construction.

M. Manufactured insert inlet protection shall be installed and anchored in accordance with the manufacturers recommendations and design details. The Contractor shall maintain all manufactured insert inlet protection units until the project is stabilized and shall remove and dispose of the sediment accumulation properly when the units are more than 1/3 full. Replace and reinstall the unit if necessary.

N. Discharge from dewatering operations for the excavated areas shall not be directed to surface waters without first properly removing the suspended sediment through filtration and/or settlement. The Contractor shall obtain any required permits associated with dewatering activities.

O. Silt fence shall be installed at locations on the Drawings and any additional locations necessary for proper sediment control. The Contractor shall maintain the silt fence until the project is stabilized and shall remove and dispose of the silt fence and silt accumulation when 1/3 the height of the fence is reached.

P. Filter Socks shall be place at locations indicated on plans or as directed by the Engineer. They should be installed parallel to the base of the slope or other affected area. The Contractor shall maintain the Filter Socks and they shall be inspected weekly and after each rain event. If the Filter Sock requires repair, it shall be repaired in accordance with the manufacture's recommendations or replaced within 24 hours of inspection notification. Biodegradable filter socks shall be replaced after 6 months; photodegradable filter socks after 1 year. Polypropylene socks shall be replaced according to the manufacturer's recommendations.

Q. Soil erosion and sediment control shall include but not be limited to the approved measures. The Contractor shall be responsible for providing all additional measures that may be necessary to accomplish the intent of the Drawings.

R. Comply with all other requirements of authorities having jurisdiction.

S. Soil Stabilization and Temporary Seeding:
   1. Soil stabilization seeding shall consist of the application of the following materials in quantities as further described herein for stockpiles and disturbed areas left inactive for more than 14 days.
      a. Lime.
      b. Fertilizer.
      c. Seed.
      d. Mulch.
      e. Maintenance.
   2. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. Should the Contractor elect to apply soil stabilization seeding by hydroseeding methods, he shall submit his operational plan and methods to the Engineer.
   3. Temporary Seeding is to be placed and maintained over all disturbed areas prior to Permanent Seeding. Maintain Temporary Seeding until such time as areas are approved for Permanent Seeding. As a minimum, maintenance shall include the following:
      a. Fix-up and reseeding of bare areas or re-disturbed areas.
      b. Mowing for stands of grass or weeds exceeding 6 inches in height.

T. Topsoil and Permanent Seeding: conform to the requirements of Section "Soil Preparation" and Section "Turf and Grasses."

END OF SECTION

SECTION 313219.13 – GEOGRID REINFORCEMENT

PART 1 – GENERAL

1.1 SUMMARY

A. This Section incudes furnishing and installing geogrid reinforcement as indicated.

B. All geogrids shall be new, clean and in accordance with material specifications. In no instance shall second-hand or damaged materials be used.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable.
      a. American Society for Testing and Materials (ASTM).
      b. U.S. Army Corp of Engineer (COE).
      c. Geosynthetic Research Institute (GRI).

B. Product Markings: Each roll shall be plainly and permanently marked with the following information:
   1. Name or trademark of manufacturer.
   2. Date of manufacture.
   3. Product identification.

C. Geogrid Manufacture:
   1. The Contractor shall supply data for each roll of material documenting that the strength and elongation at yield and break comply with the product specifications.

1.3 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's catalog cuts, specifications, and installation instructions.

B. Shop Drawings:
   1. Submit Shop Drawings which include, but are not limited to the following:
      a. Geogrid placement plan.
      b. Installation details.

C. Samples:
   1. Submit 1 square foot of each type of geogrid proposed.

D. Record Documents:
   1. Manufacturer's quality control certification for all material delivered. Submit certification upon delivery.
   2. Record drawings showing panel layout and installation sequence.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver sufficient materials to the site to prevent interruption of the work.
   2. All materials shall be inspected by Contractor upon delivery. Contractor shall notify Engineer of any damage. Damaged materials shall be returned and replaced at no cost to the Owner.

B. Storage:
   1. Geogrid shall be stored above 0 DegF.
   2. Contractor shall prevent excessive mud, wet cement, epoxy, and similar materials, which may affix themselves to the grid, from coming in contact with the geogrid material.
   3. Rolled geogrid material may be laid flat or stood on edge for storage.
   4. Geogrid shall be kept covered with protective wrapping until ready for use.

C. Handling:
   1. Geogrid shall be handled carefully with approved handling devices in strict conformance with the manufacturer's recommendations.
   2. Products shall not be dropped or rolled off trucks, nor shall products be otherwise dragged, rolled, or skidded.

PART 2 – PRODUCTS

2.1 DEFINITIONS

A. Geogrid: A polymer grid structure specifically manufactured for use as a soil reinforcement.

B. Uniaxial Grid: A geogrid which has been manufactured with high junction strength and high tensile strength and modulus in 1 direction only.

C. Biaxial Grid: A geogrid which has been manufactured with high tensile strength in 2 directions, perpendicular to one another.

D. Direction of Reinforcement: Refers to the orientation that the geogrid is used for a particular project, which is along the machine direction (roll direction) for uniaxial geogrid.

E. MD: Machine direction.

F. CMD: Cross-machine direction.

2.2 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. The Tensar Corporation, Morrow, Georgia.
   2. Strata Systems - StrataGrid
   3. Huesker – Fortrac
   4. Maccaferri – MacGrid
   5. Synteen

2.3 MATERIALS

A. The geogrid reinforcement for slope stabilization shall:

1. Be an uniaxially-oriented grid structure.

B. The geogrid reinforcement for access roads and ramps shall:
   1. Be a biaxially-oriented grid structure.

C. Upon request, the manufacturer shall furnish test reports certifying that the product meets the requirements of this Specification.

D. Uniaxial Geogrid:
   1. The geogrid shall be a regular grid structure formed by uniaxially drawing a continuous sheet of select high density polyethylene material and shall have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall have high resistance to deformation under sustained long-term design load while in service and shall also be resistant to ultraviolet degradation, damage under normal construction practices, and all forms of biological or chemical degradation normally encountered in the material being reinforced.
   2. The geogrid shall also conform in all respects to the property requirements listed below:

PROPERTY	TEST METHOD	UNITS	VALUE UX 1400	VALUE UX 1500
INTERLOCK:				
Apertures:[1]				
MD	I.D. Calipered2	in	5.70	5.70 (nom)
CMD	I.D. Calipered2	in	0.66	0.65 (nom)
Open Area	COE Method[3]	%	60	60 (nom)
Thickness:				
Ribs	ASTM D1777-64	in	0.030	0.050 (nom)
Junction	ASTM D1777-64	in	0.110	0.170 (nom)
REINFORCEMENT:				
Long-term design load- MD	GRI-GG3-87[4]	lb/ft	1,200	2,300 (min)
Flexural rigidity	ASTM 1388-64[5]	mg-cm	670,000	4,700,000 (min)
Tensile modulus MD	GRI GG1-87[6]	lb/ft	50,000	100,000 (min)
Junctions:				
Strength	GRI GG2-877	lb/ft	3,300	5,000 (min)
Efficiency	GRI GG2-877	%	90	90 (min)
MATERIAL:				
High density	ASTM D1248	%	97	97.5 (min)
Polyethylene	Type III, Class A/ Grade 5			
Carbon black		%	2.0	2.0 (min)
DIMENSIONS:				
Roll length		ft	98	98 (min)
Roll width		ft	4.3	3.3 & 4.3 (min)
Roll weight		lb	44	50 & 65 (min)

PROPERTY	TEST METHOD	UNITS	VALUE UX 1400	VALUE UX 1500

Notes:
1. MD dimension is along the roll length. CMD dimension is across the width.
2. Maximum inside dimension in each principal direction measured by calipers.
3. Percent open area measured without magnification by Corps of Engineers method, as specified in CW 022215 Civil Works Construction Guide, November 1977.
4. Long-term load capacity measured by through the junction creep testing to 10,000 hours as described in Geosynthetic Research Institute Test Method GG3-87 "Creep Behavior and Long-Term Design Load of Geogrids."
5. ASTM D1388-64 modified to account for wide specimen testing as described in Tensar Test Method TTM-5.0 "Stiffness of Geosynthetics."
6. Secant modulus at 2 percent elongation measured by Geosynthetic Research Institute Test Method GGI-87 "Geogrid Tensile Strength." No offset allowances are made in calculating secant modulus.
7. Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute Test Method GG2-87 "Geogrid Junction Strength."

E. Biaxial Geogrid:

1. The geogrid shall be a regular grid structure formed by biaxially drawing a continuous sheet of select polypropylene material and shall have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.
2. The geogrid shall also conform in all respects to the property requirements listed below:

PROPERTY	TEST METHOD	UNITS	VALUE BX 110
INTERLOCK:			
Apertures:[1]			
MD	I.D. Calipered2	in	1.70 (nom)
CMD	I.D. Calipered2	in	1.3 (nom)
Open Area	COE Method[3]	%	70 (nom)
Thickness:			
Ribs	ASTM D1777-64	in	0.03 (nom)
Junction	ASTM D1777-64	in	0.11 (nom)
REINFORCEMENT:			
Flexural rigidity	ASTM D1388-64[4]	mg-cm	250,000 (min)
Tensile modulus	GRI GG1-87[5]	lb/ft	14,000 (min)
Junctions:			
Strength	GRI GG2-876	lb/ft	750 (min)
Efficiency	GRI GG2-876	%	90 (min)

PROPERTY	TEST METHOD	UNITS	VALUE BX 110
MATERIAL:			
Polyethylene	ASTM D4101 Group 1/Class 1/ Grade 2	%	98 (min)
Carbon black	ASTM 4218	%	0.5 (min)
DIMENSIONS:			
Roll length		ft	164
Roll width		ft	9.8 & 13.1 (min)
Roll weight		lb	71 & 95 (min)

Notes:
1. MD dimension is along roll length. CMD dimension is across roll width.
2. Maximum inside dimension in each principal direction measured by calipers.
3. Percent open area measured without magnification by Corps of Engineers method as specified in CW 02215 Civil Works Construction Guide, November 1977.
4. ASTM D 1388-64 modified to account for wide specimen testing as described in Tensar test method TTM-5.0 "Stiffness of Geosynthetics."
5. Secant modulus at 2 percent elongation measured by Geosynthetic Research Institute test method GGI-87 "Geogrid Tensile Strength." No offset allowances are made in calculating secant modulus.
6. Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute test method GG2-87 "Geogrid Junction Strength."

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for the storage, handling, and installation of all geogrids in accordance with the specifications and the manufacturer's recommendation.

3.2 PREPARATION

A. Clearing and removal of organics shall be in accordance with Section "Clearing and Grubbing."

B. Excavation shall be in accordance with Section "Earthwork."

C. Prior to placing fill, localized existing slope failures and oversteepened portions of the existing slope shall be excavated and/or regraded to the satisfaction of the Engineer.

D. The subgrade to receive reinforced fill shall be graded level for a sufficient width to facilitate geogrid installation. The subgrade soils shall be compacted to the satisfaction of the Engineer and shall be firm and unyielding.

3.3 INSTALLATION

A. Geogrid shall be laid at the proper elevation and orientation as shown on the Drawings or as recommended by the manufacturer and approval by the Engineer.

B. Correct orientation (roll direction) of the geogrid shall be verified by the Contractor.

C. Geogrid shall be secured in the anchor trench as shown on the Drawings or as recommended by the manufacturer and approved by the Engineer and unrolled in its machine direction down the slope.

D. Bedding soil shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in and/or movement of the geogrid and other geosynthetic components of the system.

E. Tracked construction equipment shall not be operated directly on the geogrid. A minimum bedding soil thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the bedding soil and damaging the geogrid.

F. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.

G. Geogrid used in road reinforcement shall be oriented such that the roll length runs parallel to road direction.

H. If cutting of geogrid is required for corners, diagonal overlapping of geogrid shall be used to ensure that excessive buckling of grid material does not occur.

I. Overlaps and Connections:
   1. Uniaxial geogrid shall be mechanically connected by a 1.5-inch by 0.25-inch HDPE flat bar or as recommended by the manufacturer and approved by the Engineer.
   2. Biaxial geogrid overlap shall be at least one foot. Care shall be taken to ensure that geogrid sections do not separate at overlaps during construction. To prevent separation, joining methods such as wire ties, plastic ties, hog rings, staples, or hooks shall be employed. Joint spacing shall be no greater than 20 feet.

3.4 BACKFILL

A. Backfill placement shall be closely coordinated with geogrid and other geosynthetics.

B. Backfilling and compaction shall be in accordance with Section "Earthwork" with the following additional requirements:
   1. Equipment shall not be allowed to run on geogrids unless sufficient cover, as specified by the manufacturer, exists to ensure that no damage to the materials will occur. Any damaged materials shall be removed and replaced at the Contractor's expense. Repairs to damaged geogrids may be allowed, subject to the recommendations of the manufacturer, and approval of the Engineer.
   2. The Contractor shall continuously direct surface drainage and runoff away from the slope face through temporary grading, sandbagging, or other means acceptable to the engineer.

C. Road material shall be backdumped from trucks riding on top of the reinforced fill and bladed onto geogrid in such a manner that the fill rolls onto the grid ahead.

D. Ruts created in the road and cover soil due to construction traffic shall be filled with additional like material. Blading adjacent material into the rut shall not be permitted.

3.5 DISPOSAL OF SCRAP MATERIALS

A. On completion of installation, the Contractor shall dispose of all trash and scrap material off-site or in a location approved by the Owner and Engineer, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner.

END OF SECTION

SECTION 313710 – STONE FILL

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes provisions for the placement of stone fill on embankment slopes, drainage courses, culvert inlet's and outlets, and streambanks.

1.2 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Method of Measurement:

1. The quantity of stone fill will be measured as the actual number of square yards (SY) (square meters (SM)) for each type of stone fill placed and accepted. The quantity will be determined by computations based on field measurements taken on the stone fill covered surface.

B. Basis of Payment:

1. The unit price per SY (SM) shall include the cost of furnishing all labor, equipment, materials, including the geotextiles, bedding, stone fill and incidentals necessary to complete the work.

1.3 REFERENCES

A. Georgia Department of Transportation, Standard Specifications for Construction of Transportation Systems. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."

1.4 SUBMITTALS

A. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

B. Results of all tests, investigations, including recommendations.

C. Manufacturer's catalog cuts, production data, and recommended installation procedures for geotextile fabric.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Stone fill shall conform with Georgia Department of Transportation, Standard Specifications for Construction of Transportation Systems section 805 – Rip Rap and Curbing Stone.

B. Bedding shall conform with Georgia Department of Transportation, Standard Specifications for Construction of Transportation Systems section 815 – Graded Aggregate..

C. Geotextile: Shall conform to the requirements of Section "Geotextiles."

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. Clear the surface on which the riprap is to be placed of brush, trees, or other objectionable material.

3.2 INSTALLATION

A. Geotextile Fabric: Shall be installed in conformance with the requirements of Section "Geotextiles."

B. Bedding:
1. Place the bedding material on the geotextile to the full thickness, 6-inch minimum, in one operation using methods that will not cause segregation of the aggregate.
2. Prevent contamination of bedding material by natural soils or other materials. Remove bedding materials that become contaminated and replace with uncontaminated bedding material.
3. Do not drop bedding material onto the geotextile from a height exceeding 3 feet.

