

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.01 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 48-division format and CSI/CSC's "MasterFormat 2011" numbering system.
- B. DIVISION 01 GENERAL REQUIREMENTS apply to Work of all Specification Sections.
 - 1. PART 1 GENERAL of each specification section contains requirements which pertain only to that section.
- C. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions include:
 - 1. Abbreviated Language: Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - 3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 4. The word "provide" means to furnish and install, complete and ready for use.

1.02 SUMMARY BY REFERENCED

- A. Work of the Contract can be summarized by references to the Contract, General Conditions, Supplementary Conditions, Specification Sections, Drawings, Addenda and Modifications to the Contract Documents issued subsequent to the initial printing of this Project Manual and including, but not necessarily limited to, printed material referenced by any of these. It is recognized that work of the Contract is also unavoidably affected or influenced by governing regulations, natural phenomenon, including weather conditions and other forces outside the Contract Documents.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project will be constructed under a General Construction Contract.

- B. Project Identification: Project entitled La Puebla Fire Station Addition is located in Santa Fe County at 31 Fire House Road, La Puebla, New Mexico 87532
- C. Work consists of a 2700 sq ft addition to the existing fire station building and modifications to existing site. Project work to be incorporated:
 - 1. Selective Demolition, Cast-In-Place Concrete, Masonry; Metal Pipe and Tube Railing, Rough Carpentry; Custom Casework, Damp Proofing, Insulation, EIF and ACF Systems, Weather Barriers, TPO Roofing, Sheet Metal Roofing, flashing and Trim; Firestopping, Elastomeric Sealants, Metal Doors and Frames, Wood Doors, Aluminum Entrances and Storefronts, Tubular Daylighting Devices, Door Hardware, Glazing, Gypsum Board Assemblies, Tiling, porcelain Slab Countertops, Acoustical Ceilings, Resilient Base and Athletic Flooring, Tile Carpeting, FRP Panels, Painting, Room Signage, Dimensional Letter Signage, Wall Protection, Toilet Accessories, Fire Extinguishers and Cabinets, Commercial and Kitchen Appliances, Window Shades, Delegated Design Fire Sprinkler System, Plumbing, HVAC, Electrical Power, Lighting and Special System; Earthwork, Concrete Sidewalks, Retaining Wall, Utility Trenching, Piping and Connecting to Existing Utilities; and Septic System.
- D. Bid Items include:
 - 1. One (1) Base Bid Item: The base Bid includes all elements of construction shown for the complete and operational construction of this project.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. The awarded Contractor must have a minimum of 5 years experience as the General Contractor of Commercial Building Construction projects similar in complexity and size under the present firm or trade name.
- B. Except as noted, provide and pay for all labor, materials, and equipment.
- C. Pay required sales, gross receipts, and other taxes. Owner will pay Contractor applicable New Mexico gross receipts tax including local option tax and any increase in tax becoming effective after Contract date.
- D. Procure and pay for permits, approvals, fees, and licenses necessary for execution of Work as applicable at time of receipt of bids or as otherwise required in other sections of the Specifications.
- E. Give notice in writing and delivered in accordance with the General Conditions of the Contract.
- F. Comply with codes, ordinances, regulations, and other legal requirements of public authorities which bear on performance of Work.

- G. Request required inspections from public authorities, correct noted deficiencies, and obtain certifications of satisfactory inspection. Deliver certificates to Owner in accordance with the Closeout Submittals Section.
- H. Perform the work in good workmanlike manner, where “good workmanlike manner” is defined as “that degree of efficiency and knowledge which is possessed by those of ordinary skill, competency, and standing in a particular trade or business for which the installer is employed, and in accordance with industry standards.”

1.05 USE OF THE PREMISES

- A. Owner will occupy site and existing building during entire construction period.
 - 1. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage.
 - 2. Perform the Work so as not to interfere with Owner’s operations.
 - 3. Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations.
 - 4. Protect building and its occupants during construction period.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
 - 1. Limits: Confine constructions operations to area designated on drawings
 - 2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 10 00

SECTION 01 21 00

ALLOWANCES

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section includes administrative and procedural requirements governing the following:
 - 1. Utility Service Allowances.

1.02 UTILITY SERVICE ALLOWANCES

- A. Each Utility Service Allowance is a sum of money included in the Contract Price to cover the cost of a service, all inclusive, to be provided under the Contract by a party other than the Contractor.
 - 1. The Contractor will be reimbursed only for the costs invoiced by the party providing the service and no mark up, such as overhead and profit, shall be charged by the Contractor.
 - 2. Actual services may be less than, equal to, or greater than, the estimated allowance amount. Contractor will be paid only the actual cost of the services.
 - 3. Contractor costs to integrate the work of a Utility Service Provider are not included in Utility Service Allowances.
- B. Submit proposals for purchases of services scheduled below in the form specified for Change Orders.
- C. Submit invoices or delivery slips to show actual costs for services provided, delivered and installed.
- D. At project closeout, credit unused allowance amounts to the Owner and charge for overage amounts by Change Order.

1.03 SCHEDULE OF VALUES

- A. Include each item in Schedule of Values as a line item, listing amount of Allowances specified in this section.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 ALLOWANCE SCHEDULE

A. Utility Service Allowances Schedule:

- | | |
|----------------------|--------------------------------------|
| 1. Water Service: | Allow the amount of \$ <u>4,000.</u> |
| 2. Gas Service: | Allow the amount of \$ <u>2,500.</u> |
| 3. Electric Service: | Allow the amount of \$ <u>2,000.</u> |

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes general requirements applicable to substitutions of materials, products, equipment and systems.
- B. Substitution Requests:

*****NOTE TO SPECIFIER: RETAIN ONE OPTION, DELETE THE OTHER.*****

*****RETAIN THE SECTION BELOW IF SUBSTITUTION REQUESTS ARE REVIEWED AFTER AWARD OF THE PROJECT: MOST OFTEN PERTAINS TO STATE AND LOCALLY FUNDED PROJECTS. MATCH REQUIREMENTS OF INSTRUCTIONS TO BIDDERS AND GENERAL CONDITIONS OF THE CONTRACT.*****

1. No product is “approved” for Substitution prior to Bid. The Contract is based on material and equipment specified in the Specifications or described in the Drawings without consideration of possible substitute or “or-equal” items.
2. Where indicated that substitute or “or-equal” item of material or equipment may be furnished or used if acceptable to the A/E, application for such acceptance shall not be considered until after the effective date of the Contract.
3. Submit written requests for Product Substitution along with a copy of the **SUBSTITUTION REQUEST FORM** following this Section, after award of the Contract for Construction and within 30 days after Notice to Proceed.

*****NOTE TO SPECIFIER: RETAIN THE SECTION BELOW IF SUBSTITUTION REQUESTS ARE REVIEWED PRIOR TO THE BID DATE AND PUBLISHED VIA ADDENDUM: MOST OFTEN PERTAINS TO FEDERALLY FUNDED PROJECTS, I.E. CDBG. MATCH REQUIREMENTS OF INSTRUCTIONS TO BIDDERS AND GENERAL CONDITIONS OF THE CONTRACT.*****

4. Whenever it is indicated in the Drawings or specified in the specifications that a substitute or “or-equal” item of material or equipment may be furnished or used by the contractor if acceptable to the A/E, application for such acceptance will not be considered by the A/E unless submitted to the A/E along with a copy of the **SUBSTITUTION REQUEST FORM** following this Section, at least ten (10) days prior to the date for opening Bids.
5. Acceptable substitutions will be published via addendum.

1.02 SUBSTITUTION OF MATERIALS AND EQUIPMENT

- A. Substitutions, General: Catalog numbers and specific brands or trade names are used in materials, products, equipment and systems required by the Specifications to establish the standards of quality, utility and appearance required. Alternative products which are of equal quality and of required characteristics for the purpose intended may be proposed for use provided the Contractor complies with provisions of Contract General Conditions subject to the following provisions:
1. See Section 01 60 00: Basic Product Requirements for requirements regarding product options.
 2. Substitutions will only be authorized by properly executed Change Order or Field Instruction.
 3. Substitutions shall be considered when a product becomes unavailable through no fault of Contractor.
 4. Owner has no obligation to entertain substitutions.
- B. Substitution Provisions:
1. Documentation: Substitutions will not be considered if they are indicated or implied on shop drawing, product data or sample submittals. All requests for substitution shall be by separate written request from Contractor. See paragraph below for documentation required in the submission of request for substitution.
 2. Cost and Time Considerations: Substitutions will not be considered unless a net reduction in Contract Sum or Contract Time results to Owner's benefit, including redesign costs, life cycle costs, plan check and permit fees, changes in related Work and overall performance of building systems.
 3. Design Revision: Substitutions will not be considered if acceptance will require substantial revision of the Contract Documents or will substantially change the intent of the design, in the opinion of the A/E. The intent of the design shall include functional performance and aesthetic qualities.
 4. Data: It shall be the responsibility of the Contractor to provide adequate data demonstrating the merits of the proposed substitution, including cost data and information regarding changes in related Work.
 5. Determination by A/E: A/E will determine the acceptability of proposed substitutions and will notify Contractor in writing of acceptance or rejection. The determination by the A/E regarding functional performance and aesthetic quality shall be final.
 6. Non-Acceptance: If a proposed substitution is not accepted, Contractor shall immediately provide the specified product.
 7. Substitution Limitation: Only one request for substitution will be considered for each product.
- C. Request for Substitution Procedures: Comply with provisions of Contract General Conditions and the following.
1. Contractor shall prepare a request for substitution and submit the request to A/E for review and recommendation for acceptance. Acceptance and approval of substitutions shall be by A/E.
 - a. Present the request for substitution using form provided by A/E.

- b. Comply with other administrative requirements shall be as directed by Owner's Representative.
2. Substitution requests shall include complete product data, including drawings and descriptions of products, fabrication details and installation procedures. Include samples where applicable or requested.
3. Substitution requests shall include appropriate product data for the specified product(s) of the specified manufacturer, suitable for use in comparison of characteristics of products.
 - a. Include a written, point-by-point comparison of characteristics of the proposed substitute product with those of the specified product.
 - b. Include a detailed description, in written or graphic form as appropriate, indicating all necessary changes or modifications needed to other elements of the Work, which will be performed by the Contractor at no additional expense to the Owner, if the proposed substitution is accepted.
4. Substitution requests shall include a statement indicating the substitution's effect on the Construction Schedule. Indicate the effect of the proposed substitution on overall Contract Time and, as applicable, on completion of portions of the Work for use by Owner.
5. Except as otherwise specified, substitution requests shall include detailed cost data, including a proposal for the net change, if any, in the Contract Sum.
6. Substitution requests shall include signed certification that the Contractor has reviewed the proposed substitution and has determined that the substitution, in combination with the cost or time savings, represents an equivalent or superior condition in every respect to product requirements and value indicated or specified in the Contract Documents, and that the substitution is suited for and can perform the purpose or application of the specified product indicated or specified in the Contract Documents.
7. Substitution requests shall include a signed waiver by the Contractor for change in the Contract Time or Contract Sum because of the following:
 - a. Substitution failed to perform adequately.
 - b. Substitution required changes in on other elements of the Work.
 - c. Substitution caused problems in interfacing with other elements of the Work.
 - d. Substitution was determined to be unacceptable by authorities having jurisdiction.
8. A request constitutes a representation that Contractor:
 - a. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - b. Will provide same warranty for Substitution as for specified product.
 - c. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
9. If, in the opinion of the A/E, the substitution request is incomplete or has insufficient data to enable a full and thorough review of the intended substitution, the substitution may be summarily refused and determined to be unacceptable.

D. Contract Document Revisions:

1. Should a Contractor-proposed substitution or alternative sequence or method of construction require revision of the Contract Drawings or Specifications, including revisions for the purposes of determining feasibility, scope or cost, or revisions for the purpose of obtaining review and approval by authorities having jurisdiction, A/E will make revisions as approved in writing in advance by Owner.
2. Contractor shall pay for services of A/E for researching and reporting on proposed substitutions or alternative sequence and method of construction when such activities are considered additional services to the design services contracts of A/E.
3. Contractor shall pay for costs of expenses incurred by A/E. These costs may include travel, reproduction, long distance telephone and shipping costs reimbursable at cost plus usual and customary mark-up for handling and billing.
4. Contractor shall pay such fees whether or not the proposed substitution or alternative sequence or method of construction is ultimately accepted by Owner and a Change Order executed.

PART 2 PRODUCTS (NOT APPLICABLE TO THIS SECTION).

PART 3 EXECUTION (NOT APPLICABLE TO THIS SECTION).

END OF SECTION 01 25 00

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Section includes:
 - 1. Change Procedures.
 - 2. Proposal Requests.
 - 3. Effect of Change on Schedule.
 - 4. Correlation of Contractor Submittals.

1.02 CHANGE PROCEDURES

- A. Minor Changes in the Work:
 - 1. AIA Form G710.
 - 2. The A/E issues Supplemental Instructions to the Contractor for minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time.
- B. Construction Change Directive:
 - 1. AIA Form G714.
 - 2. A/E issues Construction Change Directive which describes changes in the Work and designates methods for determining changes in Contract Sum or Contract Time.
 - 3. Contractor proceeds with changes in the Work for subsequent inclusion in a Change Order.
 - 4. Documentation:
 - a. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.
 - b. Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - c. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
- C. Change Orders:
 - 1. County's Change Order Form.
 - 2. Execution: A/E will issue Change Orders for signatures of parties as provided in Conditions of the Contract.
 - 3. Reservation of Rights: An executed change order represents full and final settlement of all claims arising out of a modification including all claims for delays and disruptions resulting from, caused by, or incident to such modifications.

- D. Provide A/E with name of individual authorized to receive change documents, and responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

1.03 PROPOSAL REQUESTS

- A. The A/E may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications for executing the change.
- B. The Contractor may propose changes by submitting a request for a change to A/E which includes:
 - 1. A description of the proposed change and its full effect on the Work
 - 2. A description of the reason for the change and its effect on the Contract Sum/Price and Contract Time.
 - 3. A description of the change's effect on the Work of subcontractors as described in previous paragraph, with full documentation.
 - 4. Requests for substitutions in accordance with Section 01 25 00.
- C. Proposal Format:
 - 1. Within 10 days, prepare and submit a Proposal Worksheet using Work Breakdown Detail and Summary forms following this Section.
 - a. For each Element of Work, calculate additions showing:
 - 1) Description and quantity.
 - 2) Material cost including delivery charges.
 - 3) Labor cost directly attributable to the change.
 - 4) Equipment rental cost.
 - 5) Subtotal.
 - b. For each Element of Work, calculate deductions showing:
 - 1) Description and quantity.
 - 2) Material cost including delivery charges.
 - 3) Labor cost directly attributable to the change.
 - 4) Equipment rental cost.
 - 5) Subtotal.
 - c. Subcontractor's net change in cost.
 - d. Subcontractor's OH&P at percentage stipulated in Conditions of the Contract.
 - e. Subcontractor's Bond.
 - f. Subcontractor's Total.
 - g. Contractor's OH&P at percentage stipulated in Conditions of the Contract.
 - h. Contractor's Bond.
 - i. Contractor's Insurance.
 - j. Applicable Tax.
 - k. Contractor's Total.

1.04 EFFECT OF CHANGE ON SCHEDULE

- A. With proposal, include an updated Contractor's Construction Schedule that indicates the effect of the change, including but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. No change order request may include additional time required to perform the work, or additional supervision costs unless the additional work is shown to affect the critical path of the project.
- C. No changes in the work shall be made without prior written approval of the County.

1.05 CORRELATION OF CONTRACTOR SUBMITTALS

- A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
- B. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- C. Promptly enter changes in Project Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 26 00

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Schedule of values.
- B. Applications for payment.
- C. Defect Assessment.

1.02 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule:
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Submittals Schedule and Application for Payment forms with Continuation Sheets.
 - 2. Submit the Schedule of Values to A/E at earliest possible date but no later than five (5) days before the date scheduled for submittal of initial Applications for Payment.
- B. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702.
- C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section. Identify site mobilization, bonds, and insurance.
- D. Include in each line item, amount of Allowances specified in this section.
- E. Include in each line item, amount of Alternates specified in this section.
- F. Include separately from each line item, direct proportional amount of Close-out.
- G. Revise schedule to list approved Change Orders with each Application for Payment.

1.03 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by A/E and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Submit two (2) copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702, for the A/E and Owner's project site review.
- C. After reviewing Work in the field with the A/E and Owner, submit five(5) signed and notarized copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702
 - 1. One (1) copy shall include waivers of lien and similar attachments if required.
- D. Content and Format:
 - 1. Utilize Schedule of Values for listing items in Application for Payment.
 - 2. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor.
 - 3. A/E will return incomplete applications without action.
- E. Submit an updated construction schedule with each Application for Payment.
- F. Payment Period: Submit at intervals stipulated in the Agreement.
- G. Submit with transmittal letter as specified for Submittals in Section 01 33 00 - Submittal Procedures.
- H. Substantiating Data: When A/E requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
 - 1. Current construction photographs.
 - 2. Record documents for review by Owner which will be returned to Contractor.
 - 3. Affidavits attesting to off-site stored products.
 - 4. Construction progress schedules, revised and current.
- I. Include amounts of Change Orders and Construction Change Directives approved by the County before the last day of the construction period covered by the application.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of Values.
 - 3. Contractor's Construction Schedule (preliminary if not final).
 - 4. Submittals Schedule (preliminary if not final).
 - 5. List of Contractor's staff assignments.
 - 6. Certificates of insurance and insurance policies.
 - 7. Performance and payment bonds.
- K. Application for Payment at Substantial Completion:
 - 1. Submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

2. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
3. Reflect Certificates of Partial Substantial Completion issued in Application for Payment.

L. Final Payment Application:

1. Submit final Application for Payment with releases and remainder of supporting documentation , including, but not limited, to the following:
 - a. Proof that taxes, fees, and similar obligations were paid.
 - b. Updated final statement, accounting for final changes to the Contract Sum.
 - c. Final waivers from every entity involved with performance of the Work who is lawfully entitled to a lien. Evidence that claims have been settled.
 - d. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims", 2 copies.
 - e. AIA Document G706A, "Contractor's Affidavit of Release of Liens", 2 copies.
 - f. AIA Document G707, "Consent of Surety to Final Payment", 2 copies
2. Refer to Section 01 77 00 Closeout Procedures, for final completion requirements.

1.04 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the A/E it is not practical to remove and replace the Work, the A/E will direct appropriate remedy or adjust payment.
- C. At the discretion of the A/E:
 1. The defective Work may remain, but unit sum/price will be adjusted to new sum/price or,
 2. Defective Work will be partially repaired to instructions of A/E and unit sum/price will be adjusted to new sum/price.
- D. Authority of A/E to assess defects and identify payment adjustments is final.
- E. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
 1. Products wasted or disposed of in a manner that is not acceptable.
 2. Products determined as unacceptable before or after placement.
 3. Loading, hauling, and disposing of rejected products.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 29 00

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Coordination.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Pre-installation meetings.
- E. Requests for Interpretation (RFIs).

1.02 PROJECT COORDINATION

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later where indicated on the Drawings.
- B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Consider finish elements when locating fixtures and outlets to minimize disruption to finish elements. Verify locations with Architect before installation.
- E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's partial and full occupancy.

- F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.03 PRECONSTRUCTION MEETING

- A. A/E will schedule meeting after Notice of Award.
- B. Attendance Required: Owner, A/E, Contractor, and major subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of Schedule of Values and Submittals Schedule.
 - 5. Designation of personnel representing parties in Contract and A/E.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Scheduling.
 - 8. Testing, Inspecting and Laboratory Services.
 - 9. Use of premises by Owner and Contractor.
 - 10. Owner's requirements and partial occupancy.
 - 11. Construction facilities and controls.
 - 12. Temporary utilities.
 - 13. Security and housekeeping procedures.
 - 14. Procedures for maintaining record documents.
- D. Minutes shall be distributed within one week after meeting to participants.

1.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance Required: Job superintendent, major subcontractors and suppliers, A/E, and others as appropriate to agenda topics for each meeting.
- D. Agenda:
 - 1. Review minutes of previous meetings.
 - 2. Review of Work progress.
 - 3. Field observations, problems, and decisions.
 - 4. Identification of problems and Requests for information impeding planned progress.
 - 5. Review of submittals schedule and status of submittals.

6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain projected schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of projected progress.
 11. Maintenance of quality and work standards.
 12. Effect of proposed changes on progress schedule and coordination.
 13. Other business relating to Work.
- E. Record minutes and distribute copies within one week after meeting to participants, with copies to A/E, Owner, and those affected by decisions made.

1.05 PRE-INSTALLATION MEETINGS

- A. Coordination meeting required for complex items requiring coordination and understanding among several participants.
1. Hold meetings when required in individual specification sections or the Contractor deems necessary. Meetings shall focus on specific concerns and do not relieve the Contractor of the responsibility to coordinate the Work when a pre-installation meeting is not required by a Section.
 2. Hold meetings in which all trades responsible for the various assemblies of a component of the Work meet before the work begins, to discuss how each aspect is to be coordinated with other adjacent construction so that the responsibilities for installation of various components and progression of the work is clearly understood.
 3. Convene pre-installation meetings at Project site prior to commencing work of specific section.
- B. Require attendance of parties directly affecting, or affected by Work of specific section.
- C. Notify A/E in advance of meeting date.
- D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
 2. Review coordination with related work.
- E. Record minutes and distribute copies within one week after meeting to participants, with copies to A/E, Owner, and those affected by decisions made.

1.06 REQUESTS FOR INTERPRETATIONS

- A. Definition: Request from Contractor seeking interpretation or clarification of the contract Documents.

- B. Procedure: Immediately on discovery of the need for interpretation of the contract Documents, and if not possible to request interpretation at the Progress meeting. Prepare and submit an RFI in the form specified.
1. RFIs shall originate with the Contractor. RFIs submitted by entities other than the Contractor will be returned to the Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- C. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
1. Project name.
 2. Date.
 3. Name and trade of entity seeking interpretation.
 4. RFI number, numbered sequentially.
 5. Specification Section number and title and related paragraphs as appropriate.
 6. Drawing number and detail references, as appropriate.
 7. Field dimensions and conditions, as appropriate.
 8. Contractor's suggested solution(s). If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI
 9. Attachments: include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by the Contractor shall include dimensions, thicknesses, and details of affected materials, assemblies and attachments.
- D. RFI Form: Software generated form provided by the A/E or Contractor's approved form.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. A/E's action may include a request for additional information.
- F. A/E's action which may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Contract Modifications Procedures Section.
1. If so, notify A/E in writing within 10 days of receipt of RFI response.
- G. On receipt of A/E's action, update RFI log and immediately distribute the RFI response to affected parties. Review response and notify A/E within 7 days if Contractor disagrees with response.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Construction Progress Schedule.
 - 2. Submittals Schedule.
 - 3. Construction Progress Reporting.
- B. Contractor's Progress Schedule must show Critical Path in order for Submittal review schedule to be established and in order to claim time extension for additional work.
- C. Reference: The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry, Washington, D.C., the Associated General Contractors of America (AGC).

1.02 CONSTRUCTION PROGRESS SCHEDULE

- A. Submit a detailed CPM schedule using specialized software, Primavera Project Planner (P3), Suretrak, or similar which shows the interrelationships and interdependencies of the activities comprising the Project. Tabulate each critical path activity using calendar dates, and identify for each activity:
 - 1. Activity description.
 - 2. Estimated duration of activity, in maximum day intervals.
 - 3. Earliest start date.
 - 4. Earliest finish date.
 - 5. Actual start date.
 - 6. Actual finish date.
 - 7. Latest start date.
 - 8. Latest finish date.
 - 9. Total and free float.
- B. Prepare Three-Week Progress Schedules in bar graph format that show the work performed in the previous week and the work over the next two weeks. Each bar on the schedule should include the related activity identification from the Project's baseline CPM schedule.

- C. Procedures:
1. Submit within five (5) days after the effective date of Notice to Proceed, five (5) copies of a progress schedule covering project operations of the Contract period.
 2. Revise to address review comments and resubmit.
 3. Update Progress Schedule and submit three (3) copies with each Application for Payment.
 - a. Identify progress of each activity to date of submittal and projected completion date.
 - b. Show activities modified since last submittal and other identifiable changes.
 - c. Provide narrative report as needed to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken or proposed and its effect.
- D. Use: The Contractor shall endeavor to manage the work in accordance with the scheduling indicated by the first approved Progress Schedule. The intent is to promote good job management, not rigidly bind the Contractor to a planned procedure. For this reason, finish activities such as painting or laying of carpet must not be scheduled concurrently with finish plastering or door installation. The Contractor shall use special care to coordinate efforts of various subcontractors, especially mechanical and electrical, to assure proper completion of their work ahead of general finish operations.
- E. Coordinate Contractor's Progress Schedule with the Schedule of Values, Submittals Schedule, payment requests, and other required schedules and reports.
- F. No contract work shall be done without an A/E approved progress schedule. The items in the activities for the denoted critical path will determine the controlling operations of the work.
- G. During the life of the project, the Contractor shall review the progress schedule with the A/E at the regularly scheduled Progress Meetings unless otherwise specified. The Contractor shall submit a revised progress schedule within 5 working days of the review meeting if the Contractor is behind schedule or if the schedule has been modified. Revised progress schedules must be submitted to and approved by the A/E.
- H. If the Contractor deviates from the currently approved progress schedule by not following the logical sequence of the critical path, payment will be withheld for the pay items for the affected activities until the Contractor submits a revised progress schedule and this schedule is approved by the A/E.
- I. Reporting: Each month with the Request of Payment, submit a copy of the current Progress Schedule marked to show actual percentage of completion for each category of work, as well as the aggregate percentage of completion.

- J. Behind Schedule Progress: If the actual progress curve at any time falls more than 10% behind the proposed curve, the Contractor shall promptly take the steps necessary to get the work back on schedule. It is emphasized that the purpose of this scheduling is to assure orderly management of the project and the pushing of finish activities into areas where rough activities are not completed shall not be tolerated. Neither shall last minute rush scheduling be permitted to enable the Contractor to finish on time if it involves poor construction procedures.