C. Stone Fill:
1. Place the stones so that the dimension approximately equal to the layer thickness is perpendicular to the slope surface such that the weight of the stone is carried by the underlying material, not by the adjacent stones.
2. Place stone fill to minimize void spaces between adjacent stones.
3. On slopes the largest stones shall be placed at the bottom of the slope.
4. Place stone fill to avoid disruption and damage to the bedding material.

END OF SECTION

SECTION 315000 – EXCAVATION SUPPORT AND PROTECTION

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes, but is not limited to, the following:
   1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.
   2. Maintenance of shoring and bracing.
   3. Removal of shoring and bracing, as required.

B. The purpose of this work is to insure the safety of workmen and the public exposed to the hazard of falling or sliding material. It shall be the Contractor's responsibility to provide protection adequate for this purpose. Details of this sheeting must conform with the requirements of Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA). The Engineer shall reserve the right to increase the minimum requirements set forth therein, depending on the hazard.

1.2 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Method of Measurement:
   1. Excavation Support Systems and Protection will be measured by the number of square feet (SF) (square meters (SM)) computed by multiplying the vertical length by the horizontal length shown on the plans. The vertical length is measured between the upper and lower payment lines. The upper payment line shall be the ground surface and the lower the bottom of the excavation. The horizontal length is the actual length installed measured along the payment lines shown on the plans. Both sides of the excavation shall be measured in the computations.

B. Basis of Payment:
   1. Excavation Support Systems and Protection will be paid for at the contract unit price for the work specified including the cost of furnishing all labor, materials, and equipment, necessary to complete the work including waling, bracing, lagging, and design services.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
   1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
   2. Prevent surface water from entering excavations by grading, dikes, or other means.
   3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
   4. Monitor vibrations, settlements, and movements.

1.4 SUBMITTALS

A. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Layout drawings for excavation support system and other data prepared by, or under the supervision of, a qualified professional engineer.

C. System design and calculations must be acceptable to local authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Engineer Qualifications: A professional engineer legally authorized to practice in jurisdiction where Project is located, and experienced in providing successful engineering services for excavation support systems similar in extent required for this Project.

B. Regulations: Comply with codes and ordinances of governing authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is included elsewhere in the Project Manual.

B. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs or video tape to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs or video tape, and signed by Contractor and others conducting investigation.

C. During excavation, resurvey benchmarks weekly, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident.

D. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

1.7 EXISTING UTILITIES

A. Protect all existing active utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

C. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify Owner no fewer than 2 days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Owner's written permission

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

A. In general, this item will be required wherever an excavation exceeds five feet in depth and the side slopes are not laid back to a safe gradient as set forth in Title 29 Code of Federal Requirements, Part 1926, Safety and Health Regulations for Construction (OSHA).

B. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

3.2 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
   1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
   2. Fill voids immediately with approved backfill compacted to density specified in Section "Earth Moving" or Section "Trenching and Backfilling."
   3. Repair or replace, as approved by Engineer adjacent work damaged or displaced by removing excavation support and protection systems.
   4. Leave excavation support and protection systems permanently in place.

END OF SECTION

SECTION 321116 – SUBBASE COURSES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes provisions for prepared subbase courses for under walks and pavements.

B. Proof rolling of subgrade for walks and pavements is included in this Section.

C. Replacement of unsuitable subgrade materials is included in another Section.

D. Final grading of pavement subbase is specified in this Section.

E. Stabilization fabric is included in another Section.

1.2 REFERENCES

A. The latest edition of the following standards, as referenced herein, shall be applicable:
   1. Georgia Department of Transportation, Standard Specifications for Construction of Transportation Systems.
   2. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
   3. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

A. Source Quality Control Test Reports: Submit test reports directly to Engineer from the testing agency with copy to Contractor.

B. Field Testing Reports: Submit results of field testing directly to Engineer with copy to Contractor. Reference testing location to plan, and cross-reference to all retesting required to accept installed subbase material.
   1. Note action taken next to all sub-standard test results.

1.4 QUALITY ASSURANCE

A. Testing Laboratory Qualifications: To qualify for acceptance, the soil testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E699, that it has the experience and capability to conduct the required testing without delaying the progress of the Work.

B. Field Testing and Inspection Service: Contractor shall retain the services of the same independent soil testing laboratory used for source qualification testing to provide soil testing during pavement subbase installation.

PART 2 – PRODUCTS

2.1 SOURCE QUALIFICATION TESTING

A. Contractor shall employ and pay for a qualified independent soil testing laboratory to perform soil testing services for source qualification.

1. Obtain a 100-pound minimum representative sample from each potential aggregate source. Obtain samples for each different material gradation known to exist in the pit. Mix each sample thoroughly in accordance with AASHTO T87 and submit to the testing laboratory for reduction to specimen size. The laboratory shall perform the following tests in the order shown. Each material shall pass all tests in order to qualify.

a. Particle Size Analysis:

1) Method: ASTM D422.

2) Number of Tests: 2 per potential source.

3) Acceptance Criteria: Gradation within specified limits.

b. Plasticity Index Determination:

1) Method: ASTM D424.

2) Number of Tests: 1 particle size analysis on material passing no 40 mesh.

3) Acceptance Criteria: Plasticity Index within specified limits.

c. Maximum Density Determination:

1) Method: ASTM D1557 Modified Proctor.

2) Number of Tests: 2 per potential source.

d. Magnesium Sulfate Soundness Loss Test:

1) Method: GDOT Standard Test Method.

2) Number of Tests: 2 per potential source.

3) Acceptance Criteria: 4 cycle loss within specified limits.

2. Re-establish subbase material properties if source is changed during construction.

2.2 MATERIALS

A. Graded Aggregate Base Course: Materials shall consist of sound, durable blast furnace slag, stone, sand, gravel or blends of these materials per GDOT Material Specification Section 815.

B. All materials shall be well graded from course to fine and free from organic or other deleterious materials, conforming to the requirements of GDOT Section 815, and meeting the following gradation requirements:

TYPE	SIEVE	PERCENT PASSING
Group I	2"	100
	1-1/2"	97-100
	3/4"	60-95
	No. 10	25-50
	No. 60	10-35
	No.200	7-15

TYPE	SIEVE	PERCENT PASSING
Group II	2"	100
	1-1/2"	97-100
	3/4"	60-90
	No.10	25-45
	No.60	5-30
	No. 200	4-11

1. Magnesium Sulfate soundness loss after 4 cycles shall be less than 20 percent for types 1, 2, and 4. Magnesium sulfate soundness loss after 4 cycles shall be less than 30 percent for type 3.
2. Plasticity Index of material passing No. 40 sieve shall not exceed 5.0.
3. Not more than 30 percent, by weight, of the particles retained on a 1/2-inch sieve shall consist of flat or elongated particles. A flat or elongated particle is defined as one which has its greatest dimension more than 3 times its least dimension.
4. All material shall meet the specified gradation prior to placement. All processing shall be completed at the source.
5. Stabilization Fabric: Conform to Section "Geotextiles."

C. Material substitutions and/or additives such as glass, Blast Furnace Slag, Recycled Portland Cement Concrete Aggregate (RCA) and Reclaimed Asphalt Pavement shall be allowed in accordance with GDOT Section 815 and are subject to approval and acceptance by the Engineer.

PART 3 – EXECUTION

3.1 PREPARATION

A. Establish required lines, levels, contours, and datum.

B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to Owner.

C. Proof-roll existing subgrade to the satisfaction of the Engineer. Should the subbase course become unstable at any time prior to the placement of the overlying course(s), correct the unstable condition to the satisfaction of the Engineer. Replace unstable or weak subgrade materials with suitable material as provided in the Specifications.

D. Place stabilization fabric in locations as directed on the plans and in accordance with Section "Geotextiles" after subgrade has been proof-rolled and accepted by the Engineer.

3.2 INSTALLATION

A. Place subbase material in uniform horizontal layers, with a maximum compacted thickness of 12 inches.

B. Place subbase in a manner to avoid segregation. Uncontrolled spreading shall not be permitted.

3.3 COMPACTION

A. Where subbase courses must be moisture-conditioned before compaction, uniformly apply water to the surface. Prevent free water from appearing on the surface during or subsequent to compaction operations.

B. Compact all portions of each layer to a density not less than 95 percent of the maximum density.

C. Final tolerances for the top surface of the subbase course requires that the surface does not extend more than 1/4 inch above nor more than 1/4 inch below the specified grade at any location.

3.4 TRAFFIC ON SUBBASE

A. The movement of vehicular traffic over the final surface of the subbase may be permitted at locations designated by, and under such restrictions as ordered by the Engineer, provided such movements take place prior to the final finishing of this course to the specified tolerance. The movement of construction equipment on this course may be permitted, at locations designated by and under such restrictions as ordered by the Engineer at locations where permission is granted for such movement, the temporary surface of the course upon which the construction traffic is running, shall be placed and maintained for at least 2 inches above the final surface of this course. Just prior to paving, and after all construction traffic not required for the removal has ceased, remove the 2-inch protective layer, prepare the exposed surface of the course, and compact to the specified tolerance.

B. Should the subbase become mixed with the subgrade or any other material, through any cause whatsoever, remove such mixture and replace it with the specified subbase material.

3.5 FIELD QUALITY CONTROL

A. Notify the Engineer at least 1 working day in advance of all phases of subbase installation.

B. Comply with the requirements of this Section for in-place relative density testing.
   1. In-place relative density:
      a. Method: AASHTO T310, Nuclear Method.
      b. Number of Tests: 1 per specified interval.
   2. Compaction tests shall be provided for every 1000 square yard of subbase placement. A minimum of 3 for each lift is required.
   3. The Engineer may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions.
   4. Acceptance Criteria: The sole criterion for acceptability of in-place subbase shall be in situ dry density. Minimum dry density for all subbase shall be 95 percent of the maximum dry density. If a test fails to qualify, the fill shall be further compacted and re-tested. Subsequent test failures shall be followed by removal and replacement of the material.

END OF SECTION

SECTION 321216 – ASPHALT PAVING

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes provisions for hot-mixed asphalt concrete paving over prepared subbase.

B. This section includes provisions for replacing pavement removed during the course of the Work, or damaged resulting from Contractor's operations.

1.2 REFERENCES

A. The latest edition of the following standards, as referenced herein, shall be applicable:
   1. Georgia Department of Transportation (GDOT), Standard Specifications for Construction of Transportation Systems
   2. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
   3. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

A. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

B. Field Test Reports: Submit results of field testing directly to the Engineer.

C. Request for placement of Top Course HMA: If applicable, request Owner/Engineer approval for placement of Top Course HMA outside of seasonal limitations noted herein. Include a copy of the Limited Warranty for approval.

1.4 SITE CONDITIONS

A. Weather Limitations:
   1. Apply tack coats when ambient temperature is above 50 DegF and when temperature has not been below 35 DegF for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Grade Control: Establish and maintain required lines and elevations.

C. In no instance shall the materials and thicknesses of pavement and subbase courses replaced be less than that removed, unless approved by the Engineer.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the placement of asphalt concrete pavement with the completion of underground work by other trades.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Asphalt concrete and all related items shall meet the requirements of GDOT Section 828 for Hot Mix Asphalt Concrete Mixture.

B. Intermediate Course:
   1. GDOT Section 828 Hot Mix Asphalt for 19mm and/or 25 mm Superpave

C. Surface Course:
   1. GDOT Section 828 Hot Mix Asphalt for 12.5 mm.

D. Tack Coat:
   1. Emulsified asphalt, ASTM D977

E. Joint Adhesive:
   1. Hot applied modified asphalt product conforming to GDOT Specifications.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. General: Remove loose material from compacted subbase surface immediately before commencing paving operations.

B. Proof-roll prepared subbase surface with a 10-ton static, steel-wheel roller to check for unstable areas and areas requiring additional compaction, witnessed by the Engineer at least 48 hours prior to scheduled paving operations.

C. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

D. Sawcut edges of existing pavement to achieve straight line transitions between old and new pavement. Make a second sawcut through the top course of existing pavement, 18 inches from the first cut to provide a staggered joint.

E. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.03 to 0.07 gallons per square yard of surface. Tack coat shall be applied between each layer of the pavement section.
   1. Allow to dry until at proper condition to receive paving.

F. Joint Adhesive:
   1. Apply joint adhesive to all pavement edges in accordance with GDOT Specifications prior to placing the asphalt mixture in order to provide bonding with the newly laid pavement. The application of joint adhesive is for Top Course only.
   2. Apply the joint adhesive when surface temperature is 40 DEGF and rising. Use an applicator wand fitted with a sealing shoe to strike-off the adhesive. Strike-off the joint adhesive to provide a 1/4 inch to 3/8 inch thick band. The finished bands are to be approved by the Engineer.

a. Wedge Joints:

1) Apply the joint adhesive to the entire vertical face and the upper 2 inches of the wedge joint.

b. Butt Joints:

1) Apply the joint adhesive to the entire vertical face of the butt joint.

3. The joint adhesive will be considered cured when construction and/or vehicular traffic does not track or pick up the material. Reapply joint adhesive to any areas damaged by construction and/or vehicular traffic prior to placing the adjacent asphalt pavement.

G. Exercise care in applying bituminous materials to avoid smearing of adjoining surfaces. Remove and clean damaged surfaces.

H. Do not commence pavement replacement operations until all buried work beneath pavement repair has been completed to the satisfaction of the Engineer.

I. Where trench dimensions preclude the use of proof rolling equipment, demonstrate the stability of the subgrade and subbase through other means, as acceptable to the Engineer.

3.2 PLACING AND COMPACTING MIX

A. General: Place and compact asphalt pavement courses in accordance with GDOT Specifications unless otherwise specified.

B. Place inaccessible and small areas by hand, and compact with hot hand tampers or vibrating plate compactors.

C. Chamfer edges of walks at 45-degree angle where walks do not abut curb.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

E. Place tack coat between successive courses if more than 48 hours have elapsed after placing the preceding course. Apply tack coat at a rate of 0.03 to 0.07 gallons per square yard of surface.

F. Remove and patch areas of any asphalt concrete course deemed unsatisfactory by the Engineer, at the Contractor's expense. Remove hardened or set asphalt by saw cutting.

G. Adhere to GDOT compaction requirements. This, however, shall not relieve the Contractor of his responsibility to provide a well densified pavement. It shall be the Contractor's obligation to recognize difficulties in compacting the mix, and to make appropriate corrections.

H. Roll and compact the asphalt concrete course until the finished surface is free from depressions, waves or other defects that would prevent proper drainage. The finished surface shall be uniform in texture and appearance.

I. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

J. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

K. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979 or AASHTO T168.

1. Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.
   a. One core sample will be taken for every 1000 square yard (836 square meter) or less of installed pavement with no fewer than 3 cores taken.

L. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

1. Replace and compact hot-mix asphalt where core tests were taken.
2. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.3 FIELD QUALITY CONTROL

A. General: Test in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Engineer.

B. Thickness: In-place compacted thickness tested in accordance with ASTM D3549 will not be acceptable if exceeding following allowable variations:

1. Base Course: Plus or minus 1/2 inch.
2. Binder and Surface Course: Plus or minus 1/4 inch.
3. Cumulative Thickness Tolerances: Plus or minus 1/4 inch for nominal cumulative thicknesses less than or equal to 4 inches. Plus or minus 1/2 inch for nominal cumulative thicknesses greater than 4 inches.

C. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

1. Base and Binder Course Surfaces: 1/4 inch.
2. Wearing Course Surface: 3/16 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

D. Check surface areas at intervals as directed by Engineer.

E. Scuff Resistance: If, in the opinion of the Engineer, the pavement does not demonstrate reasonable resistance to deformation by punching loads and scuffing under horizontally applied shearing loads, after the pavement has cooled and hardened, the Engineer may require laboratory testing of cored pavement samples to determine the properties of the pavement; including aggregate gradation, asphalt content, air void ratio, density and any others deemed appropriate. If laboratory testing indicates that any parameters substantially deviate from the design mix tolerances specified by GDOT, replace the affected areas of pavement at no additional cost, and reimburse the Owner for all costs incurred in procurement and testing of cores.

END OF SECTION

SECTION 321613.16 – CAST-IN-PLACE CONCRETE CURBING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the installation of concrete curbing as shown on the Drawings or as specified herein.

B. The materials and methods specified herein are directly intended for placement of "new" concrete curbing.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable.
      a. Georgia Department of Transportation Standard Specifications Construction of Roads and Bridges; latest edition.
      b. American Society of Testing and Materials (ASTM).
      c. American Concrete Institute. (ACI).

B. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of materials with the specifications, if at any time during the Work, materials appear unsuitable in the opinion of the Engineer.

1.3 SUBMITTALS

A. Concrete:
   1. The Contractor shall furnish the name and location of the concrete supplier.
   2. Submit the design mix for each class of concrete prior to use in the Work.

B. Product Data:
   1. Submit manufacturer's catalog cuts, specifications, and installation instructions.

C. Test Results:
   1. The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete:
   1. All cast-in-place concrete shall be ready mixed concrete meeting the following criteria:
      a. 28-day compressive strength: 4000 psi.
      b. Air entrainment: 4% to 8%.
      c. Slump: 2 to 4 inches. For machined formed curb 1-1/2 inches maximum
   2. Concrete shall be proportioned using methods 1 or 2 as outlined in ACI-301.
   3. The approved mix design shall be used throughout this project unless changes are ordered or approved by the Engineer.

B. Pre-Moulded Expansion Joint Filler:

1. Concrete curbing shall be provided with a 1/2-inch pre-moulded expansion joint filler conforming to ASTM D1751.
2. The pre-moulded expansion joint filler shall be "pre-cut" to match the concrete curbing cross-sectioned dimensions as detailed on the Drawings.

C. Curing Materials:

1. Impervious Sheeting: ASTM C171.
2. Liquid Membrane Curing Compound: ASTM C309, compound shall be free of paraffin or petroleum.
3. Manufacturers:
   a. "Kure-N-Seal 0800" by Sonneborn.
   b. "Cure & Seal" by Symons.
   c. Or approved equal.

D. Sealants:

1. Joint Sealers: ASTM D1850.

E. Forms:

1. Curb forms shall be of wood or steel, straight, and of sufficient strength to resist springing during depositing and consolidating the concrete. The outside forms shall have a height equal to the full depth of the curb. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form.
2. Straight forms of wood shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits, or other defects. Wood forms shall have a nominal length of 10 feet, with a minimum of three stakes per form, at maximum spacing of 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness.
3. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Form ends shall be interlocked and self-aligning. Forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Forms shall have a nominal length of 10 feet, with minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips, designed for use with steel forms.
4. Rigid forms shall be provided for curb returns, except that benders of thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

PART 3 – EXECUTION

3.1 INSPECTION

A. The Contractor shall notify the Engineer 24 hours before placing concrete in order to give the Engineer an opportunity to inspect the formwork and related items prior to placement of the concrete.

B. Delivery tickets shall show the amount of cement, brand, and amount of all admixtures, in addition to information required by ASTM C94, Section 14. Water added on the job shall be approved and the amount noted on the delivery ticket and initialed by the Contractor.

3.2 SUBBASE PREPARATION

A. Concrete curbing shall be constructed on a compacted granular subbase as shown on the Drawings.

B. The subbase shall be maintained in a smooth, compacted condition in conformity with the required section and established grade, until the concrete is placed.

C. The subbase shall be in a moist condition when concrete is placed.

D. The subbase shall be prepared and protected so as to produce a subbase free from frost when the concrete is deposited.

3.3 FORMWORK

A. Earth cuts may not be used as forms for vertical surfaces.

B. All forms shall be built mortar tight and of materials sufficient in strength to hold concrete without bulging between supports. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the forms. Concrete, mis-shapen by bulges or deformations caused by inadequate forms, shall be removed or corrected as ordered by the Engineer. All replacements or corrections shall be made at the Contractor's expense.

C. All surfaces of wooden forms that will be in contact with exposed concrete shall be thoroughly treated with an approved lacquer in the procedure recommended by the manufacturer. Forms so treated shall be protected from being damaged or dirtied prior to placing of the concrete.

D. Metal forms shall be treated with an approved form lacquer or may be treated with an approved form oil. The metal used for forms shall be of sufficient thickness to remain true to shape. All bolt and rivet heads shall be designed to hold the forms rigidly together and to allow removal, without injury to the concrete. Metal forms which do not have smooth surfaces, correct alignment and clean surfaces shall not be used.

E. The forms on the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing.

3.4 CONCRETE PLACEMENT AND FINISHING

A. Preparation:
   1. Set approved forms true to line and grade. Cast curb in 40-foot long sections. If curbs abut existing pavement, locate construction joints opposite existing pavement joints as directed.
   2. Provide cut to size joint filler between 40-foot sections and where curb abuts existing concrete paving and fixed structures or appurtenances. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.
   3. Expansion joints shall be constructed at right angles to the line of the curb.

B. Concrete Placement:
   1. Concrete shall be placed in layers not to exceed 6 inches. For slipform concrete, refer to maximum placement depth as recommended by machine manufacturer,
   2. Concrete shall be thoroughly consolidated by tamping and spading or with approved mechanical vibrators, eliminating all air pockets, stone pockets and honeycombing.
   3. Place concrete in accordance with ACI 301 unless otherwise specified herein.

4. Cold Weather Concreting: Comply with ACI 306 for placement at temperatures of, or expected to be, below 40 DegF.
5. Hot Weather Concreting: Comply with ACI 305 for placement at temperatures of, or expected to be, above 90 DegF.
6. For slipform concrete, any curb placed outside the tolerance of 1/2 inch of the established line or 1/4 inch outside of the established grade shall be removed and replaced by the contractor.

C. Concrete Finishing:
1. The top of the curb shall be rounded with an edging tool to a radius of 1/2 inch and the surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes.
2. Visible surfaces and edges of finished curb shall be free of blemishes and form and tool marks, and shall be uniform in color, shape, and appearance.
3. No plastering shall be permitted.
4. Curbing forms shall be left in place at least 24 hours, or until the concrete has sufficiently set so that, in the opinion of the Engineer, the forms can be removed without injury to the curbing.

3.5 CURING

A. Impervious Sheeting Method:
1. The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used.
2. The curing medium shall not be less than 18 inches wider than the concrete surface to be cured and shall be securely weighted down by heavy wood planks, or by placing a bank of moist earth along edges and laps in the sheets.
3. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

- or -

B. Membrane Curing Method:
1. The entire exposed surface shall be covered with a membrane forming curing compound.
2. Curing compound shall be applied in two (2) coats by hand operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats, unless otherwise approved by the Engineer based upon manufacturer's data.
3. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat to all surfaces showing discontinuity, pinholes, or other defects.
4. Concrete surfaces that are subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by the above method and at the above coverage at no additional cost to the Owner.
5. Expansion-joint openings shall be sealed at the top by inserting moistened paper or fiber rope or covering with strips of waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
6. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected for 7 days from pedestrian and vehicular traffic and from any other action that might disrupt the continuity of the membrane. Any area covered with curing compound and damaged by subsequent construction operations within the 7-day curing period shall be resprayed as specified above at no additional expense to the Owner.

3.6 SEALING JOINTS

A. The approximately horizontal sections of expansion joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete.

B. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50°F at the time of application of joint-sealing materials. Excess material on exposed surfaces of the concrete shall be removed immediately and exposed concrete surfaces cleaned.

3.7 BACKFILLING AND RESTORATION

A. After curing, debris shall be removed, and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

B. All lawns, pavements, driveways, shrubs, or other improvements affected by curbing placement shall be restored to their original condition.

3.8 PROTECTION

A. The Contractor shall protect the curbing and keep it in alignment and "first class" condition until the completion of the Contract. Any curbing, which is damaged prior to final acceptance of the Work, shall be removed and replaced at the Contractor's expense.

END OF SECTION

SECTION 321630 – CONCRETE PAVEMENT

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the installation of concrete pavement, sidewalks, and pavilion shelter pads as shown on the Drawings, or as specified herein.

B. The materials and methods specified herein are directly intended for placement of "new" concrete sidewalk. Where existing sidewalk is removed and replaced during construction, modifications to these specifications to match existing conditions shall be made as directed by the Engineer.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable.
      a. Georgia Department of Transportation (GDOT), Standard Specifications for Construction of Transportation Systems.
      b. American Society of Testing and Materials (ASTM).
      c. American Concrete Institute (ACI).

B. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of materials with the specifications, if at any time during the Work, materials appear unsuitable in the opinion of the Engineer.

1.3 SUBMITTALS

A. Concrete:
   1. The Contractor shall furnish the name and location of the concrete supplier.
   2. Submit the design mix for each class of concrete prior to use in the Work.

B. Product Data:
   1. Submit manufacturer's catalog cuts, specifications, and installation instructions.

C. Test Results:
   1. The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete:
   1. All cast-in-place concrete shall be ready mixed concrete meeting the following criteria:
      a. 28-day compressive strength-psi as shown on the drawings.
      b. Air entrainment-4% to 8%
      c. Slump-2" to 4"

B. Premoulded Expansion Joint Filler:

1. Concrete curbing shall be provided with a 1/2 inch premoulded expansion joint filler conforming to ASTM D1751.
2. The premoulded expansion joint filler shall be "pre-cut" to match the concrete sidewalk cross-sectioned dimensions as detailed on the Drawings.

C. Fabric Reinforcement:

1. Flat sheets of 6 x 6 - W 2.9 x W 2.9, ASTM A1064, welded wire reinforcement.

D. Fiber Reinforcement:

1. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.
   a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   b. Monofilament Fibers:
      1) Axim Italcementi Group, Inc.; FIBRASOL II P.
      2) Euclid Chemical Company (The), an RPM company; Fiberstrand 100, Fiberstrand 150.
      3) FORTA Corporation; FORTA ECONO-MONO or FORTA Mighty-Mono.
      4) Grace, W. R. & Co. - Conn.; Grace MicroFiber.
      5) Metalcrete Industries; Polystrand 1000.
      6) QC Construction Products; QC FIBERS.
   c. Fibrillated Fibers:
      1) Axim Italcementi Group, Inc.; FIBRASOL F.
      2) The Euclid Chemical Company, an RPM company; Fiberstrand F.
      3) FORTA Corporation; FORTA Econo-Net or FORTA Super-Net.
      4) Grace, W. R. & Co. - Conn.; Grace Fibers.
      5) Propex Concrete Systems Corp.; Fibermesh 300.

E. Sealants:

1. Joint Sealers: ASTM C920.

F. Forms:

1. Sidewalk forms shall be of wood or steel, straight of sufficient strength to resist springing during depositing and consolidating concrete, and of a height equal to the full depth of the finished sidewalk.
2. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet, with a minimum of three stakes per form, at maximum spacing of 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness.
3. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Form ends shall be interlocked and self-aligning. Forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Forms shall have a nominal length of 10 feet, with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips, designed for use with steel forms.

PART 3 – EXECUTION

3.1 INSPECTION

A. The Contractor shall notify the Engineer 24 hours before placing concrete in order to give the Engineer an opportunity to inspect the formwork, reinforcing and related items prior to placement of the concrete.

B. Delivery tickets shall show the amount of cement, brand, and amount of all admixtures, in addition to information required by ASTM C94, Section 14. Water added on the job shall be approved and the amount noted on the delivery ticket and initialed by the Contractor.

3.2 SUBBASE PREPARATION

A. Concrete sidewalk shall be constructed on a compacted granular subbase as shown on the Drawings.

B. The completed subbase shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

C. The subbase shall be maintained in a smooth, compacted condition in conformity with the required section and established grade, until the concrete is placed.

D. The subbase shall be in a moist condition when concrete is placed.

E. The subbase shall be prepared and protected so as to produce a subbase free from frost when the concrete is deposited.

3.3 FORMWORK

A. Earth cuts may not be used as forms for vertical surfaces.

B. All forms shall be built mortar tight and of materials sufficient in strength to hold concrete without bulging between supports. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the forms. Concrete, misshapen by bulges or deformations caused by inadequate forms, shall be removed or corrected as ordered by the Engineer. All replacements or corrections shall be made at the Contractor's expense.

C. All surfaces of wooden forms that will be in contact with exposed concrete shall be thoroughly treated with an approved lacquer in the procedure recommended by the manufacturer. Forms so treated shall be protected from being damaged or dirtied prior to placing of the concrete.

D. Metal forms shall be treated with an approved form lacquer or may be treated with an approved form oil. The metal used for forms shall be of sufficient thickness to remain true to shape. All bolt and rivet heads shall be designed to hold the forms rigidly together and to allow removal, without injury to the concrete. Metal forms which do not have smooth surfaces, correct alignment and clean surfaces shall not be used.

E. Side forms shall not be removed for less than 12 hours after finishing has been completed.

3.4 CONCRETE PLACEMENT AND FINISHING

A. Preparation:

1. Set forms true to line and grade and anchor rigidly in position.

2. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Longitudinal expansion joints shall be installed between concrete sidewalk and abutting concrete curb, continuously. Transverse expansion joints shall be installed equally at not more than 25 feet on center, unless otherwise directed by the Engineer, or as detailed on the Drawings.
3. Transverse expansion joints shall be filled with 1/2-inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.
4. Expansion joints shall be formed about structures and features that project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. The filler shall be installed in such manner as to form a complete, uniform separation between the structure and sidewalk pavement.

B. Placement of Fabric Reinforcement:
1. Prior to placement, clean reinforcement thoroughly of mill and rust scale and of coatings which could destroy or reduce bond. Where there is a delay in depositing concrete after the positioning of reinforcement, reclean reinforcement, if necessary.
2. Place reinforcement midway between top and bottom of the slab and secure against displacement.
3. Lap edges and ends of adjoining sheets of fabric reinforcement at least half the mesh width. Offset end laps in adjacent sheets to prevent continuous joints at ends. Interrupt reinforcement at expansion joints, stopping 2 inches from edges.

C. Concrete Placement:
1. Concrete shall be placed in the forms in one layer of such thickness that when compacted and finished the sidewalk will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted.
2. The concrete shall be tamped and consolidated with a suitable wood or metal tamping bar, and the surface shall be finished to grade with a wood float. Finished surface of the walk shall not vary more than 3/16 inch from the testing edge of a 20-foot straightedge. Irregularities exceeding the above shall be satisfactorily corrected. The surface shall be divided into rectangular areas by means of contraction joints spaced at intervals shown on the drawings.
3. Place concrete in accordance with ACI 301 unless otherwise specified herein.
4. Cold Weather Concreting: Comply with ACI 306 for placement at temperatures of, or expected to be, below 40°F.
5. Hot Weather Concreting: Comply with ACI 305 for placement at temperature of, or expected to be, above 90°F.