1.03 SUBMITTALS SCHEDULE

- A. The Contractor shall prepare and keep current, for the A/E's review, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the A/E reasonable time to review submittals.
- B. Submit three (3) copies of schedule arranged in chronological order by dates required to maintain progress schedule. List the following information in a tabular format and include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Name of subcontractor.
 - 4. Description of the Work covered.

1.04 CONSTRUCTION PROGRESS REPORTING

- A. Submit three (3) copies at time of discovery of Conditions affecting Construction Progress.
 - 1. Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report.
 - 2. Submit report with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 32 00

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Construction Submittals.
- B. Related Sections requiring submittals:
 - 1. Section 01 25 00 - Substitution Procedures.
 - 2. Section 01 29 00 - Payment Procedures.
 - 3. Section 01 32 00 - Construction Progress Documentation.
 - 4. Section 01 43 00 - Quality Assurance.
 - 5. Section 01 45 00 - Quality Control.
 - 6. Section 01 60 00 - Product Requirements.
 - 7. Section 01 70 00 - Execution Requirements.
 - 8. Section 01 77 00 - Closeout Procedures.
 - 9. Section 01 78 00 - Closeout Submittals.

1.02 SUBMITTAL TYPES NOT INCLUDED IN THIS SECTION

- A. Preconstruction Submittals:
 - 1. Certificates of insurance.
 - 2. Payment and performance bonds.
 - 3. Proposed subcontractor and product lists.
 - 4. Preliminary construction progress schedule.
 - 5. Proposed use of the site and site logistics, including signage.
- B. Closeout Submittals:
 - 1. Written notices of substantial and final completion.
 - 2. Final application for payment.
 - 3. Record documents: Record drawings and specifications, addenda, change orders, field orders.
 - 4. O&M data.
 - 5. Spare parts and maintenance materials.
 - 6. Certificates of payment.
 - 7. Release of liens and waiver of debts and claims.
 - 8. Consent of surety to final payment.
 - 9. Executed Warranties.
 - 10. Keying.
 - 11. Materials, Extra Stock and Tools.

1.03 CONSTRUCTION SUBMITTALS

A. Work-related Action and Informational submittals of this section are categorized as follows:

1. Shop drawings include specially-prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.
2. Product data include standard printed information on materials, products and systems; not specially-prepared for this project, other than the designation of selections from among available choices printed therein.
3. Samples include both fabricated and unfabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either from limited visual inspection or (where indicated) for more detailed testing and analysis.
 - a. Samples shall be supplied for use by the A/E, and unless specifically requested on the Contractor's cover sheet, will not be returned to the Contractor.
 - b. Mock-ups are a special form of samples, which are too large or otherwise inconvenient for handling in specified manner for transmittal of sample submittals.
4. Design Data Design calculations, mix designs, analyses or other data pertaining to a part of work.
5. Certificates and Letters of Certification:
 - a. Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.
 - b. Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.
6. Sample Warranties.
7. Manufacturer's Installation Instructions include preprinted material describing installation of a product, system or material, including special notices and concerning impedances, hazards and safety precautions.

B. QA/ QC and Informational Submittals are categorized as follows and may be delivered in electronic format if desired.

1. Test reports.
2. Manufacturer's field reports:
 - a. Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or

after installation, to confirm compliance with manufacturer's standards or instructions.

- b. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

- 3. Construction photographs.
- 4. Draft Applications for Payment.
- 5. Schedule of values.
- 6. Construction progress schedules.

- C. Individual submittal requirements are specified in applicable sections for each unit of work.

1.04 SUBMITTAL GENERAL REQUIREMENTS

- A. Submittals Schedule: Comply with requirements of Division 1 Section "Progress Schedule" for list of submittals and time requirements for scheduled performance of related construction activities.
- B. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of A/E's review with another.
- C. Processing Time: Allow enough time for submittal review including time for resubmittals. Time for review shall commence on A/E's receipt of submittal.
- D. Submittal Log: The Contractor shall generate and maintain a submittal log which shall include:
 - 1. Every section requiring submittals.
 - 2. Category of submittal required for each section.
 - 3. Status of each category.

1.05 PREPARATION OF SUBMITTALS

- A. Shop Drawings:
 - 1. Provide newly-prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name).
 - 2. Show dimensions and note which are based on field measurement.
 - 3. Identify materials and products in the work shown.
 - 4. Indicate compliance with standards, and special coordination requirements.
 - 5. Do not allow shop drawing copies without appropriate final "Action" markings by A/E to be used in connection with the work.
 - 6. Submit six copies to the A/E of which three will be returned to the Contractor.

B. Product Data:

1. Collect required data into one submittal for each unit of work or system; and mark each copy to show which choices and options are applicable to project.
2. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements.
3. Maintain one set of product data (for each submittal) at project site, available for reference by A/E and others.
4. Do not submit product data, or allow its use on the project, until submittal has been returned with the A/E's final review.
5. Submit six copies to the A/E of which three will be returned to the Contractor.
6. Installer's Copy: Do not proceed with installation of materials, products or systems until final copy of applicable product data is in possession of Installer.

C. Samples:

1. Provide samples for A/E's use. Submit samples where required by a section, for selection or review and confirmation of color, pattern, texture, and "kind". Samples requested for color boards will not be returned to the Contractor.
2. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples (not less than 3 units) where unavoidable variations must be expected, and describe or identify variations between units of each set.
3. Provide full set of optional samples where A/E's selection is required. Prepare samples to match A/E's sample where so indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.
4. A/E will not "test" samples (except as otherwise indicated) for compliance with other requirements, which are therefore the exclusive responsibility of Contractor.

D. Mock-Ups: Mock-ups and similar samples specified in individual work sections are recognized as a special type of sample. Comply with requirements for "samples" to greatest extent possible, and process transmittal forms to provide a record of activity.

1.06 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to A/E.
- B. At time of submission, note in writing, highlight, circle or otherwise identify any deviations in submittal from Contract Documents. The Contractor must submit in writing, any request for modification to the plans and specifications.
1. Shop drawings and submittals that are submitted to the A/E for review do not constitute "in writing" unless proposed modification has been described on the

submittal form, brought to the attention of the A/E, and reason for modification is stated.

2. In any event, the responsibility for proposing changes to the plans and specifications by means of shop drawings or submittals, and receiving approval for such changes, resides with the Contractor. No additional costs for replacement of unapproved modifications with the original specified materials will be paid to the Contractor.
- C. Do not combine items from different specification sections in submittal, unless called for in specifications.
 - D. Approval Stamp: Stamp each submittal with a uniform, approval stamp.
 - E. Execute and attach to each submittal, "CONTRACTOR SUBMITTAL FORM" (sample follows this Section), to identify project, date, Contractor, subcontractor, submittal name and number.
 - F. General Distribution: Provide additional distribution of submittals to subcontractors, suppliers, fabricators, installers, governing authorities and others as necessary for proper performance of the work. Include such additional copies in transmittal to A/E where required to receive "Action" marking before final distribution. Record distributions on transmittal forms.
 - G. Begin no fabrication or work that requires submittals until return of submittals with A/E's final review.
 - H. Submittals which are received from sources other than through Contractor's office will be returned by A/E "without action."

1.07 A/E'S REVIEW

- A. General: A/E will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. A/E will review submittals and where possible return within 2 weeks of receipt. Where submittal must be held for coordination, Contractor will be so advised by A/E.
- C. Submittals requiring a color selection will be held until all Color samples and charts for the project have been received.
 1. At that time, Color Boards will be prepared and submitted to the Owner for approval.
 2. After final selections have been made by the Owner, those submittals will be processed by the A/E and returned to the Contractor.
- D. A/E will affix stamp and initials or signature, and indicate requirements for resubmittal or review of submittal.

- E. A/E will return submittals to Contractor for distribution or for resubmission.
- F. Submittal Review Stamps:
 - 1. “No Exception Taken”: Reviewed for general conformity to the requirements of Drawings and Specifications. Quantities shown not verified. Contractor’s full responsibility is in no way relieved by this action.
 - 2. “Make Corrections Noted”: Reviewed and noted for general conformity to requirements of Drawings and Specifications. Quantities shown not verified. Contractor’s full responsibility is in no way relieved by this action.
 - 3. “Revise & Resubmit”: Reviewed and noted for general conformity to requirements of Drawings and Specifications. Provide missing information, make corrections, and resubmit as noted.
 - 4. “Rejected/Resubmit”: Reviewed and not accepted. Provide product data, shop drawings, certifications, warranties, etc which meet or exceed the requirements of the Drawings and Specifications and resubmit.
 - 5. “Receipt Acknowledged”: Submittal for Section is not required or submittal is being held by A/E for coordination of work with that of another Section.
- G. A/E review does not constitute acceptance or responsibility for accuracy or dimensions, nor shall it relieve the Contractor from meeting any requirements of the Contract Documents, nor shall it constitute approval for any modification from the Contract Documents unless such modifications are specifically stated as such on the submittal and specifically allowed by the Engineer.
- H. A/E to return submittals with only cursory review when it becomes apparent the submittals are not acceptable, and/or incomplete.
- I. Payment and Time for Review of Excessive Submittals After First Resubmittal:
 - 1. Include Contractor’s statement to A/E that all costs shall be paid by the Contractor and executed by Change Order for all A/E’s review time and costs at A/E’s standard billing rates.
 - 2. Submittals will be reviewed by A/E at convenience of the A/E.
 - 3. Delays caused by the need for resubmittal shall not constitute basis for claim.

1.08 NOT ACCEPTED AND REJECTED SUBMITTALS

- A. Contractor shall make corrections required by the A/E. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, “Changes,” is to be given to the A/E.
- B. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Owner requiring rejection and removal of such work at the Contractor’s expense.

- C. If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.09 REVIEWED AND REVIEWED AND NOTED SUBMITTALS

- A. The A/E's review or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory.
- B. Review will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the General Conditions of the Contract is responsible for dimensions, and the satisfactory construction of all work.
- C. After submittals have been reviewed by the A/E, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 33 00

SECTION 01 42 00

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SUMMARY

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Back-Up: "Back-up" as relating to any item, product, or documents within the scope of this Contract, shall mean the total supporting and substantiating data which forms the basis of the summary as it relates to products, means, methods, costs, certificates, and similar items. Back-up shall include pertinent data required to support the summary including, but not necessarily limited to, the following:
 - 1. Technical data, reports, and certifications.
 - 2. Costs, both materials and labor, direct and indirect.
 - 3. Manufacturer's recommendations.
 - 4. Means and methods.
 - 5. History.
 - 6. Samples.
 - 7. Comparative analysis.
 - 8. Testing laboratory reports, tests, and recommendations.
 - 9. Code authority approvals and authorizations.
 - 10. Justification.

1.02 DEFINITIONS

- A. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- B. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- C. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- D. "Provide": Furnish and install, complete and ready for the intended use.
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to A/E for a decision before proceeding.
- D. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to A/E for a decision before proceeding.
- E. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list:

AA	Aluminum Association
AAMA	American Architectural Manufacturing Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADAAG	Americans with Disabilities Accessibility Act Guidelines
ADC	Air Diffusion Council

AHA	American Hardboard Association
AHC	Architectural Hardware Consultant
AHJ	Authority Having Jurisdiction
AI	Asphalt Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
AOC	Architectural Openings Consultants
APA	American Plywood Association
APWA	American Public Works Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWWA	American Water Works Association
AWS	American Welding Society
CBM	Certified Ballast Manufacturers
CDC	Certified Door Consultants
CFR	Code of Federal Regulations
CID	Construction Industries Division

CPSC	Consumer products Safety Commission
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
DHI	Door and Hardware Institute
EEI	Edison Electric Institute
EHC	Electrified Hardware Consultant
ETL	Electrical Testing Laboratories
FM	Factory Mutual
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS)
GA	Gypsum Association
GANA	Glass Association of North America
HMMA	Hollow Metal Manufacturers Association
HPVA	Hardwood Plywood and Veneer Association
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEBC	International Existing Building Code
IECC	International Energy Conservation Code
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
ISA	Instrument Society of America
LEED	Leadership in Energy and Environmental Design

MIL	Military Specification Naval Publications and Forms Center
MPI	Master Painters Institute
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NEC	National Electric Code
NEMA	National Electrical Manufacturers' Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NMCBC	New Mexico Commercial Building Code Code Regulations Licensing Department Construction Industries Divisions
NMDWS	New Mexico Department of Workforce Solutions
NRCA	National Roofing Contractors Association
NWWDA	National Wood Window and Door Association
OSHA	Occupational Safety & Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	Product Standard US Department of Commerce
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SIGMA	Sealed Insulating Glass Manufacturer's Association
SJI	Steel Joist Institute

SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, Inc.
SSPC	Steel Structure Painting Council
TMS	The Masonry Society
UL	Underwriters' Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code International Association of Plumbing/Mechanical Officials
WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 42 00

SECTION 01 43 00

QUALITY ASSURANCE

PART 1 GENERAL

1.01 SUMMARY

- A. Provisions for quality assurance apply to workmanship and craftsmanship applied to work executed in the performance of the Contract.
 - 1. Perform work with suitable qualified personnel to produce work of specified quality.
 - 2. Refer to applicable Standards and Codes.
 - 3. Refer to Workmanship requirements of trade associations.
 - 4. Test materials in accordance with applicable standards.
 - 5. Provide field samples and mock-ups to establish acceptable level of quality and a basis for judging work.
 - 6. Follow inspection requirements.
- B. Related Work Described Elsewhere: Provisions of trade associations, manufacturer's printed instructions, recommendations, methods, and criteria for application and installation of systems and assemblies, various technical sections of these specifications, the Drawings, and References Section.
 - 1. Provisions of work furnished under this Contract and installed under this Contract.
 - 2. Provisions of work installed under this Contract furnished by others.