D. Concrete Finishing:
1. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, or as otherwise shown on the drawings.
2. All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Corner and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3. The completed surface shall be uniform in color and free of surface blemishes and tool marks.

3.5 CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm) and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.6 SEALING JOINTS

A. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. Concrete at the joint shall be surface dry, and the atmospheric and pavement temperatures shall be above 50°F, at the time of application of joint sealing materials.

B. Joints shall be filled flush with the concrete surface in such manner as to minimize spilling on the walk surface. Spilled sealing material shall be removed immediately and the surface of the walk cleaned. Dummy groove joints shall not be sealed.

3.7 BACKFILLING AND RESTORATION

A. After curing, debris shall be removed, and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

B. All lawns, pavements, driveways, shrubs, or other improvements affected by sidewalk placement shall be restored to their original condition.

3.8 PROTECTION

A. The Contractor shall protect the sidewalk and keep it in "first class" condition until the completion of the Contract. Any sidewalk which is damaged prior to final acceptance of the Work shall be removed and replaced at the Contractor's expense.

3.9 FIELD QUALITY CONTROL

A. Testing and Inspecting: The Contractor will provide an inspecting agency to perform tests and inspections and to submit reports.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., pl us one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C23 l, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C I 064/C I 064M; one test hourly when ai r temperature is 40 DegF and below and when 80 DegF and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C3 1 /C3 I M.
   a. Cast and laboratory cure three sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days. The remaining two cylinders will be held in reserve. If the results of the 28-day tests indicate low strength concrete, the engineer will direct the contractor and laboratory to test the remaining two cylinders at a time directed by the Engineer.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Owner within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

END OF SECTION

SECTION 321723 – PAVEMENT MARKING

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes provisions for removal of existing pavement markings and for new pavement markings on finished surfaces.

1.2 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Method of Measurement
   1. The pavement markings will be measured on a lump sum (LS) basis for the markings to be completed as shown of the plans or as installed detailed in the specifications.
   2. The pavement markings will be measured on a per linear foot (LF) basis for the markings applied as shown of the plans or as detailed in the specifications.
   3. The pavement markings will be measured on a per court basis.

B. Basis Of Payment
   1. The agreed quantity will include all labor, materials equipment and services necessary to apply the Pavement Markings as shown on the drawings or described in the specification.

1.3 REFERENCES

A. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).

B. "Manual of Uniform Traffic Control Devices" .

C. Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities, US Department of Justice.

1.4 SUBMITTALS

A. Pavement marking plan indicating lane separations and defined parking spaces. Note dedicated handicapped spaces with international graphics symbol.

B. One (1) manufacturer's label including product analysis for each paint type and color.

1.5 QUALITY ASSURANCE

A. Conform to all requirements of regulatory agencies having jurisdiction.

1.6 SITE CONDITIONS

A. Perform the painting operations after working hours, on weekends or at such time so as not to interfere with the flow of traffic. Provide temporary barriers to prevent vehicles from driving over newly painted areas.

B. Apply paint on dry, clean pavement surface, when the air temperature is above 40°F.

C. All pavement markings require glass bead application, except parking stall markings.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate pavement markings with regulatory authorities having jurisdiction.

B. Schedule pavement markings to follow the completion of paved surfaces.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Marking Paint:
   1. Colors: White, yellow.

B. All paints and solvent shall conform to Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the US Environmental Protection Agency.

C. Glass Beads: Glass Beads for Reflectorized Pavement Marking Paints.

D. Epoxy Reflectorized Pavement Markings.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. Remove dust, dirt, and other foreign material detrimental to paint adhesion.

B. Mark layout of pavement markings with chalk or paint prior to final application.

C. Grind, scrape or sandblast existing pavement markings as indicated on the Drawings or as required by the Engineer. Conduct grinding, scraping, or sandblasting operations in such a manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect traffic.

D. Painting out existing pavement markings will only be approved for short-term temporary use.

3.2 APPLICATION

A. Apply pavement markings in accordance with the City of Au**gusta**, Application for Epoxy Reflectorized Pavement Markings.

B. Reflective glass spheres are injected into, or dropped onto, the liquid epoxy marking at a minimum rate of 20 lb/gal of epoxy resin.

C. Use rollers and brushes for miscellaneous markings.

D. Use templates and guides to provide uniform patterns and straight edges.

END OF SECTION

SECTION 329000 – PLANTING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Trees.
   2. Shrubs.
   3. Ground covers.
   4. Plants including ferns and perennials.
   5. Planting accessories.
   6. Planting soil mixes.
   7. Mulch.
   8. Maintenance and warranty of exterior plants.

1.2 REFERENCES

A. ANSI Z60: American Standard for Nursery Stock

B. ASTM B221: ASTM International Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.3 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.

B. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of exterior plant required.

C. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

E. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted exterior plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of exterior plant.

F. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

1.4 SUBMITTALS

A. Before plant material is shipped to the project site, submit the following:
   1. A complete itemized list of all plants including the source of supply and nursery certificates.
   2. Photographs of plant material.

B. Product Data: For each type of product indicated.
   1. Peat moss (including certification).
   2. Fertilizer (including certification).
   3. Top mulch.
   4. Wrapping
   5. Guying and staking material.
   6. Weed control barriers.
   7. Antidesiccant (including certification).

C. Photographs: Submit photographs of plants and mulches prior to Observation, as listed in Quality Assurance below. Photographs shall include a person holding a clearly marked measuring rod next to plants and mulches. Photographs shall exhibit the size, growth habit, and general visual quality of plants. Photographs of dense clusters of plants, in which one plant is not distinguishable from another, are not acceptable. Digital photographs submitted via email are acceptable.
   1. At the request of the Owner, the Landscape Architect/Engineer may observe the plant and mulch material at place of growth in lieu of photographs.

D. Material Test Reports: For existing surface soil and/or imported topsoil as required by Section "Soil Preparation"

E. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:
   1. Manufacturer's certified analysis for standard products.
   2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

F. Qualification Data: For Landscape Installer.

G. Planting Schedule: Indicating anticipated planting dates for exterior plants.

H. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

I. Maintenance bond: Contractor shall provide list of items, quantities, and cost to be performed during the maintenance period. Once approved by the owner, the contract shall submit a formal performance bond.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants on similar projects:
   1. Installer's Field Supervision: Require Installer to maintain an experienced full-time, English-speaking, supervisor on Project site when exterior planting and regular maintenance is in progress.
   2. Installer must have a minimum of three (3) years' experience in this type of landscaping.

3. Installer must have installed previous projects in similar size and scope as this project and provide a listing of projects including name and contact person with phone number or email address.

B. Provide quality, size, genus, species, and variety of exterior plants indicated on the plans, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

1. Substitutions of plants will not be permitted unless authorized in writing by the Landscape Architect/Engineer prior to purchase for this Project.

C. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes.

D. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

E. Observation: Landscape Architect/Engineer may observe trees and shrubs at site before planting for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect/Engineer retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site. Notify Landscape Architect/Engineer of sources of planting materials seven days in advance of delivery to site.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

G. Planting Schedule: Indicating anticipated planting dates for exterior plants.

H. Maintenance Instructions: Recommended procedures to be established by owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

I. Topsoil Analysis: Furnish soil analysis as required in Section "Soil Preparation".

J. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to product a satisfactory topsoil.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store, irrigate, maintain, and otherwise protect balled and burlapped trees in a manner that prevents mechanical injury and physiological stress between the time of digging and delivery. The trees and shrubs shall be balled with firm, natural balls of soil and wrapped with burlap and tied in accordance with ANSI Z60.1.

B. All container grown shrubs shall be healthy, vigorous, well rooted, and established in the container in which they are growing. They shall have tops of good quality and be in a healthy growing condition. A container shrub shall be in that container a sufficient time that fibrous roots are formed so the shape will remain and the medium will hold together when removed from the container. All shrubs sold in containers shall meet Contract Documents for both plant size and container size. The plant size shall agree with sizes specified in the American Standard for Nursery Stock.

C. Groundcovers/perennials shall be supplied in pots or flats; plants shall be 1-year old cuttings (minimum) with well-established root systems.

D. Deliver exterior plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

E. Do not prune trees and shrubs before delivery, except as approved by Landscape Architect/Engineer. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Irrigate balled and burlapped plants thoroughly immediately prior to transport. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

F. Handle planting stock by root ball. Planting stock with cracked or broken root balls will not be accepted.

G. Furnish the following with each planting material delivery:
   1. An invoice indicating sizes, quantity, genus, species and variety of exterior plant material.
   2. All certificates of inspection required by State and Federal agencies.
   3. Labels for each plant or bundles of plants indicating name and size.

H. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.
   1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.
   2. Set balled stock on ground and cover ball with woodchip mulch or other acceptable material.
   3. Do not remove container-grown stock from containers before time of planting.
   4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

I. Deliver fertilizer in manufacturer's standard sized bags showing weight, analysis, and manufacturer's name. Store under a waterproof cover or in a dry place as approved by the Landscape Architect/Engineer.

1.7 COORDINATION

A. Contractor is responsible for verifying plant quantities shown on the planting plan. Contractor is responsible for filling all areas on plans shown to be planted on planting plan. Contractor shall prepare his or her own quantity list from the plan(s). All ground cover, perennial, and annual beds are to be filled at the specified spacing.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion:

Spring:	**Deciduous**	**April 15 to June 15**
	Evergreen	**April 15 to June 15**
Fall:	**Deciduous**	**September 1 to October 31**
	Evergreen	**Only on approval of the Landscape Architect/Engineer**

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

D. Coordination with Other Work: Coordinate planting with all other work of the project, including site utilities and flatwork.

E. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Landscape Architect/Engineer. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Warranty: Warrant all exterior plants covered by this Section, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from abuse by Owner, or incidents that are beyond Contractor's control.

1. Warranty Period for Exterior Plants:
   a. From date of Installation to Substantial Completion.
   b. One (1) year from date of Substantial Completion.
2. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
3. Replace without cost to Owner, as soon as weather and soil conditions permit, exterior plants that are more than 25 percent dead or in an unhealthy condition as determined by the Landscape Architect/Engineer at end of warranty period.

1.9 MAINTENANCE

A. Maintenance Period for all exterior plants covered by this Section: Concurrent with Warranty Period and same duration as Warranty Period. Maintenance requirements are itemized in Part 3 of this Section. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

B. Owner will assume maintenance following completion of Maintenance Period.

C. Maintenance Period: 1 year (12 months) from the date of planting completion and acceptance and approval by the Owner.

D. The contractor shall provide a performance bond for the value of the labor and materials provided during the maintenance period.

PART 2 – PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs in accordance with good horticultural practices under climatic conditions similar to those of the Project for at least two years, unless specifically noted otherwise. Trees and shrubs shall comply with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Trees and shrubs shall exceed American Association of Nurseryman standards for quality by being exceptionally heavy, uniform, so trained or favored in development and appearance as to be superior in form, density and spread of branches, compactness, and symmetry. Determination of quality shall be made by the Landscape Architect/Engineer.

B. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, leaf spotting, injuries, abrasions, and disfigurement.

C. Trees shall be planted such that the root flare is 1 inch above adjacent grade unless the Drawings indicate otherwise. Tree planting height shall be dictated by the actual root flare rather than the top of rootball as received from growers or nurseries:

1. Tops of tree rootballs shall be no higher than 2 inches above the tops of main order tree roots.
2. If main order roots are buried greater than 2 inches but less than 4 inches below the top of tree rootballs, Contractor must trim rootballs by carefully removing soil from the top of the rootballs so that main order roots are within 2 inches of the top of rootball.
3. If main order roots are buried greater than 4 inches below the top of rootball, the tree will be rejected, and the Contractor must remove the tree from the job site.
4. The Contractor is responsible for ensuring that trees received on site and planted on site meet the aforementioned specifications regarding tree root flare and rootball. The Contractor is responsible for ensuring that the Landscape Architect/Engineer has an opportunity to review the tree root flares of trees in the grower's field or nursery yard. If tree root flares are obscured (due to trunk wrap or burlap or other obstructions), Landscape Architect/Engineer's acceptance of trees in the grower's yard or nursery shall constitute acceptance of trees WITH THE EXCEPTION of trees whose root flare is buried greater than 4 inches below top of rootball. In the event that Contractor does not allow Landscape Architect/Engineer to visually observe tree root flares during tree selection at grower's yard or nursery, Landscape Architect/Engineer reserves the right to reject any tree delivered to the site if tree's root flare is buried greater than 4 inches below top of rootball, even if Landscape Architect/Engineer previously accepted said trees at the grower's yard or nursery.

D. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect/Engineer with a proportionate increase in size of roots or balls.

E. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

F. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

G. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height, branching height, and spread, and number label to assure symmetry in planting.

H. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.2 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader of height and caliper indicated complying with ANSI Z60.1 for type of trees required. Provide balled and burlapped, balled and potted, or container-grown trees. Branching Height: One-third to one-half of tree height. For street trees, branching height shall be one half of tree height.

B. Small Upright or Spreading Trees: Branched or pruned naturally according to species and type with relationship of caliper, height, and branching according to ANSI Z60.1. Stem form as follows: Stem Form: Multistem, clump, with two or more main stems. Provide balled and burlapped trees.

C. Multistem Trees: Branched or pruned naturally according to species and type with relationship of caliper, height, and branching according to ANSI Z60.1. Stem form as follows: Stem Form: Clump. Provide balled and burlapped trees.

D. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub. Provide balled and burlapped, balled and potted, or container-grown shrubs.

B. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Specimen-quality, exceptionally heavy, densely branched, symmetrically-shaped coniferous evergreens and the following grade: Heavy Grade. Provide balled and burlapped trees.

B. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens of type, height, spread, and shape required, complying with ANSI Z60.1. Provide balled and burlapped, balled and potted, container-grown, or fabric bag-grown trees.

B. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.6 GROUND COVER PLANTS

A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1:

B. Herbs/Ferns: Provide herbs and ferns of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1:

C. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.7 OTHER PLANTS

A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery of species and variety shown or listed.

C. Woody Vines: Provide vines of species indicated, and size indicated, complying with requirements of ANSI 13.6

D. Fast-Growing Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

1. Two-year plants with heavy, well-branched tops with not less than three (3) runners 18 inches or more in length and with a vigorous well-developed root system.
2. Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.

E. Bulbs: Top Size, including corresponding designation of "Jumbo", "Giant" or "Extra Large" per ANSI 12.

F. Comply with the "PLANTING SCHEDULE" as shown on the Drawings.

2.8 PLANTING SOIL MIX

A. Planting Soil Mix: Mix three (3) parts acceptable topsoil with one (1) part peat moss.

2.9 MULCHES

A. Shredded hardwood mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs.
   1. Color: As selected by Owner.
   2. Size: Range between 3/8 inch to 8". Fine particles (3/8 inch or less) shall make up to 25% of total volume. Large particles (1 to 1 ½ inch in diameter and 4 to 8 inches in length) shall make up to 20% of total volume. Pieces larger than 8 inches long that are visible on the surface of the mulch after installation shall be removed.

2.10 STAKES AND GUYS

A. Install Stakes and Guys per methods and locations as shown on the Drawings.

B. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches by length indicated, pointed at one end.

C. Guy Ties and Guards:
   1. Guy and Tie Wire: ASTM A641/A641M, Class 1, galvanized-steel wire, 2-strand, twisted,
   2. 0.106 inch in diameter.
   3. Guy Cable: For large trees: 5-strand, 3/16-inch diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
   4. Hose Chafing Guard: Reinforced rubber or plastic hose at least 1/2 inch in diameter, black, cut to lengths required to protect tree trunks from damage.
   5. Woven Fabric Guy Ties: Flat, woven, non-fraying, polypropylene material, 3/4-inch wide, white. Arbor Tie or approved equivalent.

D. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.11 WEED CONTROL BARRIERS

A. Non-woven Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum.

B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a non-woven polypropylene fabric, 4.8 oz./sq. yd.

2.12 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs, designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Topsoil: Refer to Section "Soil Preparation".

C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

D. Fertilizer:
   1. Bonemeal: Commercial, steamed finely ground material with a minimum of 1.0 percent nitrogen and a minimum of 11 percent phosphoric acid.
   2. Commercial Fertilizer (10-6-4): Containing not less than 10 percent nitrogen, 6 percent available phosphoric acid, and 4 percent water soluble potash.

E. Water: Clean, potable.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify final grades have been established prior to beginning planting operations.

B. Inspect trees and ground covers for injury, insect infestation, or improper pruning. Do not begin planting until deficiencies have been corrected, or plants replaced.

C. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Notify Landscape Architect/Engineer, in writing, of any conditions that might prevent satisfactory completion. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Test drainage of pits and planting beds. Notify Landscape Architect/Engineer of potential poor drainage of tree and shrub pits and planting beds. Recommend a program for correction of poor drainage conditions and submit proposal to Landscape Architect/Engineer. Do not proceed with planting operations in areas of poor drainage until conditions are corrected, or direction is given by the Landscape Architect/Engineer.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect/Engineer's acceptance of layout before planting. Make minor adjustments as required.

C. Lay out exterior plants at locations directed by Landscape Architect/Engineer. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING BED ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section "Soil Preparation" and Part 2 above.

B. Place planting Soil: Blend planting soil in place.

C. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

D. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB PIT/TRENCH EXCAVATION

A. Pits and Trenches: Excavate circular pits with sides sloped inward, so that top of pit is larger than bottom of pit. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for planting stock.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.

B. Subsoil removed from excavations may be used as backfill.

C. Obstructions: Notify Landscape Architect/Engineer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations. Hardpan Layer: Drill 6-inch-diameter holes into

D. free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

E. Drainage: Notify Landscape Architect/Engineer if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

A. Set balled and burlapped stock plumb and in center of pit or trench with root flare 1 inch above adjacent finish grades:

1. Cut burlap and wire baskets from top half of root balls, but do not remove from under root balls. Discard removed burlap and wire baskets; do not turn down baskets and leave in tree or shrub pits. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, install transplant inoculants per manufacturer's directions and water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
3. Prepare surface of planting bed as shown on the Drawings.

B. Set balled and potted or container-grown stock plumb and in center of pit or trench with root flare 1 inch above adjacent finish grades:

1. Carefully remove root ball from container without damaging root ball or plant.
2. Make four (4) evenly spaced vertical cuts in the sides of the root ball with a clean, sharp utility knife. Cuts are to be 1-inch deep and are to extend the full height of the rootball.
3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, install transplant inoculants per manufacturer's directions and water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
4. Prepare surface of planting bed as shown on the Drawings.

C. Set fabric bag-grown stock plumb and in center of pit or trench with root flare 1 inch above adjacent finish grades:
1. Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, install transplant inoculants per manufacturer's directions and water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
3. Prepare surface of planting bed as shown on drawings.

D. Mulching: Mulch per planting detail.

3.6 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect/Engineer.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Landscape Architect/Engineer, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

3.7 GUYING AND STAKING

A. Guy and Stake trees as indicated on the drawings. Installation of tree support systems shall be completed within 48 hours of planting, utilizing applicable methods as indicated.

B. Remove tree Guys and Stakes at end of warranty period.

3.8 GROUNDCOVER AND PERENNIAL PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.9 PLANTING BED MULCHING

A. Mulch backfilled surfaces of planting beds and other areas indicated. Apply 3-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.10 INITIAL ACCEPTANCE

A. When all work except maintenance and guarantee program of this contract has been completed, Landscape Architect/Engineer will perform a Substantial Completion inspection. Provide notification at least ten (10) working days before inspection date. If required a "punch list" of items to be completed by an agreed upon date will be issued by the Landscape Architect/Engineer after the Substantial Completion inspection.

B. Work will be considered Substantially Complete after all "punch list" items are complete. Notify the Landscape Architect/Engineer at least five (5) working days before re-inspection date, to verify completion of the "punch list" items.

C. Substantial Completion certificate will be issued and dated by the Landscape Architect/Engineer following the "punch list" verification inspection.

3.11 MAINTENANCE

A. Maintain all exterior plants covered by this Section, as required to establish healthy, viable plantings, including the following maintenance requirements during the maintenance period indicated in Part 1 of this Section:

1. Mowing.
2. Edging.
3. Pruning.
4. Cultivating.
5. Watering including filling tree water bags if used; do not allow plants to wilt at any time.
6. Weeding.
7. Fertilizing.
8. Mulching.
9. Restoring plant saucers for trees.
10. Maintaining trees support systems at correct tension.
11. Resetting plants to proper grade and vertical position.
12. Insect and pest control as required to keep plants free of insects and disease.
13. Removal of trash and debris.
14. Removal of dead or dying plants.

3.12 FINAL ACCEPTANCE

A. Inspection to determine Final Acceptance of planted areas will be made by the Landscape Architect/Engineer upon Contractor's request at completion of the one-year Warranty Period. Provide notification at least fifteen (15) working days before requested inspection date.

1. Planted areas will be acceptable provided all requirements, including plant replacements and maintenance, have been complied with and healthy, thriving, and growing plants are established.
2. Remove all Tree Staking and Guying materials prior to Final Acceptance inspection.
3. Knock down, regrade, and remulch all tree pit saucers prior to Final Acceptance inspection.

3.13 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.14 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of off Owner's property.

END OF SECTION

SECTION 329113 – SOIL PREPARATION

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes provisions for the placement of topsoil in conformance with the lines, grades and thicknesses as shown on the Drawings and as herein specified.

B. Minimum thickness is 6 inches, for all areas disturbed during construction and not receiving other surface treatment.

C. The Contractor shall furnish all materials and perform all work in accordance with these specifications, drawings, and instructions provided by the Owner.

1.2 SUBMITTALS

A. Samples: Furnish earth materials to the testing laboratory for analysis and report, as directed by the Engineer or as outlined in the specifications.

B. Quality Control Submittals:

1. Test Reports: The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer. Indicate quantities of materials necessary to bring topsoil into compliance with textural/gradation requirements. Indicate quantity of lime and quantity and analysis of fertilizer.

1.3 REFERENCES

A. Comply with the latest edition of the following standards:

1. Standard Specifications, Construction and of Transportation Systems, Georgia Department of Transportation
2. "Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO)."
3. ASTM International (ASTM)
   a. C33, Standard Specification for Concrete Aggregates.
   b. C602, Standard Specification for Agricultural Liming Materials
4. U.S. Bureau of Reclamation (USBR)
   a. 514.4.4, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 4—Particle-Size Analyses.
   b. 14.8.7, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 8—Soil Chemical Tests

1.4 QUALITY ASSURANCE

A. Provide and pay for all costs in connection with an approved independent testing facility to determine conformance of soils and aggregate with the specifications.

1.5 PROJECT CONDITIONS

A. Coordinate the placement of topsoil with the completion of all underground work including that of the other trades.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural, friable, fertile, fine loamy soil possessing the characteristics of representative topsoils in the vicinity which produces a heavy growth; free from subsoil, objectionable weeds, litter, sods, stiff clay, stones larger than 1 inch in diameter, stumps, roots, trash, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations. Contractor is to verify amount stockpiled and supply any additional as needed:

1. Topsoil shall contain not less than 6% nor more than 12% organic matter as determined by the wet combustion method (chronic acid reduction); topsoil shall have a pH value of not less than 5.5 nor more than 7.0;
2. Topsoil shall meet the following mechanical analysis:

SIZE OF SCREEN	% OF SOIL RETAINED	% OF SOIL PASSING
1"	0	100
1/4	3	97
No. 100	40-60	40-60

3. Imported topsoil in which more than 60% of the material passing a No. 100 sieve shall be rejected. All percentages are to be based on the dry weight of the samples.
4. Laboratory tests of the topsoil shall be performed by a certified testing laboratory, and shall perform tests for the following:
   a. Sieve particle size analysis and gradient of mineral content
   b. Chemical analysis of the following:
      1) pH and buffer pH.
      2) Percent of organic content.
      3) Nutrient levels of phosphorus, potassium magnesium, manganese, iron, zinc and calcium.
      4) Soluble salt.
      5) Cation exchange capacity (CEC).
   c. Recommended fertilizer and rate of application for low and medium level nutrient soils.

2.2 MATERIAL ACCEPTANCE

A. Topsoil may be acquired from approved sites that are designated on the Drawings. If no sites are designated, material proposed for use as topsoil must be stockpiled, sampled, and tested prior to use.

B. Topsoil containing foreign material may be rejected on the basis of visual examination by the Engineer, prior to testing.

C. Acceptance of topsoil shall be based upon test results. Tested topsoil must be approved in writing by the Engineer before any material is used.

2.3 SOIL AMENDMENT

A. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust

B. Fertilizer: Shall be delivered to the site, mixed as specified, in the original unopened standard size bags showing weight, analysis and name of manufacturer. Store fertilizer in a weatherproof place and in such a manner that it shall be kept dry and its effectiveness shall not be impaired.

1. Percentages of nitrogen, phosphorus and potassium shall be based on laboratory test recommendations. For the purpose of bidding, assume 10% nitrogen, 6% phosphorus and 4% potassium by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen. At least 60% of the phosphorous content shall be derived from super-phosphate containing not less than 18% phosphoric acid or bone meal containing 25% to 30% phosphoric acid and 2% to 3% nitrogen. Potassium shall be derived from muriate of potassium containing 55% to 60% potassium.
2. Grass or sodded areas shall have fertilizer applied according to soil text report or as specified on the drawings.

C. Organic Matter: Leaf matter and yard waste composted sufficiently to break down all woody fibers, seeds, and leaf structures, and free of toxic and non-organic matter. Organic matter shall be commercially prepared.

D. Lime: Shall be ground palletized, or pulverized lime manufactured to meet agricultural standards and contain a maximum of 60% oxide.

PART 3 – EXECUTION

3.1 STOCKPILING

A. Stockpile topsoil from on-site sources or provide from off-site sources and stockpile, if on-site quantities are deficient.

B. Stockpiles are to contain not less than 200 cubic yards or the minimum required for the project.

C. Stockpiles are to have a maximum height of 10 feet and be trimmed to uniform surfaces and slopes.

D. The sites of all stockpiles and adjacent areas, which have been disturbed are to be graded and put into an acceptable condition by seeding, as directed by the Engineer.

3.2 PREPARATION

A. Preparation - Disk, drag, harrow or hand rake subgrade to a depth of 3 inches to provide bond for topsoil. Topsoil, which must be transported across finished walks, shall be delivered in such a manner that no damage will be done to the walks. The Contractor shall be responsible for the repair of such damage.

B. Before placing topsoil, rake subsoil surface clear of stones larger than 1.5 inches, debris, and roots. Compact topsoil to form a layer with minimum depth of 4 inches in lawn areas and 12 inches in shrub beds. Topsoil shall be placed so that after final settlement there will be good drainage (and conforming to elevations shown on drawings). Contractor is to maintain surfaces and place any additional topsoil necessary to replace that which may have eroded before acceptance.

C. Locations containing unsuitable subsoil shall be treated in one of the following manners:
1. Where unsuitability within the construction site is deemed by the Owner to be due to excessive compaction caused by heavy equipment or by the presence of boards, mortar, concrete or other construction materials in subgrade, and where the natural subsoil is other than A.A.S.H.T.O. classification of A6 or 7, the Contractor shall loosen such areas with spikes, discs, or other means to loosen the soil to a condition acceptable by the Owner. The Contractor shall also remove all debris and objectionable material. Soil should be loosened to a minimal depth of 12 inches with additional loosening as required to obtain adequate drainage. Contractor may

introduce peat moss, sand, or organic matter into the subsoil to obtain adequate drainage should he so desire. All such remedial measures shall be considered as incidental to the work and no extra payment shall be made for this part of the work; and

2. Where subgrade is deemed by the Owner to be unsuitable because the natural subsoil falls into an AASHTO classification of A6 or 7 and contains moisture in excess of 30%, then such a condition shall be rendered suitable by installation of a subdrainage system or by other means described elsewhere in these specifications. Where such conditions have not been known or revealed prior to planting time and where they have not been recognized in the preparation of drawings and specifications, then the Owner shall issue a change order to install the proper remedial measures, all of which shall be in addition to the contract sum.

3.3 TOPSOIL PLACEMENT

A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.

B. Mix soil amendments, lime, and fertilizer with topsoil before placement or spread on topsoil surface and mix thoroughly into entire depth of topsoil before planting or seeding. Delay mixing of fertilizer if planting or seeding will not occur within 3 days.

C. Place 1/2 of total depth of topsoil and work into subgrade soil to create a transition layer. Place remainder of topsoil to depth after compacting to 75% where seeding and planting are scheduled.

D. Uniformly distribute to within 1/2 inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade to ensure positive drainage.

E. Remove stones exceeding 1 inch, roots, sticks, debris, and foreign matter during and after topsoil placement.

F. Remove surplus subsoil and topsoil from Site. Grade stockpile area as necessary and place in condition acceptable for planting or seeding.

3.4 CLEANING

A. Remove all surplus subsoil and topsoil from project site.

B. Leave the site in clean, satisfactory condition ready to receive subsequent operations.

END OF SECTION

SECTION 329200 – TURF AND GRASSES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the preparation of ground surfaces, fertilization of applicable areas, seeding, mulching of applicable surface areas, and maintenance of turf areas until such time as project is accepted by Owner. Applicable areas shall include those identified on the Contract Drawings or as specified herein.

B. Seed shall be sown from April 1 to June 15, or from August 15 to October 15 of given calendar year, unless otherwise approved by Owner.

1.2 SUBMITTALS

A. Quality Control Submittals:
   1. Certification:
      a. Submit manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials.
      b. Submit vendor's certified analysis for each grass seed mixture required, stating botanical and common name, percentages by weight, percentages by purity, germination, and weed seed.

B. Maintenance Instructions: Submit instructions recommending procedures to be implemented for maintenance of landscaped work for one (1) full year. Submit prior to expiration of Contractor's maintenance period.

C. Submit description of planned mulching techniques and corresponding manufacturer's installation recommendations for approval by Owner.

1.3 QUALITY ASSURANCE

A. All turf and grasses work shall be performed by one Contractor, with proven expertise in this type of construction.

B. Package standard products with the manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

C. The Contractor shall provide and pay for all costs in connection with an approved independent testing facility to determine conformance of materials with the specifications.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials in containers, showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored on site.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Fertilizer:

1. Commercial fertilizer (5-10-5) inorganic, or organic, containing not less than five (5) percent nitrogen, ten (10) percent available phosphoric acid, and five (5) percent water soluble potash.
2. If, as an alternative, the Contractor wishes to substitute for commercial fertilizer 5-10-5, another commercial fertilizer with a 1-2-1 ratio, such as 10-20-10 or 6-12-6, they may do so with the approval of the Owner and the rate of fertilizer to be used shall be whatever amount is required to furnish the same amount of nitrogen as would be supplied by the 5-10-5.