1.02 QUALIFICATIONS

- A. Project Superintendent:
 - 1. The superintendence of the General Contractor for the total overall Work shall be administered by one qualified person who is thoroughly trained and experienced in the duties of a Project Superintendent.
 - 2. Project Superintendent shall have a minimum of 10 years of construction experience, with a minimum of 5 years being in commercial construction.
 - 3. Project Superintendent shall demonstrate successful completion of a minimum of 5 projects of similar scope and budget through a resume and letters of recommendation.
 - 4. The Project Superintendent shall exercise general supervision over the Work, have the decision-making authority of the Contractor, and be familiar with the specified requirements and methods to be used in the scheduling, supervision, performance, and execution of the Work.
 - 5. Project Superintendent's qualifications are subject to review and approval by the Owner and A/E and shall not be reassigned until final acceptance of the Work, unless permitted in writing by the Owner.

- B. Subcontractors: The superintendence of trades involved in work of this project shall be administered, supervised, and directed by at least one qualified journeyman foreman who is thoroughly trained and skilled in the arts generic to his trade and such qualifications may be subject to review and approval by the A/E.
- C. Workmen: Workmen engaged in the performance of work comprising a part of the total Work of this Contract shall be adequate in number, thoroughly trained and experienced in the installation of the specified and selected products and who are completely familiar with the requirements of their respective work and this Work.
- D. Apprentice: Apprentice personnel shall, in the performance of their respective Work, be supervised and directed in their duties under the competent supervision and direction of experienced journeymen experienced and skilled in their trade.
- E. Manufacturers: Products used in the work of this project shall be produced by recognized manufacturers regularly engaged in the manufacturing of such and similar products with a history of successful production of products specified in the various sections of these specifications and as otherwise approved by the A/E.
 - 1. In the use of equal or similar manufactured products proposed for inclusion into the Work, comply with the provisions of Submittal Section.
- F. Fabricators, Suppliers, and Personnel: Fabricators, erectors, suppliers, installers, and applicators shall have not less than five years continuous experience in the execution of their respective duties and their qualifications may be subject for review and approval by the A/E.
- G. Licensed Applicators: Applicators of specific systems, licensed by a manufacturer or company of such products, shall be qualified in every respect required by the manufacturer or company to the extent permitting the issuance of all required guarantees, warranties, and certificates of compliance to the approval of the A/E.

1.03 SUBMITTALS

- A. Within ten (10) days following the execution of the Contract, submit the personal work history of the Project Superintendent proposed to be assigned to the project to its final conclusion.
- B. Submittal may be in the form of a letter or standard employment “Job Application” covering the person’s last five (5) years work history and contact source, names, and telephone numbers for use in verification of qualifications and recommendations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. General: Prior to any work being performed in the execution of the Contract, personnel who supervise, or otherwise direct the scope of their respective work, shall become thoroughly familiar with surface conditions affecting their work, the interface requirements of all other trades whose work affects their work, and become completely knowledgeable with the specified materials and methods needed for the proper coordination and execution of the work.

END OF SECTION 01 43 00

SECTION 01 45 00

QUALITY CONTROL

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Quality Control and Control of Installation.
- B. Tolerances.
- C. Testing and Laboratory Services:
 - 1. Provisions of cooperation with the selected testing laboratory and others responsible for testing and inspection of the Work.
 - 2. Requirements for testing may be described in various other sections of these specifications.
 - 3. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may direct that such testing be performed under current standards for testing. Payment for such testing will be made as described in this section.
 - 4. The County shall select and pay for the testing laboratory directly and not as part of the Contract.
- D. Special Inspection Services:
 - 1. Where the New Mexico Building Code mandates that the Owner employ "Special Inspectors", the county shall pay for inspection services directly and not as part of the Contract. For special inspection type and frequency refer to Structural Drawings Quality Insurance Plan for Schedule.
 - 2. Requirements for inspections may be described in various sections of these specifications.
- E. Manufacturers' Field Services: Requirements for manufacturers' field services may be described in various other sections of these specifications.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from A/E before proceeding.

- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from A/E before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.04 TESTING AND INSPECTION SERVICES

- A. Codes and Standards:
 - 1. Testing, when required, will be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.
 - 2. Inspections will be conducted at intervals required by current building codes and regulations and include:
 - a. Regulatory Inspections.
 - b. Special Inspections:
 - c. Seismic Inspections.
 - d. Structural Observations.
- B. Qualifications of testing agency or laboratory: The testing agency or laboratory will be qualified in accordance with ASTM E329.
- C. Agency Responsibilities:
 - 1. Cooperate with A/E and Contractor in performance of duties.
 - 2. Provide qualified personnel to perform required tests and inspections.
 - 3. Notify A/E and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 4. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 5. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

6. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
7. Do not perform any duties of Contractor.

D. Agency Reports:

1. Prepare and submit certified written reports that include the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of the Work and test and inspection method.
 - g. Identification of product and Specification Section.
 - h. Complete test or inspection data.
 - i. Test and inspection results and an interpretation of test results.
 - j. Ambient conditions at time of sample taking and testing and inspecting.
 - k. Name and signature of laboratory inspector.
 - l. Recommendations on retesting and reinspecting.
2. Promptly process and distribute required copies of reports and related instructions to ensure necessary retesting and replacement of materials with the least possible delay in progress of the Work.

E. Special Inspection Reports:

1. Provide Special Inspection Reports listing all construction special inspections or reviews of testing performed during that month, noting all uncorrected deficiencies, and describing the corrections made both to these deficiencies and to previously reported deficiencies.
2. Each report shall be signed by the special inspector who performed the special inspection or reviewed the testing, regardless of whether they reported any deficiencies.
3. Each report shall be signed by the Contractor and submitted to the Engineer of Record.

F. Limits on Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

G. Contractor Responsibilities: Cooperate with agencies performing required tests, inspections, and similar quality-control services. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Preliminary design mix proposed for use for material mixes that require control by testing agency.

1.05 PAYMENT FOR TESTING

- A. The Owner will pay for initial testing and inspections services required by these specifications, the Quality Assurance Plans shown on the drawings and building code or regulatory agencies. Where the New Mexico Building Code mandates that the Owner employ Special Inspectors, Special Inspectors shall be selected by the Owner and paid by the Owner.
- B. When there is work which the Owner requires tested and inspected in addition to specified and required tests, the Owner will pay for the tests if the work does comply with the required standards and specifications; the Contractor will pay for the tests if the work does not comply with required standard and specifications.
- C. Retesting and Re-inspecting: When initial reports indicate non-compliance with the Contract Documents, all subsequent retesting and re-inspecting occasioned by the non-compliance shall be performed by the same agency and costs thereof will be paid by the Contractor at no additional cost to the Owner.

1.06 CODE COMPLIANCE TESTING AND INSPECTING

- A. Inspections and tests required by codes, ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

1.07 CONTRACTOR'S CONVENIENCE TESTING AND INSPECTING

- A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

1.08 INSPECTION BY OWNER'S PERSONNEL

- A. From time to time, personnel in the employ of the Owner may inspect the Work where the work is in progress, but shall have no authority to direct the Contractor or request changes in the Work except through the A/E.

1.09 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, warranty

inspections, start-up of equipment, and test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TAKING SPECIMENS

- A. Specimens for testing and samples, unless otherwise provided in the Contract documents, will be taken by the testing personnel. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.02 SCHEDULES FOR TESTING AND INSPECTING

- A. By advance discussion with the selected agency, determine the time required for the agency to perform its tests and inspection and to issue each of its findings.
- B. Provide required time within the construction schedule.
- C. When changes of construction schedule are necessary during construction, coordinate such changes of schedule with the agency as required.
- D. When the agency is ready to test or inspect according to the established schedule, but is prevented from performing its duties due to incompleteness of the Work, all extra charges attributable to the delay shall be back-charged to the Contractor and shall not be borne by the Owner.

3.03 ALTERNATIVE INSPECTION PROCEDURE

- A. The A/E shall have the right to require alternative inspection procedures other than as specified when, in the A/E's judgment, other inspections are required to demonstrate compliance with the contract requirements. Costs of such alternative inspections will be borne by the Owner if products are found to comply; otherwise, costs shall be borne by the Contractor.

END OF SECTION 01 45 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. Types of temporary facilities and controls may include, but not be limited to:
 - 1. Temporary Utilities.
 - 2. Construction Facilities.
 - 3. Temporary Construction.
 - 4. Construction Aids.
 - 5. Vehicular Access.
 - 6. Temporary Barriers.
 - 7. Temporary Controls.
 - 8. Project Identification.
 - 9. Removal of Utilities, Facilities, and Controls.

1.02 CONDITIONS OF USE

- A. The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Minimize waste and abuse; limit availability of temporary facilities to essential and intended uses.
 - 3. Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 - 4. Relocate temporary services and facilities as required by progress of the Work.
- B. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- C. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

1.03 TEMPORARY UTILITIES

- A. Types of temporary services required may include, but not be limited to water service, sewer and drainage, sanitary facilities, heating and cooling, ventilation and humidity control, electrical power, electrical distribution, lighting, surface drainage, and telephones.
 - 1. Standards: Comply with ANSI A10.6, NEC's "Temporary Electrical Facilities," and NFPA 241.

- B. Water Service: Provide rubber hoses as necessary to serve Project site. Where non-potable water is used, mark each outlet with adequate health-hazard warning signs.
- C. Sewers and Drainage:
1. If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. Connect temporary sewers to system as directed by sewer department officials.
 2. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities.
 3. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
 4. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 5. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 6. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- D. Dewatering Equipment and Drains: Comply with requirements in applicable Division 32 Sections for temporary drainage and dewatering facilities, and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
- E. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Provide portable, UL rated-fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 2. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
 3. Store combustible materials in containers in fire-safe locations.
 4. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting.
 5. Prohibit smoking in occupied buildings and hazardous fire-exposure areas.
 6. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- F. Heating and Cooling:
1. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

2. Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity.
 3. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
- G. Ventilation and Humidity Control:
1. Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
 2. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
 3. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- H. Electrical Power and Distribution System:
1. General: Where possible, engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
 2. Electric Power and Distribution Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
 - a. Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
 - b. Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
 - c. Receptacles: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light and adequate for connection of power tools and equipment.
 - d. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
 3. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
 - a. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

- b. Provide one 100-W incandescent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
- c. Provide one 100-W incandescent lamp every 50 feet in traffic areas.
- d. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
- e. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.

I. Use Charges:

- 1. Cost or use charges for temporary utilities are not chargeable to Owner or A/E and shall be included in the Contract Sum. This includes water for site work.
- 2. Water Service: Use water from Owner's existing water system without metering and without payment of use charges, for minor uses.
- 3. Electric Power Service: Use electric power from Owner's existing system without metering and without payment of use charges.

1.04 CONSTRUCTION FACILITIES

- A. Locate field offices, storage sheds, sanitary facilities, and other facilities for easy access. Coordinate location with Owner.
- B. Maintain support facilities until Substantial Completion. Remove immediately after Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Single-occupant self-contained toilet units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material, including hand-sanitizing capability.
 - 2. Shield toilets to ensure privacy.
 - 3. When toilets for public use are included in the Work, provide accessible unit located on an accessible route and provide separate facilities for males and females.
 - 4. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
- D. Drinking Water: Provide drinking-water fountains or containerized bottled drinking water, or tap supply including paper cups.
- E. Field Offices: With lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading. Provide space for Project meetings, with table and chairs.

- F. Storage Areas and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section.

1.05 TEMPORARY CONSTRUCTION

- A. Provide access, ramps, stairs, ladders and similar temporary access elements as required to perform the work and facilitate its inspection during installation.
- B. Comply with inspection requests from Authorities having Jurisdiction.
- C. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
 - 1. Cover finished permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.
 - 2. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 3. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.
- D. When permanent stairs are available for access during construction, finishes shall be covered and protected from damage. Damage to existing conditions will be repaired to the owner's satisfaction, prior to Project Completion.
- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
 - 1. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved in writing by A/E and Owner. Provide materials suitable for use intended.
 - 2. Provide temporary weathertight enclosure for building exterior to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons.
 - a. Provide access doors with self-closing hardware and locks.
 - b. Gypsum Board: 5/8" thick Type X for fire-rated areas.
 - 3. Provide temporary exitways as required by the Fire Marshall or Authority having jurisdiction.
 - 4. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures.
 - 5. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

6. Close vertical openings of 25 sq.ft. or less with plywood or similar materials. Close horizontal openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction. Lumber and Plywood: Comply with requirements in Division 06 Section.

1.06 CONSTRUCTION AIDS

- A. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

1.07 VEHICULAR ACCESS

- A. Temporary Roads: Construct and maintain temporary trafficways adequate to support loads and to withstand exposure to traffic during construction period.
 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

1.08 TEMPORARY BARRIERS

- A. Site Enclosure Fence: Before construction operations begin install enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
 1. Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts.
- B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
 1. Dust Control:
 - a. Execute Work by methods to minimize raising dust from construction operations.
 - b. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

2. Noise Control:
 - a. Provide methods, means, and facilities to minimize noise produced by construction operations.
 - b. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

1.09 TEMPORARY CONTROLS

- A. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Erosion and Sediment Control: Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation. Minimize surface area of bare soil exposed at one time. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- D. Stormwater Control:
 1. Stormwater pollution prevention plan: In order to discharge stormwater from a construction site, construction projects that disturb 1 acre or more of land must seek coverage under a National Pollutant Discharge Elimination System (NPDES) general construction permit. Disturbance includes, but is not limited to, soil disturbance, clearing, grading, and excavation.
 - a. EPA is the Permitting Authority, Permit Number: NMR150000.
 - b. Additionally, see Part 10 of the (CGP) - NPDES Construction General Permit for Stormwater Discharges from Construction Activities.
 2. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
 3. Compliance with Storm Drainage Discharge Requirements:
 - a. Contractor shall meet all requirements of the most current version of the NPDES General Permit for Discharge from Construction Activities (CGP).

- b. Contractor shall file a Notice of Intent (NOI) at least 14 days prior to commencing earth-disturbing activities and is required to use EPA's electronic NOI system or "eNOI system" to prepare and submit the NOI.
 - 1) In addition to submitting the Contractor's NOI, the Contractor shall assist the Owner in a timely fashion with the preparation and submittal of the NOI that is required to be submitted by the Owner.
 - c. Contractor shall file a Notice of Termination (NOT) and is required to use EPA's electronic NOI system or "eNOI system" to prepare and submit the NOT.
 - 1) In addition to submitting the Contractor's NOT, the Contractor shall assist the Owner with the preparation and submittal of the NOT that is required to be submitted by the Owner.
 - E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with pollution and environmental control requirements of authorities having jurisdiction.
 - F. Pest and Rodent Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
 - G. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

1.10 PROJECT IDENTIFICATION

- A. Project Identification and Temporary Signs:
 - 1. Project identification sign:
 - a. Engage an experienced sign painter to apply graphics.
 - b. Sign size: 4' x 8"
 - c. Sign material: 0.75 inch thick exterior grade plywood.
 - d. Supports: Two, 4" x 4" x 8' supports, sign bolted to supports.
 - e. Color: One color background, two colors for lettering.
 - f. Artwork: Graphic file will be supplied by Owner.
 - g. Lettering: Minimum 2" height.
 - 2. Prepare temporary signs to provide directional information to construction personnel and visitors.
 - 3. Install where directed to inform public and persons seeking entrance to Project.
 - 4. Do not permit installation of unauthorized signs.
 - 5. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing, or sign.

1.11 BULLETIN BOARD

- A. Furnish and maintain bulletin board adjacent to field office. Display the following throughout construction period:
 - 1. Wage rates.
 - 2. Safety requirements.
 - 3. Official notices and announcements.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. At earliest feasible time, when acceptable to Owner, change over from use of temporary utility to use of permanent service.
- B. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."
- C. Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for selecting products for use in Project
 - 1. Product Delivery, Storage, and Handling
 - 2. Product Warranties
 - 3. Product Options
 - 4. Reuse of Existing Materials
- B. See individual specification sections for specific requirements

1.02 DEFINITIONS

- A. For the purposes of this Specification Section, the terms “material and equipment” and “products” have the same meaning and are used interchangeably.
 - 1. Named Products: Items identified by manufacturer’s product name, including make or model number or other designation, shown or listed in manufacturer’s published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Manufacturer’s Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

1.03 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on project, product selected shall be compatible with other products incorporated into the Project, even if other products were also options.

- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

1.04 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.05 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground

1.06 PROTECTION AFTER INSTALLATION

- A. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove coverings when no longer needed.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Submittal Time: Comply with requirements in Division 1.

1.08 PRODUCT OPTIONS

- A. General Product Requirements:
 - 1. Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

2. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 3. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 4. Limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 5. Where products are accompanied by the term “as selected,” A/E will make selection.
 - a. Standard Range: Where Specifications include the phrase “standard range of colors, patterns, textures” or similar phrase, A/E will select color, pattern, or texture from manufacturer’s product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase “full range of colors, patterns, textures” or similar phrase, A/E will select color, pattern, or texture from manufacturer’s product line that includes both standard and premium items.
 6. Where products are accompanied by the term “match sample,” sample to be matched is sample provided by A/E.
 7. Descriptive, performance, and reference standard requirements in the Specifications establish “salient characteristics” of products.
 8. Comply with size, make, type and quality specified, or as specifically approved in writing by the A/E.
- B. Manufactured and Fabricated Products:
1. Design, fabricate and assemble in accordance with the referenced engineering and shop practices.
 2. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
 3. Two or more items of the same kind shall be identical, by the same manufacturer.
 4. Products shall be suitable for service conditions.
 5. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically requested by the Contractor and favorably reviewed by the A/E.
 6. Do not use material or equipment for any purpose other than that for which it is designed or is specified.
- C. Selection Criteria:
1. Products Specified Only By Reference Standard: select any product meeting that standard.
 2. Products Specified By Naming Several Products Or Manufacturers: select any one of the products or manufacturers named, which complies with the specifications; no options or substitutions.

3. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.
 - a. Other manufacturers' products may be accepted, provided sufficient information is submitted to allow the A/E to determine that products proposed as substitutions are equivalent to those named.
 - b. Contractor must submit written request for substitutions for any product or manufacturer not specifically named.
 - c. Proof of product equivalency is the Contractor's responsibility.
 - d. A/E and the named manufacturer (when manufacturer desires) shall be the judge of the acceptability of the proposed product substitution
4. Products specified by naming only one product and manufacturer: provide specified product
5. "Basis of Design" provides the performance and operational requirements of the system
 - a. Term indicates specific product or system used as basis for design
 - b. Manufactures listed as "Optional Manufactures" may submit their equivalent products, but only if product complies with specified requirements, including salient qualities of "Basis of Design Product."
 - c. Products proposed by "Optional" manufactures must also comply with descriptive requirements listed in technical specification.
 - d. Optional Products that obviously differ in appearance and quality of "Basis of Design Product" will be rejected.

1.09 REUSE OF EXISTING MATERIAL

- A. Except as specifically indicated or specified, materials and equipment removed from an existing structure shall not be used in the completed Work.
- B. For material and equipment specifically indicated or specified to be reused in the Work:
 1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
 2. Arrange for transportation, storage, and handling of products which require off-site storage, restoration or renovation. Include all costs for such work in the Bid.

1.10 MANUFACTURER'S INSTRUCTIONS

- A. When Contract Documents require installation of work to comply with manufacturer's instructions, such instructions must be included with:
 1. Shop drawing and/or product data submitted if an operation and maintenance manual is not required.
 2. Operation and maintenance data if required.

- B. Handle, install, connect, clean, condition, and adjust products in strict accordance with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with A/E for further instructions.
 - 2. Do not proceed with work without clear instructions.
- C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for Execution of the Work, including, but not limited to, the following:
1. Installation
 2. Field Engineering
 3. Cutting and Patching
 4. Protecting Installed Construction
 5. Progress Cleaning

1.02 INSTALLATION

- A. Utility Requirements:
1. The Contractor shall arrange for all spotting of lines by utility companies in advance of any excavation work.
 2. Verify utility requirements and characteristics of equipment are compatible with facility utilities. Coordinate work of various specification sections having interdependent requirements for installing, connecting to, and placing in service such equipment.
- B. Space Requirements:
1. Coordinate space requirements and installation of mechanical, electrical, and other work shown diagrammatically on Drawings. Follow routing shown for pipes, ducts, and wireways as closely as practicable. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs.
 2. Where space is limited, coordinate installation of components to ensure maximum access for maintenance. Ensure space provided around equipment and fixtures complies with applicable codes.
- C. Concealment: In finished areas, conceal pipes, ducts, and wire ways within construction except as otherwise indicated. Where practical, conceal supports, fasteners, and other attachment devices.
- D. Arrangement:
1. Unless otherwise indicated, installations shall be aligned vertically and horizontally. Place piping, conduit, wire ways, and other linear items parallel with lines of building.

2. Coordinate mounting heights and spacing of components so that finished work is neat and orderly with organized appearance.
 3. Repetitive items such as hangers and fasteners shall be equally spaced unless indicated otherwise.
- E. Blocking, anchors, and supports: Determine and coordinate requirements for blocking, anchors, and supports needed for proper installation of products. Provide necessary components whether or not indicated on Drawings or specified.
- F. Finished surfaces: Coordinate locations of fixtures, boxes, and other recessed or surface mounted items with finish elements and grades to ensure proper installation and neat appearance.
- G. Openings made in installed exterior surfaces shall be closed to protect construction from weather and extremes of temperature and humidity.

1.03 FIELD ENGINEERING

- A. Employ Registered Land Surveyor acceptable to Owner.
- B. Locate and protect survey control and reference points. Promptly notify A/E of discrepancies discovered.
- C. Control datum for survey is that shown on Drawings.
- D. Verify set-backs and easements; confirm drawing dimensions and elevations.
- E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- F. Maintain complete and accurate log of control and survey work as Work progresses.

1.04 CUTTING AND PATCHING

- A. Employ skilled and experienced installer to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements affecting:
1. Structural integrity of element.
 2. Integrity of weather-exposed or moisture-resistant elements.
 3. Efficiency, maintenance, or safety of element.
 4. Visual qualities of sight exposed elements.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
1. Fit the several parts together, to integrate with other Work.

2. Uncover Work to install or correct ill-timed Work.
 3. Remove and replace defective and non-conforming Work.
 4. Remove samples of installed Work for testing.
 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.
- E. Identify hazardous substances or conditions exposed during the Work to A/E for decision or remedy.
- F. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- G. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work. Remove debris and abandoned items from area and from concealed spaces.
- H. Cut masonry and concrete materials using masonry saw or core drill.
- I. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- J. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- K. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of penetrated element.
- L. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to original or specified condition. Restore Work with new products in accordance with requirements of Contract Documents.
1. Materials: As specified in product sections; match existing with new products and salvaged products for patching and extending work.
 2. Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.
 3. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.
 4. Prepare surface and remove surface finishes to permit installation of new work and finishes.

5. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.
6. Where new Work abuts or aligns with existing, provide smooth and even transition.
 - a. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to A/E for review.
 - b. Where change of plane of 1/4-inch or more occurs, submit recommendation for providing smooth transition; to A/E for review.
7. Patch Work to match existing adjacent Work in texture and appearance.
8. Trim existing doors to clear new floor finish. Refinish trim to specified condition.

M. Asphalt Pavement:

1. Where existing or new pavement is damaged from construction operations, cut to install new underground utilities and where existing items are removed from paved areas:
 - a. Cut pavement with saw or other means to provide neat, straight joints.
 - b. Where existing pavement is damaged by removals, remove additional pavement to allow clean cuts.
 - c. Backfill and sufficiently compact removal area prior to placement of pavement.
 - d. Place pavement to match existing materials and thickness.
 - e. Immediately after placement.

N. Special Roof Penetrations:

1. New roofing:
 - a. Coordinate, locate and schedule roof penetrations prior to installation of new roof system.
 - b. Coordinate roof penetrations such that installation does not void roof warranty.
2. Existing roofing:
 - a. Prior to penetrating, cutting, and patching existing roofing, verify with Owner if roof is under warranty. If warranted, employ roof contractor certified by manufacturer of roof system, make required inspections and notifications, and perform cutting and patching as required to ensure warranty is not violated.
 - b. Protect building interior during operations and return roof to weather tight condition after the work is performed.

1.05 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.

- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- F. Prohibit traffic from landscaped areas.

1.06 PROGRESS CLEANING

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.
- B. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- C. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- D. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
- E. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- F. Remove waste materials, debris, and rubbish from site weekly and legally dispose of off-site.
- G. Remove debris and rubbish from pipe chases, plenums, crawl spaces, above suspended ceilings, and other closed and remote spaces prior to enclosing space.
- H. Prior to surface finishing, broom and vacuum clean interior areas to eliminate dust.
- I. Washing of concrete trucks and dumping of excess cementitious material on site is not allowed. All such materials and contaminated soil shall be removed.
- J. Soils and other site material contaminated by paint residues, oils, fuels, and other construction products shall be removed and replaced with equivalent soil or material.

K. Existing lawns, landscaped areas, and areas for future landscaping affected by construction operations shall be raked to remove stones, mortars, aggregates, and other construction debris in excess of 3/4 inch diameter.