B. Seed:

1. Seed shall be fresh, clean, new-crop seed mixed in the proportions specified for species and variety, conforming to Federal and State Standards.
2. Use the following standard mixture blue seal classic, unless a special mixture is otherwise indicated or approved by the Owner.

SPECIES	% BY WEIGHT	% BY PURITY	% BY GERMINATION
Zenith Zoysia	95	95-99	80-85

3. Weed seed content shall not exceed 0.25%.

C. Mulch:

1. Provide and install a mulch adequate to protect the seeding during its growing period. It shall be the responsibility of the Contractor to determine the appropriate mulching techniques for the particular site conditions and acquire approval of the same from the Owner.
2. Clean straw for gentle slopes, consisting of stalks of oats, wheat, rye, or other approved crops which are free of noxious weed seeds. Weight shall be based on a fifteen (15) percent moisture content.
3. Mulching blanket for steep slopes and drainage swales: "Curlex Blanket" by American Excelsior, "Ero-Mat" by Contech Construction Products, Inc, or approved equal.
4. Bonded fiber matrix for mulching in areas where slopes are 1.5H:1V or greater, or cut or fill slopes 20 feet (6m) or more in height. Product shall be EcoAegis as manufactured by Canfor, or approved equal meeting U.S. DOT Standard Specification FP-96, Section 713.05(h)
   a. Package Weight: 50 pound (18.6kg) bags.
   b. Moisture Content: 12 +/- 3 percent by weight.
   c. Minimum Water Holding Capacity: Approximately 10 times dry weight.
   d. Composition:
      1) Refined Softwood Fiber: (90% by weight).
      2) Blended Hydrocolloid-based Binder: (9% by weight).
      3) Mineral Activator: (1% by weight).
   e. Color: Natural – No Dye Products.

D. Water: Clean and potable.

2.2 ACCESSORIES

A. Soil Amendments: Soil amendments are not to be made without review and authorization by the Owner.

1. Lime: Natural limestone containing not less than 85% of total carbonates, ground so that not less than 90% passes a 10-mesh sieve and not less than 50% passes a 100-mesh sieve.
2. Aluminum Sulfate: Commercial grade.
3. Peat Humus: FS Q-P-166 and with texture and pH range suitable for intended use.
4. Bonemeal: Commercial, raw, finely ground; 4% nitrogen and 20% phosphoric acid.
5. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.
6. Sand: Clean, washed sand, free of toxic materials.
7. Perlite: Conforming to National Bureau of Standards PS 23.
8. Vermiculite: Horticultural grade, free of toxic substances.
9. Sawdust: Rotted sawdust, free of chips, stones, sticks, soil, or toxic substances and with 7.5 pounds (2.8 kg) nitrogen uniformly mixed into each cubic yard of sawdust.
10. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25% by volume of straw, sawdust, or other bedding materials and containing no chemicals or ingredients harmful to plants.
11. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing available plant nutrients.
12. Composted Organic Material: Shall have a minimum organic matter content of 60 percent, as determined by ASTM D-2974, and screened to ¾-inch (1.9 cm).

PART 3 – EXECUTION

3.1 PREPARATION OF TOPSOIL

A. Clean topsoil of roots, plants, stones, clay lumps and other extraneous materials harmful or toxic to plant growth.

B. Mix fertilizer into top 2 inches (5 cm) of topsoil at a rate of 10 pounds (3.7 kg) per 1,000 square feet. (92.9 m^2)

C. Mix approved soil amendments into top 2 inches (5cm) of topsoil at necessary rates.

D. Water dry topsoil to depth of 4 inches (10cm) at least 48 hours prior to seeding to obtain a loose friable seed bed.

3.2 PREPARATION OF UNCHANGED GRADES

A. Where lawns are to be planted in areas not altered or disturbed by excavating, grading, or stripping, prepare soil for seeding as follows:

1. Till to a depth of not less than 6 inches (15cm).
2. Apply soil amendments and initial fertilizers as specified.
3. Remove high areas and fill in depressions.
4. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
   a. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such materials off the site; do not turn over into soil being prepared for lawns.

b. Apply specified commercial fertilizer at rates specified and thoroughly mixed into upper 2 inches (5 cm) of topsoil. Delay application of fertilizer, if lawn planting will not follow within one week.

3.3 SEEDING

A. Apply seed only when wind velocities are less than five (5) miles per hour (9km/hr).

B. Sow half the seed with mechanical seeder.

C. Sow remaining half of the seed at right angles to the direction of the first seeding pattern, using the same method.

D. Apply seed at the rate of 4 pounds (1.5 kg) per 1,000 square feet (92.9 sq. meters) of disturbed area.

E. Cover seed to a depth of ⅛-inch (3mm) by raking, harrowing, or cultipacking.

F. Roll seeded area with roller weighing no more than 150 pounds per foot of roller width.

G. Water seeded areas to a depth of four (4) inches (10cm) as required during the maintenance period.

3.4 MULCHING

A. Spread straw uniformly over seeded area with 75% ground coverage and at least 1-½ inches loose depth.

1. If, in the opinion of the Owner, wind will disrupt the mulching, apply asphalt emulsion at a rate of 10 gallons (37.81) per 1,000 square feet (92.9 m^2).

B. Place mulching blanket in accordance with submitted manufacturer's recommendations.

C. Place bonded fiber matrix mulch material, EcoAegis, at a rate of 3,500 to 4,100 pounds per acre, based on manufacturer's recommendations.

3.5 HYDROSEEDING

A. Mix specified seed, fertilizer, and pulverized mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

B. Apply slurry uniformly to all areas to be seeded. Rate of application as required to obtain specified seed sowing rate.

3.6 PROTECTION

A. Immediately after seeding, erect barricades and warning signs as required to protect newly planted areas from pedestrian and vehicular traffic. Maintain barricades throughout maintenance period until grass and/or turf is established.

B. Repair or replace damaged landscape work as directed by Owner.

3.7 MAINTENANCE

A. Begin maintenance immediately after seed placement.

B. Watering:

1. Keep soil moist during seed germination period.
2. Supplement rainfall to produce a total depth penetration of 2 inches per day after germination.
3. Prevent erosion and displacement of seed.

C. Mowing:

1. When grass reaches 4 inches in height, mow to 2-½ inches in height.
2. Maintain grass between 1-½ inches and 2-½ inches in height.
3. Do not cut off more than 30% of grass leaf in a single mowing.
4. Remove grass clippings.

D. Reseed and mulch spots larger than 1 square foot not having uniform coverage.

E. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

F. Maintain and protect all seeded areas until final acceptance of the Contract.

3.8 FINAL ACCEPTANCE

A. Final acceptance of lawn areas will be granted when a uniform stand of acceptable grass is obtained, with a minimum of 95 percent coverage.

1. Portions of the lawn areas may be accepted at various times at the discretion of the Owner.

B. Upon acceptance by the Owner of a seeded area, the Owner will immediately assume responsibility for maintenance and protection of that portion of the Contract seeding.

END OF SECTION

SECTION 330500 – COMMON WORK RESULTS FOR UTILITIES

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes the installation of buried piping.

1.2 REFERENCES

A. The following references shall be applicable: American Society of Testing and Materials (ASTM).
   1. American National Standards Institute (ANSI).
   2. American Water Works Association (AWWA).
   3. Uni-Bell Plastic Pipe Association.

1.3 SUBMITTALS

A. Submit for approval a schedule for all proposed testing. Include proposed testing procedures indicating the sequence in which pipe sections will be tested and description of methods and equipment to be used.

B. Field Test Reports: Submit results of field testing directly to Engineer with copy to Contractor.

1.4 STORAGE, AND HANDLING

A. Deliver and store materials within the Contract limits as approved by Engineer.

B. Handle materials carefully with approved handling devices in accordance with manufacturer's recommendations. Special care shall be exercised during delivery and storage to avoid damage to the materials.

C. Do not drop or roll products off trucks. Products are not to be otherwise dragged, rolled, or skidded.

D. Materials shall be stored on heavy wood blocking or platforms in accordance with the manufacturer's instructions and recommendations. Materials shall not be in contact with the ground and their interiors shall be maintained free from dirt and other foreign matter.

E. Products cracked, gouged, chipped, dented, or otherwise damaged will not be approved and are to be removed and replaced at the Contractor's expense, unless the product can be repaired in a manner acceptable to the manufacturer and the Engineer. All repairs shall be at the Contractor's expense.

1.5 COORDINATION

A. Contractor shall be responsible for coordinating site utility work with other trades to ensure building service connection locations are verified and coordinated prior to commencing site construction.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Conform to individual pipe specification(s).

B. Pipe transition fittings: Shall be as indicated on the drawings. If not specifically indicated selection shall be based on pressure requirements of the system and types of materials being joined. Product selection shall be approved by the engineer.

C. Grout:
   1. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
      a. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
      b. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
      c. Packaging: Premixed and factory packaged.

PART 3 – EXECUTION

3.1 UTILITY DEMOLITION

A. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.2 BURIED PIPE INSTALLATION

A. General:
   1. Installation of all pipe, fittings, valves, specials, and appurtenances shall be subject to the review and/or approval of the Engineer.
   2. Install piping valves and fittings as shown, specified and as recommended by the manufacturer and in conformance with referenced standards, and approved Shop Drawings.
   3. Request instructions from Engineer before proceeding if there is a conflict between the manufacturer's recommendations and the Drawings or Specifications.
   4. All piping and appurtenances shall be inspected by the Engineer prior to installation. Engineer's inspection will not relieve Contractor or manufacturer from responsibility for damaged products.
   5. Present all conflicts between piping systems and equipment, structures or facilities to Engineer for determination of corrective measures before proceeding.
   6. Take field measurements prior to installation to ensure proper fitting of Work. Uncover the existing pipelines sufficiently in advance of the proposed Work in order that the type and location of the existing pipes and joints and other information required to fabricate the proposed piping can be determined. Obtain whatever information is required to complete the connections of the proposed pipelines to the existing pipelines.
   7. Carefully examine all piping for cracks, damage, or other defects before installation. Immediately remove defective materials from the site, unless the defective materials can be repaired in a manner acceptable to the manufacturer and Engineer. Remove, replace, or repair at the Contractor's expense piping found to be broken or defective.

8. Inspect interior of all piping and mating surfaces and remove all dirt, gravel, sand, debris, or other foreign material before installation. Maintain the interior of all piping clean until acceptance of the completed Work. Prevent foreign matter from entering joint space.
9. Install buried piping accurately to line and grade shown, specified or directed, unless otherwise approved by the Engineer. Use accurate means of determining and checking the alignment and grade subject to the approval of the Engineer. Remove and relay piping that is incorrectly installed at Contractor's expense.
10. Do not lay piping in water, unless approved by the Engineer. Ensure that the water level in the trench is at least 6 inches below the bottom of piping. Maintain a dry trench until jointing and backfilling are complete, unless otherwise specified in these Specifications or approved by the Engineer.
11. Pipe laying work shall be conducted so that trenching operations are not advanced too far ahead of the pipe laying operation resulting in excessive lengths of open trench. In general, open trench ahead of pipe laying shall not exceed 50 feet.
12. Start laying piping at lowest point and proceed toward the higher elevations, unless otherwise approved by the Engineer. Slope piping uniformly between elevations shown on the Drawings or as otherwise provided by the Engineer.
13. Where pipe crossings occur, the lower pipe shall be laid first and all backfill thoroughly compacted to the level of the higher pipe before the higher pipe is installed. Backfill material under such conditions may be earth, broken stone, or 2500 psi concrete.
14. Install piping so that the barrel of the piping and not the joints receives the bearing pressure from the trench bottom, or other bedding condition.
15. No piping shall be brought into position until the preceding length, valve, fitting, or special has been bedded and secured in place.
16. Whenever pipe laying is not actively in progress, the open ends of the piping shall be closed by a temporary plug or cap to prevent soil, water and other foreign matter from entering the piping.
17. Where required for inserting valves, fittings, special appurtenances, and closures, shall be made with a machine specially designed for cutting piping and in accordance with the manufacturer's instructions for field cutting of pipe. Make cuts carefully, without damage to piping, so as to leave a smooth end at right angles to the axis of the piping. Taper cut ends and file off sharp edges until smooth. Flame cutting will not be permitted. Replace and repair damaged piping.
18. Blocking under piping will not be permitted unless specifically approved by Engineer for special conditions.
19. Touch up protective and linings and coatings prior to installation.
20. Rotate piping to place outlets in proper position.

B. Bedding and Backfilling:
1. Bedded and installed piping in conformance with Section "Trenching and Backfilling" and as shown except as otherwise specified.
2. No piping shall be laid until Engineer approves the bedding condition.
3. Excavation in excess of that required as shown on the Drawings or specified, which is not authorized by the Engineer, shall be at the Contractor's expense. Backfilling and compaction of the over-excavated areas shall be at the Contractor's expense.
4. Carefully and thoroughly compact all pipe bedding and fill up to the pipe centerline with hand-held pneumatic compactors.

C. Restraints, Supports, and Thrust Blocks:
1. Install restrained joints as shown, specified, required, and as recommended by manufacturer. Assembly of restrained joints shall be in strict accordance with manufacturer's recommendations.

2. Provide concrete and metal cradles, collars, and blocks as shown on the Drawings or otherwise required by Engineer.
3. Thrust Blocks:
   a. Provide concrete thrust blocking to resist test pressure on all plugs, caps, tees, bends and other fittings in pressure piping systems unless otherwise shown on the Drawings.
   b. Conform to the details for concrete thrust blocks and tie rods.
   c. Concrete: 3000 psi, placed around the fittings to completely fill the space between the fittings and the undisturbed walls of the trench. Do not overlap any joint with concrete and place concrete so as not to interfere with removing or installing any of the jointing hardware.
4. Retainer Glands (for water distribution and sewer force main piping):
   a. Provide retainer glands for joint restraint of all fittings and valves.
   b. Retainer glands shall be Megalug Series 1100 as manufactured by EBAA or approved equal.

D. Transitions From One Type of Pipe to Another:
1. Provide all necessary adapters, specials, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

E. Work Affecting Existing Piping:
1. Location of Existing Piping:
   a. Locations of existing piping shown shall be considered approximate. Contractor shall perform all necessary subsurface investigation to verify actual locations in the field.
   b. Determine exact location of existing piping to make connections, relocate, replace or which may be disturbed during earth moving operations, or which may be affected by work in any way.
   c. Coordinate all excavations with utility companies, Owner and Engineer.
2. Taking Existing Pipelines Out of Service:
   a. Do not take pipelines out of service unless specifically approved by Engineer.
   b. Notify Engineer at least 48 hours prior to taking any pipeline out of service.

3.3 SPECIFIC PIPE INSTALLATION

A. Reinforced Concrete Pipe (RCP):
1. Lay pipe with bell and spigot joints with bells upstream.
2. Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry.
3. Affix gaskets and jointing materials to the pipe not more than 24 hours prior to the installation of the pipe, and protect from the sun, blowing dust, and other deleterious agents.
4. Inspect gaskets and jointing materials before installing the pipe; remove and replace loose or improperly affixed gaskets and jointing materials.
5. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint, the gasket or jointing material becomes loose and can be seen through the exterior joint recess when joint is pulled up to within 1 inch of closure, remove the pipe and remake the joint.

B. Polyvinyl Chloride Pipe (PVC):

1. Gravity Sewers: Install all PVC piping in accordance with ASTM D2321 "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications."
2. Water Distribution/Pressure Sewers: Install all PVC pipe in accordance with AWWA Standard C605 "Underground Installation of PVC Pressure Pipe and Fittings for Water."
3. Lay pipe with bell and spigot joints with bells upstream.
4. Completely clean all jointing surfaces and adjacent areas prior to making joint.
5. Field cut pipe for shorter than standard pipe lengths. Cut ends square and perpendicular to the pipe axis. Remove and smoothly bevel ends. Field spigots shall be stop marked with a felt tip mark or wax crayon for proper length of assembly insertion. The angle and depth of field bevels, and lengths to stop marks, shall be comparable in quality to factory made spigots.
6. Assemble all joints in accordance with recommendations of the manufacturer. If a lubricant is required to facilitate assembly, it shall have no detrimental effect on the gasket or on the pipe when subjected to prolonged exposure.
7. Rotate the spigot by hand or with a strap wrench to verify proper jointing. If unusual joining resistance is encountered or if the insertion mark does not reach the flush position, disassemble the joint, inspect for damage, reclean the joint components and repeat the assembly steps.
8. Use a bar and wood blocking to properly seat pipe joints. DO NOT USE BACKHOE BUCKET, OR SIMILAR MACHINERY, TO FORCE JOINT ASSEMBLY.

C. High Density Polyethylene Gravity Piping (HDPE):

1. Install in accordance with the pipe manufacturer's specifications
2. Completely clean all jointing surfaces and adjacent areas prior to making joints.
3. Field cut pipe for shorter than standard pipe lengths. Cut ends square and perpendicular to the pipe axis. Remove and smoothly bevel ends.
4. Assemble all joints in accordance with recommendations of the manufacturer. If a lubricant is required to facilitate assembly, it shall not have a detrimental effect on the gasket or on the pipe when subjected to prolonged exposure.

3.4 FIELD QUALITY CONTROL

A. General:

1. Notify Engineer at least 48 hours in advance of all testing.
2. Provide all testing apparatus including pumps, hoses, gauges, fittings, temporary bulkheads, plugs, compressors and miscellaneous other required items.
3. Provide temporary blocking and bracing or approved thrust and joint restraint to prevent joint separation and pipe movement during testing.
4. Unless otherwise approved, conduct all tests in the presence of the Engineer and in the presence of local authorities having jurisdiction.
5. Water Source:
   a. Provide all water for testing, flushing, and other water uses. The source of the water shall be subject to the approval of the Engineer.
   b. The point of introduction of water for conducting tests shall be subject to the approval of the Engineer.
6. All costs for tests shall be included in the Contractor's bid.
7. Locate, and repair or replace, section of piping which fail the test and retest until acceptance.

B. Required Tests for Storm Sewers:

1. Perform the following tests after the storm drainage pipe has been installed and prior to final acceptance:
   a. Alignment Test for all pipe.
2. Based upon visual observations, the Engineer may order additional testing including the following:
   a. Television Inspection, if required by the Engineer.
   b. Deflection Test, if required by the Engineer
   c. Water-tight field test ASTM F1417 if required by the Engineer.
3. Perform tests prior to placement of pavement, or other construction which may, in the opinion of the Engineer, be detrimentally affected by excavation required for repairs.
4. Submit details prior to making tests of proposed testing procedures with a description of methods and equipment to the Engineer for approval.
5. Alignment Test:
   a. All storm drainage pipe will be subject to a visual inspection in order to identify proper alignment, grade, and excessive deflection.
   b. The Engineer may choose to perform an alignment test using the hand-lamp method, in which case the full diameter of the pipe shall be visible when viewed between consecutive structures.
6. Television Inspection:
   a. The Engineer will notify the Contractor in writing which completed sewers shall be inspected by closed-circuit television.
   b. The Contractor shall commence the television inspection within 15 days of the Engineer's written notification. The Contractor shall notify the Engineer at least 5 days prior to commencement of television inspection.
   c. No television inspection shall be performed without the Engineer or his representative present to witness the inspection.
   d. The Contractor shall provide the Engineer with 3 copies of a report of the televising inspection of each section of completed sewer inspected. Show the exact location and extent of all cracks, loose joints, holes, vertical and horizontal, misalignment, faulty service connections, caved-in pipe, points of infiltration, obstructions, debris and all else detrimental to the proper functioning and service of the completed sewer. The Contractor shall provide the actual television inspection video with the report showing all the above conditions found, at all wyes, tees and laterals and as directed by the Engineer.
   e. The Engineer will review the report and will instruct the Contractor, to repair any conditions which, in the opinion of the Engineer, are detrimental to the proper function and service of the storm pipe.
7. Deflection Test:
   a. The Engineer will notify the Contractor in writing which completed sewers shall be tested by the deflection method.
   b. The Contractor shall commence the deflection test within 15 days of the Engineer's written notification. The Contractor shall notify the Engineer at least 5 days prior to commencement of television inspection.
   c. No Deflection testing shall be performed without the Engineer or his representative present to witness the test.
   d. The deflection test shall be performed on flexible drainage pipe with a "go/no-go" mandrel with a diameter equal to 95 percent of the inside diameter of the pipe being tested.
   e. The maximum pipe deflection shall be 5 percent.

f. The Engineer will review the Deflection Test results and will instruct the Contractor, to repair any conditions which, in the opinion of the Engineer, are detrimental to the proper function and service of the storm pipe.

8. Visual Inspection: Prior to final acceptance, a visual inspection of all appurtenance structures (i.e., manholes, chambers, etc.) will be required. Repair visual leaks, regardless of their magnitude.

END OF SECTION

SECTION 330513 – MANHOLES AND STRUCTURES

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes the following:
   1. Installation of manholes, catchbasins, precast concrete structures, frames, grates, covers, steps, and piping connections as shown on the Drawings and as specified herein.
   2. Alteration of existing structures as shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
   1. American Society of Testing and Materials (ASTM).
   2. American National Standards Institute (ANSI).
   3. Occupational Health and Safety Administration (OSHA).

1.3 SUBMITTALS

A. Shop Drawings: Submit the following for approval:
   1. Design and construction details of all precast concrete units.
   2. Fabrication, assembly, and installation details for all castings and miscellaneous metal works.
   3. Precast concrete structure design calculations verifying the structures have been designed to withstand the burial, submergence and anticipated live and dead loads. Design calculations for uplift forces shall incorporate a minimum factor of safety of 1.15.

B. Product Data:
   1. Manufacturer's catalog cuts, specifications, and installation instructions.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site to prevent interruption of the Work.

B. All materials shall be inspected by the Contractor upon delivery to the site. The Contractor shall notify the Engineer of any loss or damages. Replace loss or repair damage to new condition at the Contractor's expense.

C. Store materials to allow easy access for inspection and identification.

PART 2 – PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Design: In accordance with ASTM C890 – Minimal Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

B. Loading: AASHTO HS-20 with 30 percent impact and 130 pound/cubic foot equivalent soil pressure.

2.2 PRECAST CONCRETE DRAINAGE STRUCTURES

A. Drainage manholes shall conform to subpart "Precast Concrete Manholes."

B. Catch basins with greater than 6 feet sidewall depth shall conform to subpart "Precast Concrete Manholes."

C. Catch basins with less than or equal 6 feet sidewall depth shall be 2-foot 6-inch by 2-foot 6-inch square I.D. precast concrete catch basin units as manufactured by Eagle Precast of Statesboro, GA or equal.

D. Precast catch basin units shall conform to the dimensions shown on the Drawings and as detailed in Shop Drawings approved by the Engineer.

E. Unless otherwise specified precast concrete units shall conform to ASTM C478.

F. A precast concrete slab, as necessary for proper frame and grate placement, shall be provided at the top of the catch basin unit. The slab shall be designed for an H-20.

2.3 PRECAST CONCRETE MANHOLES

A. All precast concrete manhole units shall be as manufactured by Eagle Precast of Statesboro, GA or approved equal.

B. Precast manhole units shall conform to the dimensions shown on the Drawings and as detailed in Shop Drawings approved by the Engineer.

C. Unless otherwise specified, manhole sections shall conform to ASTM C478.

D. Precast structure bases shall be of the "base unit" type, with an integral base and barrel section. The barrels shall be constructed in increments of 1 foot to provide the indicated height with the fewest joints. Openings for pipe connections will not be permitted closer than 1 foot to the nearest joint. Mark the date of manufacture and name or trademark of manufacturer in the inside of each section.

E. Manholes barrels, servicing pipes less than 27-inch diameter, shall be 48-inch diameter. Manholes barrels, servicing pipes 27-inch diameter and larger shall be 60-inch diameter. Larger diameter manholes barrels shall be provided as indicated on the Drawings or as specified herein.

F. Joints shall be rubber and concrete using O-ring gaskets (ASTM C443) or butyl rubber gaskets (ASTM C443), or tongue and groove buttered with 1:2 cement mortar (ASTM C270, Type M). A precast eccentric cone, or precast slab where shown, shall be provided at the top of the manhole barrel to receive the frame and cover. The slab or cover shall be designed for an H-20 loading.

G. Precast manhole units shall be coated on the exterior with a two-coat application of polyamide-cured epoxy-coal tar. Application shall meet manufacturer's recommendations. Do not apply the polyamide-cured epoxy-coal tar within 28 days of concrete manufacture. Epoxy-coal tar to be as manufactured by Coopers Creek Chemical Corporation, Cooper Black #775 Epoxy Tar Coating or approved equal.

2.4 MANHOLE STEPS

A. Manhole sections shall contain manhole steps at 12 inches on center for all structures over 3 feet 6 inches in height. The steps shall be embedded in the concrete and accurately positioned both vertically and horizontally.

B. Steps shall be capable of withstanding a 300-pound concentrated live load without permanent distortion, conforming to the requirements of ANSI A14.3, OSHA, and the details shown on the Drawings.

C. Manhole rungs shall be steel reinforced copolymer polypropylene plastic. Rungs shall be 14 in. wide, M.A. Industries type PS2-PF, or equal. Copolymer polypropylene shall be type II, grade 16906 meeting ASTM D4101. Steel reinforcing shall be 3/8-inch diameter, Grade 60 conforming to ASTM A615 and shall be continuous throughout the rung. The portion of the legs to be embedded in the precast section shall have fins and be tapered to insure a secure bond.

2.5 FRAMES AND COVERS/GRATES

A. Frames and covers/grates shall be cast iron, ASTM A48, Class 30, free from flaws or unsightly defects.

B. Frames and covers shall conform to the details on the Drawings and have "SANITARY SEWER" [**or** "STORM SEWER" cast on every cover.

C. Frames and covers/grates shall be designed for an H-20 loading and be machined to ensure correct fit and even bearing.

D. Frames and covers/grates shall be as shown on the on the Drawings. Otherwise, conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable).

E. Frames and covers shall be as shown on the Drawings. Otherwise, conform to the standard detail of the regulatory authorities having jurisdiction for the project (if applicable). Access clear width shall be a minimum of 24-inches.

2.6 GRADE ADJUSTMENTS

A. Grade Rings: Reinforced-concrete rings, 3- to 12-inch (75- to 300-mm) total thickness, to match diameter of manhole frame and cover.

2.7 GROUT

A. Description: ASTM C1107, Grade B. nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.8 DROP INLET

A. Drop inlets for manholes shall be constructed where shown on the Drawings and shall conform with the details shown on the Drawings.

B. Pipe and fittings shall be the same type and class as the sewer pipe beings installed.

C. Concrete for pipe encasement shall be 3,000 psi.

PART 3 – EXECUTION

3.1 EARTHWORK

A. Earthwork shall be in accordance with Section "Trenching and Backfilling" or Section "Earth Moving."

3.2 PRECAST MANHOLE SECTIONS

A. Base units shall be placed on a minimum 12-inch foundation of pipe zone bedding material, and be set at the proper elevation, carefully leveled, and aligned.

B. Barrel units shall be set vertical with steps and sections in proper alignment. All joints shall be sealed with cement mortar inside and out, and troweled smooth to the contour of the wall surface. Joints shall be installed in accordance with manufacturer's recommendations.

C. Lifting holes shall be sealed tight with a tapered solid rubber plug driven into the hole and the remaining void filled with mortar on the outside only.

3.3 GRADE RINGS

A. Grade rings placed upon the eccentric cone or slab shall be used for all manholes to provide the potential for future adjustment.

B. Grade rings shall be placed in a combined thickness of at least 4 inches but not more than 12 inches in order to bring the manhole frame to proper grade.

C. Consecutive grade ring layers shall be laid on an even mortar bed.

3.4 PIPE CONNECTIONS

A. Pipe connections to manholes shall be installed true to line and grade as shown on the Drawings. Wall fittings shall be watertight, compatible with the sewer pipe joint. Connections shall conform to the details shown on the Drawings.

3.5 INVERT CHANNEL AND BENCH WALLS

A. An invert channel and bench walls shall be constructed as shown on the Drawings to provide a smooth transition in flow through the manhole. The invert channel and bench wall shall be constructed of 3,000 psi concrete. Benches shall be built-up to the height called for on the Drawings, or as directed by the Engineer, and given a steel trowel finish. Care shall be taken to slope all benches for proper drainage to the invert channel.

3.6 FRAMES

A. Frames shall be firmly set and bonded at the proper grade to conform with the finished grade shown on the Drawings.

B. Frames for manholes in unpaved areas shall be set at an elevation higher than finished grade as shown on the Drawings or as directed by the Engineer.

3.7 WATERTIGHTNESS

A. All manholes shall be free of visible leakage. Each manhole shall be inspected, and all leaks shall be repaired in a manner approved by the Engineer.

B. Testing: Manhole Negative Air Pressure (Vacuum) Test shall be performed prior to backfilling and in accordance with ASTM C1244.

1. Preparation of manhole
2. All lift holes shall be plugged.
3. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipe and plugs to prevent them from being drawn into the manhole during testing Procedure.
4. The test apparatus shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
5. A vacuum of 10 inches (254 mm) of mercury shall be drawn on the manhole. The valve on the vacuum line of the test apparatus shall be closed and the vacuum pump shut off.
6. The time shall be recorded for the vacuum to drop to 9 inches (229 mm).
7. If the time recorded exceeds the values in the following table, based on the manhole's depth and diameter, the manhole is acceptable.

DIAMETER (IN.)			
DEPTH (FT)	**48"**	**60"**	**72"**
	TIME (SEC.)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97

3.8 CONNECTION TO EXISTING STRUCTURES

A. The Contractor shall make connections to existing manholes as shown on the Drawings or as specified herein.

B. For connections to precast or cast-in-place concrete manholes, the Contractor shall core drill a hole 1 inch larger than the O.D. of the sewer pipe into the existing manhole at the location and elevation shown on the Drawings.

C. For connections to masonry manholes, the Contractor shall open the sidewall of the existing manhole by removing masonry units no more than necessary to accommodate the sewer pipe.

D. Connection methods shall be in accordance with the details shown on the Drawings. Any open spaces around the new pipe entry shall be sealed with non-shrink grout to prevent leakage.