L. Clean mud and sediment resulting from Contractor's operations or traffic from all sidewalks, public streets and parking areas.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 70 00

SECTION 01 75 00

STARTING AND ADJUSTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for:

1. Starting of Systems
2. Testing, Adjusting and Balancing

1.02 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Owner seven days prior to start-up of each item.

C. Prior to startup, inspect items of equipment and systems to ensure that:

1. Installation is in accordance with manufacturer's instructions.
2. No defective items have been installed and there are no loose connections.
3. Power supplies are correct voltage, phasing, and frequency.
4. Grounding and transient protection systems are properly installed.
5. Items have been properly lubricated, belts tensioned, and control sequence and other conditions which may cause damage have been addressed.
6. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
7. Verify wiring and support components for equipment are complete and tested.
8. Verify that provisions have been made for safety of personnel.

D. Execute start-up under supervision in accordance with manufacturers' instructions.

1. When specified in individual sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment and system installation prior to startup and to supervise placing equipment and system in operation.
2. Adjustment: Monitor systems and verify performance. Correct deficiencies. Replace defective components and equipment. Adjust equipment and systems for smooth and proper installation.
3. Submit written report in accordance with Submittal Procedures that equipment and systems have been properly installed and are functioning correctly

1.03 TESTING, ADJUSTING AND BALANCING

A. Independent firm will perform testing, balancing and adjusting services specified in other sections.

- B. Reports will be submitted by independent firm to A/E indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 75 00

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Closeout Procedures
 2. Final Cleaning
 3. Final Completion and Inspection
 4. Maintenance service
 5. Correction Period Inspection

1.02 CLOSEOUT PROCEDURES

- A. Substantial Completion:
1. Preliminary Procedures: Prior to requesting A/E's inspection for certification of substantial completion (for either entire work or portions thereof), complete the following and list known exceptions in request:
 - a. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - b. Advise Owner of pending insurance change-over requirements.
 - c. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
 - d. Obtain and submit releases enabling Owner's full and unrestricted use of the work and access to services and utilities, including occupancy permits, operating certificates, and similar releases.
 - e. Prepare and submit Project Record Documents, operation and maintenance manuals, and similar final record information.
 - f. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - g. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - h. Complete startup testing of systems.
 - i. Submit test/adjust/balance records.
 - j. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - k. Advise Owner of changeover in heat and other utilities.
 - l. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- m. Complete final cleaning requirements, including touchup painting.
 - n. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - 2. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, A/E will either proceed with inspection or notify Contractor of unfulfilled requirements. A/E will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor' list or additional items identified by A/E, that must be completed or corrected before certificate will be issued.
 - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - b. Results of completed inspection will form the basis of requirements for Final Completion.
- B. List of Incomplete Items (Punch List):
- 1. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction:
 - a. Organize list of spaces in sequential order, starting with exterior areas first then proceeding from lowest to highest room number.
 - b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.03 FINAL CLEANING

- A. Employ experienced workers or professional cleaners for final cleaning.
 - 1. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program.
 - 2. Comply with manufacturer's written instructions.
- B. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
- C. Replace filters of operating equipment.
- D. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - 1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove tools, construction equipment, machinery, and surplus material from Project site.
5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
7. Sweep concrete floors broom-clean in unoccupied spaces.
8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
9. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
10. Remove labels that are not permanent.
11. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - b. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - c. Replace parts subject to unusual operating conditions.
 - d. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - e. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - f. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - g. Leave Project clean and ready for occupancy.

E. Comply with Safety Standards for Cleaning:

1. Do not burn waste materials.
2. Do not bury debris or excess materials on Owner's property.
3. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
4. Remove waste materials from Project site and dispose of lawfully.

- F. Removal of Protection: Except as otherwise indicated or requested by A/E/Engineer, remove temporary protection devices and facilities which were installed during course of the work.
- G. Compliances: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at site, or bury debris or excess materials on Owner's property, or discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from site and dispose of in a lawful manner.
- H. Where extra materials of value remaining after completion of associated work have become Owner's property, dispose of these to Owner's best advantage as directed.

1.04 FINAL COMPLETION

- A. Preliminary Procedures:
 - 1. Submit a final Application for Payment according to Section 01 29 00 Payment Procedures. Submit with final releases, waivers and consents.
 - 2. Submit certified copy of A/E's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by A/E. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 - 4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 5. Notify Owner and request change over in insurance, utilities, and security; send copy of notice to A/E.
 - 6. Submit insurance certificates for products and completed operations as required by Specification Sections.
 - 7. Submit complete close-out package per Section 01 78 00 Closeout Submittals.
 - 8. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems per Section 01 79 00 Demonstration and Training.

1.05 FINAL INSPECTION

- A. Submit a written request for final inspection for acceptance. On receipt of request, A/E will either proceed with inspection or notify Contractor of unfulfilled requirements. A/E will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

- B. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.06 MAINTENANCE SERVICE

- A. Furnish service and maintenance of components indicated in specification sections for specified period from date of Substantial Completion.
- B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
- D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

1.07 CORRECTION PERIOD INSPECTION

- A. 30 days prior to end of one year correction period, schedule and attend a one year correction period inspection. Appropriate subcontractors shall attend.
- B. Coordinate time of inspection with A/E.
- C. Representatives of Owner, A/E, and appropriate consultants will attend.
- D. Correct deficiencies shall be noted and addressed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 77 00

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following Closeout Submittals:
1. Project Record Documents
 2. Operation and Maintenance Manuals
 3. Tools, Spare Parts, Maintenance and Extra Stock Products
 4. Warranties
 5. Certificates of Inspection and Compliance

1.02 PROJECT RECORD DOCUMENTS

- A. General:
1. Do not use Project Record Documents for construction purposes. Store Record Documents and Samples in the field office apart from the Contract Documents used for construction.
 2. Protect Project Record Documents from deterioration and loss.
 3. Provide access to Project Record Documents for A/E reference during normal working hours.
 4. Maintain one (1) copy of each document type during construction period for Project Record Document purposes.
 5. Post changes and modifications to Project Record Documents on a weekly basis.
- B. Record Drawings: Maintain and submit one (1) set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 1) Clearly describe the change by note and by graphic line, as required.
 - 2) Date all entries.

- 3) Call attention to the entry by a “cloud” around the area or areas affected.
- 4) In the event of overlapping changes, different colors may be used for each of the changes.
- d. Where changes are caused by Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification, clearly indicate the change by note in ink, colored pencil, or rubber stamp.
- e. Where changes are caused by Contractor-originated proposals approved by the A/E, including inadvertent errors by the Contractor which have been accepted by the A/E, clearly indicate the change by note in erasable colored pencil.
- f. Because design of future modifications to the facility may require accurate information as to the final physical arrangement of items which were originally drawn schematically on the Drawings convert schematic layouts to show its final physical arrangement.
- g. Show on the job set of Record Drawings, by dimension accurate to within 1 inch, the centerline of each run of items described in the preceding paragraph. Clearly identify the item by accurate note such as “3” cast iron water main”, etc. Show, by symbol or note, the vertical control elevation of the item. Make all identification sufficiently descriptive that it may be related reliably to the specifications.
- h. The A/E may waive the requirements for conversion of schematic data where, in the A/E’s judgment, such conversion serves no beneficial purpose. A/E will issue a written waiver when this applies.
- i. Identify and date each Record Drawing; include the designation “PROJECT RECORD DRAWING” in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- j. Submit documents to A/E prior to or in conjunction with submission of Contractor’s request for Substantial Completion and in accordance with Owner’s procedures.

- C. Record Specifications: Submit one (1) copy of Project’s Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Note related Change Orders and Record Drawings, where applicable.

- D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work Bind or file miscellaneous records and identify each, ready for continued use and reference. Include the following:
1. Addenda.
 2. Change Orders and other modifications to the Contract.
 3. Reviewed Shop Drawings, Product Data, and Samples.
 4. Manufacturer's instruction for assembly, installation, and adjusting.
 5. Test and Inspection Reports.
 6. Design Mix Records.
 7. Inspections by Authority having Jurisdiction.

1.03 OPERATION AND MAINTENANCE MANUALS

- A. General:
1. Submit two (2) copies of each manual in final form at least 10 days before final inspection. A/E will return copy with comments.
 2. Correct or modify each manual to comply with comments. Submit two (2) copies of each corrected manual within 10 days of receipt of A/E's comments.
- B. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
1. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
- C. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.
1. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 2. Subject matter included in manual.
 3. Name and address of Project.
 4. Name and address of Owner.
 5. Date of submittal.
 6. Name, address, and telephone number of Contractor.

7. Name and address of A/E.
 8. Table of Contents: List each product included in manual, identified by product name, indexed to content of volume, and cross-referenced to Specification Section number in Project Manual.
 9. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 10. Include information needed for daily operations and management of systems and equipment. In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
 11. Include the following:
 - a. Product name and model number.
 - b. Manufacturer's name.
 - c. Equipment identification with serial number of each component.
 - d. Equipment function.
 - e. Operating characteristics.
 - f. Limiting conditions.
 - g. Performance curves.
 - h. Engineering data and tests.
 - i. Complete nomenclature and number of replacement parts.
 12. Operating Procedures: Include startup, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
 13. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
 14. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.
- D. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
1. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 2. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. Include the following in combined or separate manuals:
1. Manual for materials and finishes:
 2. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations.

3. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
4. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
5. Manual for equipment and systems.
6. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
7. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.
8. Include color coded wiring diagrams as installed.
9. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
10. Include control diagrams by controls manufacturer as installed.
11. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
12. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
13. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

1.04 TOOLS, SPARE PARTS, MAINTENANCE AND EXTRA STOCK PRODUCTS

- A. Furnish tools, spare parts, maintenance, extra products and computer programming materials in quantities specified in individual specification sections and deliver to Owner.
 1. Provide list of tools, spare parts, maintenance materials, extra stock and computer programming, materials for review by A/E.
- B. Deliver to Project site and place in location as directed by Owner, extra stock as specified in sections.
 1. Owner's Representative will log in materials as delivered.
 2. Obtain receipt for delivered materials.

1.05 WARRANTIES

- A. Submittal Time: Submit written warranties on request of A/E or designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.06 CERTIFICATES OF INSPECTION AND COMPLIANCE

- A. For inspections throughout the construction period required by regulatory agencies, obtain and maintain certificates issued to show compliance.
- B. Assemble certificates and any formal written evidence of regulatory compliance in three ring binder with table of contents and submit to A/E prior to or in conjunction with submission of Notice of Substantial Completion.
 - 1. Include Contractor's Certification that all work has been performed in compliance with the New Mexico Building Code, current edition and all of its referenced codes including, but limited to IBC, UPC, UMC, NEC.
- C. Certificate of Occupancy: Prior to Substantial Completion, obtain Certificate of Occupancy from authorities having jurisdiction. Submit with Notice for Substantial Completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 78 00

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for Demonstration of Equipment and Systems and Training of Owner's Personnel.

1.02 DEMONSTRATION AND TRAINING SCHEDULING

- A. Schedule demonstration and training sessions after equipment and systems have been completely installed, startup completed, and adjustments made prior to date of Substantial Completion.
 - 1. Submit list of names, resumes, and qualifications of personnel conducting training sessions. Provide instructors experienced in operation and maintenance procedures.
 - 2. Submit preliminary schedule listing times, dates, and outline showing organization and proposed contents of training sessions for approval by A/E and Owner.
 - 3. Provide instruction at mutually agreed-on times.
 - 4. Required instruction time for each item of equipment and system is specified in individual sections.
- B. Owner shall be responsible for designating and notifying personnel to attend and ensuring attendance at scheduled sessions.

1.03 TRAINING MATERIALS

- A. Training manuals: Loose leaf notebook format with agenda and objectives of each lesson.
 - 1. Manuals shall describe function, operation, and maintenance of various items of equipment and be suitable for personnel with high school education.
 - 2. Manuals shall be suitable for future training of Owner personnel by Owner staff.
 - 3. Manuals shall useful reference for staff maintaining facility.
 - 4. Provide 3 copies.
- B. Visual aids: Provide charts, handouts, overhead projector slides, electronic presentations, and other visual aids required to make effective presentation and facilitate training.

1. Equipment needed for showing visual training aids shall be provided by Contractor.
 2. Visual aids shall be suitable for use by Owner's staff to train additional personnel in the future.
- C. Submit report within 1 week after completion of training that sessions have been satisfactorily completed. Give times, dates, list of persons trained, and summary of instructions.
- D. For equipment or systems requiring seasonal operation, perform demonstration for all seasons.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction

1.04 DEMONSTRATION AND TRAINING SESSIONS

- A. Provide demonstration and training session to emphasize operation, use, and maintenance of installed items and systems:
1. Mechanical systems specified in respective divisions
 2. Electrical systems specified in respective division.
 3. Fire protection systems specified in respective divisions
 4. Other items and systems as designated by A/E or requested by Owner.
- B. Conduct at project site using actual installed equipment and systems.
- C. Have copies of operation and maintenance manuals available. Use as training aids.
- D. Owner shall have right to record or video tape demonstration and training sessions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 79 00

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Demolishing designated building equipment and fixtures.
 - 2. Demolishing designated construction.
 - 3. Removing designated items for reuse and Owner's retention.
 - 4. Protecting items designated to remain.
 - 5. Removing demolished materials.
- B. Related Work:
 - 1. Section 01 31 00: Project Management and Coordination
 - 2. Section 01 33 00: Submittal Procedures: Requirements for submittals.
 - 3. Section 01 70 00: Cutting and Patching

1.02 CONSTRUCTION SUBMITTALS

- A. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.
- B. Where Work of this Section involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
- C. Submit list of utilities and systems that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

1.03 CLOSEOUT SUBMITTALS

- A. Section 01 78 00 Closeout Submittals: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.
- C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.04 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- E. Cutting and Patching: Removal of portions of existing construction as required to accommodate the Work.