E. The existing bench and channel shall be removed and reconstructed to permit flow through the manhole as it now exists and also for the new sewer pipe. Bench and channel reconstruction shall conform with the details on the Drawings, or as directed by the Engineer.

F. The Contractor shall be responsible for diverting flow through the manhole in order to allow bench and channel construction.

3.9 CHANGING ELEVATIONS OF EXISTING STRUCTURES

A. Lower existing frames of manholes by the removal of appropriate masonry courses, to the elevations shown on the Drawings or as directed by the Engineer.

B. Raise the existing frames of manholes by the addition appropriate grade rings to the elevations shown on the Drawings or as directed by the Engineer.

C. Where the manhole frames cannot be lowered by removal of masonry courses, such as may be the case with precast concrete manholes, the upper barrel section shall be removed and/or replaced with a section of less depth, to permit the necessary adjustment of the frame.

D. Frames and covers damaged during the Work shall be replaced at the Contractor's expense.

END OF SECTION

SECTION 334100.20 – HIGH DENSITY POLYETHYLENE STORM UTILITY DRAINAGE PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the installation of polyethylene piping systems as shown on the Drawings and as specified herein.

B. All piping, fittings, and appurtenances shall be new, clean, and in accordance with material specifications. In no instance shall second- hand or damaged materials be acceptable.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. The latest edition of the following standards, as referenced herein, shall be applicable:
      a. Standard Specifications for Construction of Transportation Systems, Georgia Department of Transportation (GDOT).
      b. Standard Specifications for Highway Materials and Methods of Sampling and Testing, American Association of State Highway and Transportation Officials (AASHTO).
      c. American Society of Testing and Materials (ASTM).

1.3 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's catalog cuts, specifications, and installation instructions for both pipe and coupling system.
   2. Submit manufacturer's certification that product was manufactured, tested, and supplied in accordance with the standards specified herein.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:
   1. Pipe, fittings, specials, appurtenances, and accessories shall be delivered to and stored within the Contractor's work limits as shown on the Drawings.
   2. Special care shall be exercised during delivery and storage to avoid damage to the products.
   3. Products shall be stored so as to avoid unnecessary handling and in locations where they will not interfere with the Owner's operations or public travel.

B. Handling:
   1. Pipe, fittings, special appurtenances, and accessories shall be handled carefully with approved handling devices in strict conformance with the manufacturer's recommendations.
   2. Products shall not be dropped nor shall products be otherwise dragged, rolled, or skidded.

C. Products cracked, gouged, chipped, dented, or otherwise damaged will not be approved and shall be removed and replaced at the Contractor's expense, unless the product can be repaired in a manner acceptable to the manufacturer and Engineer. All repairs shall be at the Contractor's expense.

PART 2 – PRODUCTS

2.1 MATERIALS

A. HDPE Soil Tight Pipe:

1. Pipe shall be ADS N-12 ST IB (per AASHTO) smooth interior with annular exterior corrugations and a Manning's "n" value of 0.012 high-density polyethylene pipe (HDPE) as manufactured by Advanced Drainage Systems (ADS) or approved equal. Pipe shall have an integral soil tight gasketed bell and spigot.
   a. 4 inches through 11 inches conforming to AASHTO M252 Type S.
   b. 12 inches through 60 inches conforming to AASHTO M294 Type S or ASTM F2306.
2. Pipe shall be joined using a bell and spigot joint meeting AASHTO M252, M294, ASTM F2306. The joint shall be soil-tight and gasketed and shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the manufacturer shall be used on the gasket and bell during assembly.
3. Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the soil-tight joint performance requirements of ASTM F2306.

B. HDPE Water Tight Pipe:

1. Pipe shall be ADS N-12 WT IB (per AASHTO) smooth interior with annular exterior corrugations and a Manning's "n" value of 0.012 high-density polyethylene pipe (HDPE) as manufactured by Advanced Drainage Systems (ADS) or approved equal. Pipe shall have an integral water tight gasketed bell and spigot or approved equal.
   a. 4 inches through 11 inches conforming to AASHTO M252 Type S.
   b. 12 inches through 60 inches conforming to AASHTO M294 Type S or ASTM F2306.
2. 4 inches through 60 inches (100 to 1500 mm) shall be watertight according to the requirements of ASTM D3212. Gaskets shall be made of polyisoprene meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly 12- through 60-inch (300 to 1500 mm) diameters shall have a reinforced bell with a bell tolerance device. The bell tolerance device shall be installed by the manufacturer.
3. Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the water-tight joint performance requirements of ASTM F2306.

C. Flared End Section:

1. Flared end sections shall be 1210 NP or 1810 NP HDPE end sections as manufactured by ADS or equal.
2. End sections shall be fastened to the last corrugation of the pipe length using a high strength nylon cable tie supplied by the manufacturer through pre-drilled holes at the top of the end section collar.

PART 3 – EXECUTION

3.1 INSPECTION

A. Inspect all pipe and fittings prior to laying in the trench. Remove defective pipe and fittings from the site.

B. Do not backfill until inspection by the Engineer, unless otherwise approved by the Engineer.

3.2 INSTALLATION AND TESTING

A. Trenching, backfilling and compaction shall conform to Section "Trenching and Backfilling."

B. Pipe installation and testing shall conform to Section "Common Work Results for Utilities."

END OF SECTION

Augusta, Georgia Conditions

These Augusta, Georgia Conditions amend or supplement the Agreement for ITB 26-182 (#2), the Scope of Services and Proposal (#3), the Invitation to Bid #26-182 (#4), the Addendum for ITB 26-182 (#5), the General Conditions (#6), the Special Conditions (#7), and the Boykin Road Park Improvements Specifications and Project Manual (#8). All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Augusta, Georgia Conditions have the meanings stated in the General or Supplementary Conditions, except as otherwise defined below.

If there is any conflict between the Augusta, Georgia Conditions as used in this document and any other part of this Contract, the Augusta, Georgia Conditions shall control. It is the purpose of these Conditions in this form and format as to place in a clear and easily discernable location those provisions, paragraphs, or terms which by state law or local ordinance must or should be in any multiyear agreement for services, including construction contracts, made with Augusta, Georgia.

I. Term Pursuant to O.C.G.A. § 36-60-13(a)(1-2). The term of this Contract terminates absolutely and without further obligation on the part of Owner each and every December 31st, and automatically renews each January 1st, unless terminated in accordance with any other provision of this Contract.

II. Use of Augusta, Georgia Landfill. All debris, trash, and rubble from the project shall be transported to and disposed of at the Augusta, Georgia Solid Waste Landfill in accordance with local and state regulations. The contractor shall provide evidence of proper disposal through manifests, which shall include the types of material disposed of, the name and location of the disposal facility, date of disposal and all related fees.

III. Lack of appropriations. If Owner should not appropriate or otherwise receive funds sufficient to maintain those services set forth in this Contract, Owner may unilaterally terminate this Contract effective on the final day of the fiscal year through which funding is available. In the event of termination due to a lack of appropriations, Owner shall pay for all undisputed fees and expenses related to the services Owner has received, or Owner has incurred or delivered, prior to the effective date of termination.

IV. Section 1-10-104(b)16 Acknowledgement. Contractor acknowledges that this contract and any changes to it by amendment, modification, change order or other similar document may have required or may require the legislative authorization of the Board of Commissioners and approval of the Mayor. Under Georgia law, Contractor is deemed to possess knowledge concerning Augusta, Georgia's ability to assume contractual obligations and the consequences of Contractor's provision of goods or services to Augusta, Georgia under an unauthorized contract, amendment, modification, change order or other similar document, including the possibility that the Contractor may be precluded from recovering payment for such unauthorized goods or services. Accordingly, Contractor agrees that if it provides goods or services to Augusta, Georgia under a contract that has not received proper legislative authorization or if the Contractor provides goods or services to Augusta, Georgia in excess of the any contractually authorized goods or services, as required by Augusta, Georgia Charter and Code, Augusta, Georgia may withhold payment for any unauthorized goods or services provided by Contractor. Contractor assumes all risk of non-payment for the provision of any unauthorized goods or services to Augusta, Georgia, and it waives all claims to payment or to other remedies for the provision of any unauthorized goods or services to Augusta, Georgia, however characterized, including, without limitation, all remedies at law or equity.

V. Unilateral Stoppage Order. Owner may unilaterally, upon written notice, demand that a temporary and immediate stopping of the work under this Contract be done.

VI. Retainage. If any payment under this Contract is subject to a retention as contemplated by Augusta Code Section 1-10-106, Owner shall retain no more than ten percent (10%) of each progress payment or installment, and may be reduced to five percent (5%) after five percent (50%) of the work is complete if Owner desires. Funds held by Owner as retainage under the Contract shall be released upon completion and acceptable of work except as described in the contract. No interest shall be due to any contractor on any sum held as retainage.

VII. Defective pricing. To the extent that the pricing provided by Contractor is erroneous and defective, the parties may, be agreement, correct pricing errors to reflect the intent of the parties.

VIII. Force Majeure. "Force Majeure Event" means any act or event that (a) prevents a party (the "Nonperforming Party") from performing its obligations or satisfying a condition to the other party's (the "Performing Party") obligations under this Contract, (b) is beyond the reasonable control of and not the fault of the Nonperforming Party, and (c) the Nonperforming Party has not, through commercially reasonable efforts, been able to avoid or overcome. If a Force Majeure Event occurs, the Nonperforming Party is excused from the performance thereby prevented and from satisfying any conditions precedent to the other party's

performance that cannot be satisfied, in each case to the extent limited or prevented by the Force Majeure Event. When the Nonperforming Party is able to resume its performance or satisfy the conditions precedent to the other party's obligations, the Nonperforming Party shall immediately resume performance under this Contract. The relief offered by this paragraph is the exclusive remedy available to the Performing Party with respect to a Force Majeure Event. A Force Majeure Event includes, but is not limited to: epidemics, pandemics, declared national, state, local states of emergency, hurricanes, tornadoes, floods, severe and unexpected acts of nature, or the availability of funds in the budget of Owner.

IX. Insurance. The Contractor shall, at all times that this Agreement is in effect, cause to be maintained in force and effect an insurance policy(s) that will ensure and indemnify the Owner against liability or financial loss resulting from injuries occurring to persons or property or occurring as a result of any negligent error, act, or omission of the Contractor in performance of the work during the term of this Agreement. The Contractor shall provide, at all times that this agreement is in effect, Worker's Compensation insurance in accordance with the laws of the State of Georgia.

a. The Contractor shall provide, at all times that this Agreement is in effect, Insurance with limits of not less than:

i. Workmen's Compensation Insurance – in accordance with the laws of the State of Georgia.

ii. Public Liability Insurance – in an amount of not less that One Million ($1,000,000) Dollars for injuries, including those resulting in death to any one person, and in an amount of not less than One Million ($1,000,000) Dollars on account of any one occurrence.

iii. Property Damage Insurance – in an amount of not less than One Million ($1,000,000) Dollars from damages on account of an occurrence, with an aggregate limit of One Million ($1,000,000) Dollars.

iv. Valuable Papers Insurance – in an amount sufficient to assure the restoration of any plans, drawings, field notes, or other similar data relating to the work covered by the Project.

v. Professional Liability Insurance – in an amount of not less than One Million ($1,000,000) Dollars or an amount that correlates to the aggregate fee on the project should it exceed $1,000,000.

b. Owner will be named as an additional insured with respect to Contractor's liabilities hereunder in insurance coverage's identified in items a(ii) and (iii)

c. The policies shall be written by a responsible company(s), to be approved by the Owner, and shall be noncancellable except on thirty-(30) days' written notice to the Owner. Such policies shall name the Owner as co-insured, except for worker's compensation and professional liability policies, and a copy of such policy or a certificate of insurance shall be filed with the Owner at the time of the execution of this Contract.

X. Right to Inspect. Owner, may at reasonable times, inspect that part of the plant, place of business, or work site of Contractor or any subcontractor of Contractor or subunit thereof which is pertinent to the performance of the Contract.

XI. Audit. Owner shall be entitled to audit the books and records of Contractor or subcontractor at any time to the extent that such books, documents, papers, and records are pertinent to the performance of the Contract or subcontract. Such books and records shall be maintained by Contractor for a period of three (3) years from the date of final payment under the prime contract and by the subcontractor for a period of three (3) years from the date of final payment under the subcontract.

XII. Audit for cost or pricing data. Owner may at reasonable times and places, audit the books and records of any contractor who has submitted cost or pricing data to the extent that such books, document, papers and records are pertinent to such cost or pricing data. Any person who received a contract, change order, or contract modification for which cost or pricing data is required, shall maintain such books, documents, paper and records that are pertinent to such cost or pricing data for three (3) years from the date of final payment under the contract.

XIII. Indemnification. Except as otherwise provided in this Contract, Contractor shall indemnify and hold harmless Owners, its offers, employees, and agents from and against all liabilities, claims, suits, demands, damages, losses, and expenses, including attorneys' fees, arising out of or resulting from the performance of its Work.

XIV. All contractors and subcontractors entering into contracts with Owner for the physical performance of services shall be required to execute an Affidavit verifying its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm, or corporation which is contracting with Owner has registered with and is participating in a federal work authorization program. All contractors and subcontractors must provide their E-Verify number and must be in compliance with the electronic verification of work authorized programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603, in accordance with the applicability provisions and deadlines established in O.C.G.A. § 13-10-91

and shall continue to use the federal authorization program throughout the contract term. All contractors shall further agree that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services pursuant to its contract with Owner the contractor will secure from such subcontractor(s) each subcontractor's E-Verify number as evidence of verification of compliance with O.C.G.A. § 13-10-91 on the subcontractor affidavit provided in Rule 300-10-01-.08 or a substantially similar form. All contractors shall further agree to maintain records of such compliance and provide a copy of each such verification to Owner at the time the subcontractor(s) is retained to perform such physical services.

XV. Georgia Open Records Act. Contractor warrants that it has reviewed O.C.G.A. § 50-18-70 et seq. and acknowledged that Owner is an "agency" pursuant to O.C.G.A. § 50-18-70(b)(1). Contractor acknowledges and understands that anything generated related to this Contract may be a "public record" as defined by O.C.G.A. § 50-18-70(b)(2). Contractor shall designate an "Open Records Officer" for any requests for inspection or copying under the Georgia Open Records Act, and specifically agrees to abide by all statutory and/or local regulations relating to the Georgia Open Records Act. Contractor releases and holds harmless Owner and its officers, employees, and agents from and against all liabilities, claims, suits, demands, damages, losses and expenses, including attorneys' fees, arising out of or resulting from the disclosure of information pursuant to the Georgia Open Records Act or the failure to comply with the Georgia Open Records Act for public records related to this Contract.

XVI. Georgia Prompt Pay Act. The terms of this Contract superseded any and all provisions of the Georgia Prompt Pay Act.

XVII. Prohibition on Contingent Fees. Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this Contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by Contractor for the purpose of securing business and that Contractor has not received any non-Augusta fee related to this Contract without the prior written consent of Owner. For breach or violation of this warranty, Owner shall have the right to annul this Contract without liability or at its discretion to deduct from the Contract Price of consideration the full amount of such commission, percentage, brokerage or contingent fee.

XVIII. Venue. Contractor consents, and waives any objection and/or contest, to jurisdiction and venue in the Superior Court of Richmond County, Georgia. Contractor's consent herein is related to all claims, disputes, and other matters in question between Owner and Contractor arising out of or relating to the Agreement.