1.05 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.06 QUALITY ASSURANCE

- A. Conform to current applicable codes for demolition work, dust control, and products requiring utility disconnection and re-connection.
- B. Conform to current applicable codes for procedures when hazardous or contaminated materials are discovered.
- C. Obtain required permits from authorities having jurisdiction.

1.07 PRE-DEMOLITION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.08 SEQUENCING

- A. Owner will conduct salvage operations before demolition begins to remove materials Owner chooses to retain.

1.09 SCHEDULING

- A. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation in adjoining spaces.
- B. Provide Owner with timely notice of noisy, malodorous, and dusty, work.

- C. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.
 - 3. Coordinate Work to ensure fire protection systems, emergency lighting, exit signs and other life safety systems remain in operation in occupied areas.

1.10 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent [and occupied] building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

- A. Notify affected utility companies before starting work and comply with their requirements.
- B. Mark location and termination of utilities.
- C. Erect, and maintain temporary barriers and security devices at locations indicated, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.
- D. Erect and maintain weatherproof closures for exterior openings.
- E. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- F. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- G. Provide appropriate temporary signage including signage for exit or building egress.
- H. Do not close or obstruct building egress path.
- I. Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

3.02 SALVAGING REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be

- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.03 DEMOLISHING

- A. Conduct work to minimize interference with adjacent occupied building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Do not close or obstruct roadways and sidewalks without permits.
- D. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer
- E. Disconnect and remove designated utilities within demolition areas.
- F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- G. Demolish in orderly and careful manner. Protect existing improvements and supporting structural members
- H. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.
- I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

- J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- K. Remove temporary Work.
- L. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work. Cut finished surfaces such as masonry, tile, plaster and metals, by methods to terminate surfaces in a straight line at a natural point of division.
- M. Protect from damage existing finishes, equipment, and adjacent work scheduled to remain. Protect existing and new work from weather and extremes of temperature.
- N. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Proceed with patching after construction operations requiring cutting are complete.

3.04 SCHEDULES

- A. Remove the following and salvage to the Owner:
 - 1. Security cameras on and around building exterior
 - 2. Dish receiver/parabolic antenna
- B. Protect materials and equipment remaining.
- C. Relocate equipment noted to be relocated.
- D. Demolish materials, equipment and construction as shown on the Drawings.
- E. Dispose of debris.

END OF SECTION 02 41 19

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

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PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes for the building.
- B. Cast-in-place concrete includes the following:
 - 1. Foundations and footings.
 - 2. Slabs-on-grade.
 - 3. Equipment pads and bases.

1.03 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

. REVISE BELOW TO SUIT PROJECT.

- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.

. DELETE BELOW IF NOT REQUIRED. REVIEW WITH GOVERNING AUTHORITIES CONCERNING DESIGN RESPONSIBILITY.

- C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

. DELETE BELOW IF NOT REQUIRED. INDICATE LOCATION OF SPECIALTY FINISHES.

- D. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.

1. Architect's review is for general architectural applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

- E. Samples of materials as requested by Architect, including names, sources, and descriptions, as follows:

1. Reglets.
2. Vapor retarder/barrier.

. RETAIN BELOW UNLESS LABORATORY TESTS ARE DELETED FROM SPECIFICATIONS.

- F. Laboratory test reports for concrete materials and mix design test.

. DELETE BELOW IF LABORATORY TEST REPORTS ARE REQUIRED FOR ALL MATERIALS.

- G. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

. DELETE BELOW IF THERE IS NO PREINSTALLATION CONFERENCE.

- H. Minutes of preinstallation conference.

. ADD PROVISIONS FOR SPECIAL FINISH MOCKUPS IF REQUIRED.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- . REVISE BELOW IF OWNER PROVIDES TEST LAB SERVICES OR IF TESTING IS PROVIDED UNDER "ALLOWANCES." COORDINATE WITH QUALITY CONTROL TESTING IN PART 3.
- B. Concrete Testing Service: Engage a testing agency acceptable to Architect to perform material evaluation tests and to design concrete mixes.
- C. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.
- . BELOW IS DESIRABLE FOR MAJOR CONCRETE INSTALLATIONS. CONFERENCE CAN HELP MINIMIZE POSSIBILITY OF MISUNDERSTANDINGS AND PROJECT CONDITIONS THAT MIGHT OTHERWISE LEAD TO SIGNIFICANT PROBLEMS.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Coordination" and the following:
1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
 - a. Contractor's superintendent.
 - b. Agency responsible for concrete design mixes.
 - c. Agency responsible for field quality control.
 - d. Ready-mix concrete producer.
 - e. Concrete subcontractor.
 - f. Primary admixture manufacturers.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than **1-1/2 inches** to the plane of the exposed concrete surface.
 - 1. Provide ties that, when removed, will leave holes not larger than **1 inch** in diameter in the concrete surface.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: **ASTM A 615 Grade**, deformed.
- B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
 - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
 - 1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.
- B. Fly Ash: ASTM C 618, Type F.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
 - 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
 - 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
- D. Water: Potable.
- E. Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Air-Tite, Cormix Construction Chemicals.
 - b. Air-Mix or Perma-Air, Euclid Chemical Co.
 - c. Darex AEA or Daravair, W.R. Grace & Co.
 - d. MB-VR or Micro-Air, Master Builders, Inc.
 - e. Sealtight AEA, W.R. Meadows, Inc.
 - f. Sika AER, Sika Corp.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Chemtard, ChemMasters Corp.
 - b. PSI N, Cormix Construction Chemicals.
 - c. Eucon WR-75, Euclid Chemical Co.
 - d. WRDA, W.R. Grace & Co.
 - e. Pozzolith Normal or Polyheed, Master Builders, Inc.
 - f. Metco W.R., Metalcrete Industries.
 - g. Prokrete-N, Prokrete Industries.
 - h. Plastocrete 161, Sika Corp.

- H. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Super P, Anti-Hydro Co., Inc.
 - b. Cormix 200, Cormix Construction Chemicals.
 - c. Eucon 37, Euclid Chemical Co.
 - d. WRDA 19 or Daracem, W.R. Grace & Co.
 - e. Rheobuild or Polyheed, Master Builders, Inc.
 - f. Superslump, Metalcrete Industries.
 - g. PSPL, Prokrete Industries.
 - h. Sikament 300, Sika Corp.
- I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Q-Set, Conspec Marketing & Manufacturing Co.
 - b. Lubricon NCA, Cormix Construction Chemicals.
 - c. Accelguard 80, Euclid Chemical Co.
 - d. Daraset, W.R. Grace & Co.
 - e. Pozzutec 20, Master Builders, Inc.
 - f. Accel-Set, Metalcrete Industries.
- J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. PSI-R Plus, Cormix Construction Chemicals.
 - b. Eucon Retarder 75, Euclid Chemical Co.
 - c. Daratard-17, W.R. Grace & Co.
 - d. Pozzolith R, Master Builders, Inc.
 - e. Protard, Prokrete Industries.
 - f. Plastiment, Sika Corporation.

2.04 RELATED MATERIALS

- A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch- thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- C. Sand Cushion: Clean, manufactured or natural sand.

- D. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:
1. Polyethylene sheet not less than 6 mils thick.
- E. Vapor Barrier: Premolded seven-ply membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weathercoating, and plastic antistick sheet. Water vapor transmission rate of 1 perm when tested according to ASTM E 96, Method B. Provide manufacturer's recommended mastics and gusset tape.
1. Product: Subject to compliance with requirements, provide Sealtight Premoulded Membrane by W.R. Meadows, Inc.
- F. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd., complying with AASHTO M 182, Class 2.
- G. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Waterproof paper.
 2. Polyethylene film.
 3. Polyethylene-coated burlap.
- H. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. m when applied at 200 sq. ft./gal.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. A-H 3 Way Sealer, Anti-Hydro Co., Inc.
 - b. Spartan-Cote, The Burke Co.
 - c. Conspec #1, Conspec Marketing & Mfg. Co.
 - d. Sealco 309, Cormix Construction Chemicals.
 - e. Day-Chem Cure and Seal, Dayton Superior Corp.
 - f. Eucocure, Euclid Chemical Co.
 - g. Horn Clear Seal, A.C. Horn, Inc.
 - h. L&M Cure R, L&M Construction Chemicals, Inc.
 - i. Masterkure, Master Builders, Inc.
 - j. CS-309, W.R. Meadows, Inc.
 - k. Seal N Kure, Metalcrete Industries.
 - l. Kure-N-Seal, Sonneborn-Chemrex.
 - m. Stontop CS2, Stonhard, Inc.
- I. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.
1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.
 2. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Highseal, Conspec Marketing and Mfg. Co.

- b. Sealco - VOC, Cormix Construction Chemicals.
 - c. Safe Cure and Seal, Dayton Superior Corp.
 - d. Aqua-Cure, Euclid Chemical Co.
 - e. Dress & Seal WB, L&M Construction Chemicals, Inc.
 - f. Masterkure 100W, Master Builders, Inc.
 - g. Vocomp-20, W.R. Meadows, Inc.
 - h. Metcure, Metalcrete Industries.
 - i. Stontop CS1, Stonhard, Inc.
- J. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Aquafilm, Conspec Marketing and Mfg. Co.
 - b. Eucobar, Euclid Chemical Co.
 - c. E-Con, L&M Construction Chemicals, Inc.
 - d. Confilm, Master Builders, Inc.
 - e. Waterhold, Metalcrete Industries.
- K. Bonding Agent: Polyvinyl acetate or acrylic base.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Polyvinyl Acetate (Interior Only):
 - 1) Superior Concrete Bonder, Dayton Superior Corp.
 - 2) Euco Weld, Euclid Chemical Co.
 - 3) Weld-Crete, Larsen Products Corp.
 - 4) Everweld, L&M Construction Chemicals, Inc.
 - 5) Herculox, Metalcrete Industries.
 - 6) Ready Bond, Symons Corp.
 - b. Acrylic or Styrene Butadiene:
 - 1) Acrylic Bondcrete, The Burke Co.
 - 2) Strongbond, Conspec Marketing and Mfg. Co.
 - 3) Day-Chem Ad Bond, Dayton Superior Corp.
 - 4) SBR Latex, Euclid Chemical Co.
 - 5) Daraweld C, W.R. Grace & Co.
 - 6) Hornweld, A.C. Horn, Inc.
 - 7) Everbond, L&M Construction Chemicals, Inc.
 - 8) Acryl-Set, Master Builders Inc.
 - 9) Intralok, W.R. Meadows, Inc.
 - 10) Acrylpave, Metalcrete Industries.
 - 11) \Sonocrete, Sonneborn-Chemrex.
 - 12) Stonlock LB2, Stonhard, Inc.
 - 13) Strong Bond, Symons Corp.

- L. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a. Burke Epoxy M.V., The Burke Co.
 - b. Spec-Bond 100, Conspec Marketing and Mfg. Co.
 - c. Resi-Bond (J-58), Dayton Superior.
 - d. Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - e. Epoxitite Binder 2390, A.C. Horn, Inc.
 - f. Epabond, L&M Construction Chemicals, Inc.
 - g. Concrevice Standard Liquid, Master Builders, Inc.
 - h. Rezi-Weld 1000, W.R. Meadows, Inc.
 - i. Metco Hi-Mod Epoxy, Metalcrete Industries.
 - j. Sikadur 32 Hi-Mod, Sika Corp.
 - k. Stonset LV5, Stonhard, Inc.
 - l. R-600 Series, Symons Corp.

2.05 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
1. Do not use the same testing agency for field quality control testing.
 2. Limit use of fly ash to not exceed 25 percent of cement content by weight.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect.
- C. Design mixes to provide normal weight concrete with the following properties as indicated on drawings and schedules:
1. 3000 psi, 28-day compressive strength; water-cement ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained).
- D. Water-Cement Ratio: Provide concrete for following conditions with maximum water-cement (W/C) ratios as follows:
1. Subjected to freezing and thawing: W/C 0.45.
 2. Subjected to deicers/watertight: W/C 0.40.
 3. Subjected to brackish water, salt spray, or deicers: W/C 0.40.
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramps, slabs, and sloping surfaces: Not more than 3 inches.

2. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
 3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 - 3 inch slump concrete.
 4. Other concrete: Not more than 4 inches.
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.06 ADMIXTURES

- A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F.
- C. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- D. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
 1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
 - a. 4.5 percent (moderate exposure); 5.5 percent (severe exposure) for 1-1/2 inch maximum aggregate.
 - b. 4.5 percent (moderate exposure); 6.0 percent (severe exposure) for 1 inch maximum aggregate.
 - c. 5.0 percent (moderate exposure); 6.0 percent (severe exposure) for 3/4 inch maximum aggregate.
 - d. 5.5 percent (moderate exposure); 7.0 percent (severe exposure) for 1/2 inch maximum aggregate.
 2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.
- E. Use admixtures for water reduction and set accelerating or retarding in strict compliance with manufacturer's directions.

2.07 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.02 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

- F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.03 VAPOR RETARDER/BARRIER INSTALLATION

- A. General: Place vapor retarder/barrier sheeting in position with longest dimension parallel with direction of pour.
- B. Lap joints **6 inches** and seal with manufacturer's recommended mastic or pressure-sensitive tape.
 - 1. Cover vapor retarder/barrier with sand cushion and compact to depth indicated.

3.04 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
 - 1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.05 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
- B. Provide keyways at least **1-1/2 inches** deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."
- F. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown. Use saw cuts **1/8 inch** wide by one-fourth of slab depth or inserts **1/4 inch** wide by one-fourth of slab depth, unless otherwise indicated.
 - 1. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
 - 2. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
 - 3. If joint pattern is not shown, provide joints not exceeding **15 ft.** in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
 - 4. Joint fillers and sealants are specified in Division 7 Section "Elastomeric Sealants."

3.06 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

- B. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- C. Install dovetail anchor slots in concrete structures as indicated on drawings.
- D. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.07 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.08 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible

effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

- E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 3. Maintain reinforcing in proper position on chairs during concrete placement.
- F. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- G. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 2. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F. Mixing water may be chilled 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. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.09 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding [1/4 inch](#) in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
 - 1. Combine one part portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
 - 2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
 - 1. After placing slabs, finish surface to tolerances of F(F) 15 (floor flatness) and F(L) 13 (floor levelness) measured according to [ASTM E 1155](#). Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 18 (floor flatness) and F(L) 15 (floor levelness) measured according to [ASTM E 1155](#). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F(F) 20 (floor flatness) and F(L) 17 (floor levelness) measured according to [ASTM E 1155](#). Grind smooth any surface defects that would telegraph through applied floor covering system.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

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

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
- D. Provide moisture curing by the following methods:
 - 1. Keep concrete surface continuously wet by covering with water.
 - 2. Use continuous water-fog spray.
 - 3. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.
- E. Provide moisture-retaining cover curing as follows:
 - 1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- F. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:
 - 1. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 2. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

- G. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- H. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
 - 1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.13 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.14 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

3.15 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.

- B. Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 2. For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas 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.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces 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. Proprietary underlayment compounds may be used when acceptable to Architect.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with

patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

- E. Perform structural repairs with prior approval of Architect for method and procedure, using specified epoxy adhesive and mortar.
- F. Repair methods not specified above may be used, subject to acceptance of Architect.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. Laboratory tests for concrete materials and mix design will be performed in accordance with Section 01 45 23 Testing Laboratory Services.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Architect.
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 - c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below, when 80 deg F and above, and one test for each set of compressive-strength specimens.
 - d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- E. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 04 00 00

UNIT MASONRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Concrete unit masonry.
 - 2. Reinforced unit masonry.
- B. Products furnished but not installed under this Section include the following:
 - 1. Dovetail slots for masonry anchors installed under Division 3 Section "Cast-in-Place Concrete."
- C. Allowances: Furnish the following under the allowances indicated as specified in Division 1 Section "Allowances."
 - 1. Source and field quality-control testing under the Inspection and Testing Allowance.

1.03 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f_m) at 28 days.
 - 1. For Concrete Unit Masonry: As follows, based on net area:
 - a. $f_m = 1900$ psi.

1.04 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each different masonry unit, accessory, and other manufactured product specified.

- C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
- D. Material certificates for the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.
 - 1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 2. Each material and grade indicated for reinforcing bars.
 - 3. Each type and size of joint reinforcement.
 - 4. Each type and size of anchors, ties, and metal accessories.
- E. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
 - 1. Mortar complying with property requirements of ASTM C270.
 - 2. Mortar complying with BIA M1.
 - 3. Grout mixes. Include description of type and proportions of grout ingredients.
 - 4. Masonry units.

1.05 QUALITY ASSURANCE

- A. Provide a survey and inspection of foundations for compliance with dimensional tolerances.
- B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:
 - 1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
 - a. 40 to 32 deg F (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).
 - b. 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry.
 - c. 25 to 20 deg F (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in

masonry. Heat masonry units to 40 deg F (4 deg C) if grouting. Use heat on both sides of walls under construction.

- d. 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F (0 deg C) within the enclosures.
2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
 - a. 40 to 25 deg F (4 to -4 deg C): Cover masonry with a weather-resistant membrane for 48 hours after construction.
 - b. 25 to 20 deg F (-4 to -7 deg C): Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h (25 km/h).
 - c. 20 deg F (-7 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after construction.
3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and above.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Concrete Masonry Units:
 - a. Burns & Russell Co.
 - b. Trenwyth Industries, Inc.
 - c. CSR Crego
 - d. Utility Block Company, Inc.

2. Portland Cement, Mortar Cement, Masonry Cement, and Lime:
 - a. Essroc Materials, Inc.
 - b. Glen-Gery Corporation.
 - c. Lafarge Corporation.
 - d. Lehigh Portland Cement Co.
 - e. Riverton Corporation (The).
3. Joint Reinforcement, Ties, and Anchors:
 - a. AA Wire Products Co.
 - b. Dur-O-Wal, Inc.
 - c. Heckman Building Products, Inc.
 - d. Hohmann & Barnard, Inc.
 - e. Masonry Reinforcing Corp. of America.
 - f. National Wire Products Industries.
 - g. Southern Construction Products.

2.02 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.
 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners, unless otherwise indicated.
 3. Provide square-edged units for outside corners, except where indicated as bullnose.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated below:
 - a. 1900 psi.
 2. Weight Classification: Normal weight.
 3. Provide Type I, moisture-controlled units.
 4. Color as specified by Architectural Drawings.
 5. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:
 - a. 6 inch nominal: 5-5/8 inch actual.
 - b. 8 inch nominal: 7-5/8 inch actual.
 - c. 12 inch nominal: 11-5/8 inch actual.

2.03 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Masonry Cement: ASTM C91.
- C. Mortar Cement: U.B.C. Standard No. 21-14.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C207.
- F. Aggregate for Mortar: ASTM C144; except for joints less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 1. White-Mortar Aggregates: Natural white sand or ground white stone.
- G. Aggregate for Grout: ASTM C404.
- H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.
- I. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C1142.
- J. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for, and approved by manufacturer of, structural clay tile facing units; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
- L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMU, containing integral water repellent by same manufacturer.
- M. Water: Potable.
- N. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- O. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Cold-Weather Admixture:
 - a. Accelguard 80; Euclid Chemical Co.
 - b. Morset; Grace: W.R. Grace & Co.

- 2. Water-Repellent Admixture:
 - a. Dry-Block Mortar Admixture; Grace: W.R. Grace & Co.

2.04 REINFORCING STEEL

- A. Steel Reinforcing Bars: Material and grade as follows:
 - 1. Billet steel complying with ASTM A615.
 - a. Grade 60.
- B. Deformed Reinforcing Wire: ASTM A496, with ASTM A153, Class B-2 zinc coating.
- C. Welded-Wire Fabric: ASTM A185.

2.05 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement formed from the following:
 - 1. Galvanized carbon-steel wire, coating class as follows:
 - a. ASTM A641, Class 1, for interior walls; and ASTM A153, Class B-2, for exterior walls.
 - b. ASTM A153, Class B-2, for both interior and exterior walls.
- B. For single-wythe masonry, provide type as follows with single pair of side rods:
 - 1. Ladder design with perpendicular cross rods spaced not more than 16 inches o.c.
- C. For multi-wythe masonry, provide type as follows:
 - 1. Ladder design with perpendicular cross rods spaced not more than 16 inches o.c.

2.06 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.
- B. Wire: As follows:
 - 1. Galvanized Carbon-Steel Wire: ASTM A82; with ASTM A 153, Class B-2 coating.
 - 2. Galvanized Carbon-Steel Wire: ASTM A82; with ASTM A 153, Class B-2 coating for wire ties and anchors in exterior walls.
 - a. Wire Diameter: 0.1875 inch.

2.07 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron inserts of type and size indicated.

- B. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet.
- C. Anchor Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153, Class C; of diameter and length indicated and in the following configurations:
 - 1. Headed bolts.

2.08 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Type 2, Class A, Grade 1; compressible up to 35 percent; of width and thickness indicated; formulated from the following material:
 - 1. Neoprene.
 - 2. Urethane.
 - 3. Polyvinyl chloride.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1. Styrene-Butadiene Rubber Compound: ASTM D2000, Designation M2AA-805.
 - 2. Polyvinyl Chloride: ASTM D2287, General Purpose Grade, Type PVC-65406.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

2.09 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.
 - 1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
 - 2. For dark-colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
 - 3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.

4. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
5. Products: Subject to compliance with requirements, provide one of the following:
 - a. 202 New Masonry Detergent; Diedrich Technologies, Inc.
 - b. 200 Lime Solv; Diedrich Technologies, Inc.
 - c. 202V Vana-Stop; Diedrich Technologies, Inc.
 - d. Sure Klean No. 600 Detergent; ProSoCo, Inc.
 - e. Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.
 - f. Sure Klean Vana Trol; ProSoCo, Inc.

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, in order to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification, for types of mortar indicated below:
 1. Type: S. – above grade.
- C. Grout for Unit Masonry: Comply with ASTM C476. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.
 1. Use fine grout in grout spaces less than 2 inches in horizontal dimension, unless otherwise indicated.
 2. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.

2.11 SOURCE QUALITY CONTROL

- A. The Contractor will employ and pay a qualified independent testing agency to perform the following testing for source quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested for strength, absorption, and moisture content per ASTM C140.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.
- C. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

3.03 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet, nor 1/2 inch maximum.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For top surface of bearing walls, do not exceed 1/8 inch in 10 feet, nor 1/16 inch within width of a single unit.

- C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet, nor 3/4 inch in 40 feet or more.
- D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/2 inch.
- E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch. Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch. Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch. Do not vary from collar-joint thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.
- E. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- F. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

- H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
 - 4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
 - 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.
- C. Cut joints flush for masonry walls that are to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.06 HORIZONTAL-JOINT REINFORCEMENT

- A. General: Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

- B. Form control joints in concrete masonry as follows:
 - 1. Fit bond-breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.

3.08 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes structural steel and grout.

1.02 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
- C. Welding certificates.
- D. Mill test reports.
- E. Source quality-control test reports.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code – Steel".
- C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- D. Pre-Installation Conference: Conduct conference at Architect's Office.

PART 2 PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M or ASTM A 572-A 572M, Grade 50.
- B. Channels, Angles, M, S-Shapes: ASTM A 36, or ASTM A 572, A 572M, Grade 50.
- C. Plate and Bar: ASTM A 36 or ASTM A 572, Grade 50.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
 - 1. Finish: Plain.
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type.
 - a. Finish: Plain.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight or Hooked as indicated.
 - 2. Finish: Plain.
- D. Headed Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Finish: Plain.
- E. Threaded Rods: ASTM A 193.
 - 1. Finish: Plain.

2.03 PRIMER

- A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.
- B. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer.

2.04 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.06 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.07 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials.
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning".
 - 2. SSPC-SP 3, "Power Tool Cleaning".

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.08 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 3, Article "Field Quality Control."
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding.

PART 3 EXECUTION

3.01 ERECTION

- A. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges".
- C. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.02 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION

SECTION 05 30 00

STEEL DECK

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Roof Deck.
 - 2. Floor Deck

1.02 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Include layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- C. Product certificates.
- D. Welding certificates.
- E. Research/evaluation reports.

1.03 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- B. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BHP Steel Building Products USA Inc.
 - 2. Consolidated Systems, Inc.
 - 3. Epic Metals Corp.
 - 4. Marilyn Steel Products, Inc.
 - 5. Nucor Corp.; Vulcraft Div.
 - 6. Roof Deck, Inc.
 - 7. United Steel Deck, Inc.
 - 8. Verco Manufacturing Co.
 - 9. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.02 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29.
 - 1. Painted Steel Sheet: ASTM A 653 Structural Steel, Grade 33.
 - 2. Deck Profile: Type 1.5 B and Type 3 N.
 - 3. Profile Depth: 1-1/2 inches, type B, 3 inches Type N.
 - 4. Design Uncoated-Steel Thickness: 0.0295 inches - 22 gage, both types.

2.03 ACCESSORIES

- A. Accessories: Steel deck manufacturer's standard accessory materials, including mechanical fasteners, closure strips, pour stops, and closures for deck.
- B. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- C. Galvanizing Repair Paint: ASTM A 780, SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- D. Repair Paint: Lead- and chromate-free rust-inhibitive primer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
- B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
 - 1. Mechanical fasteners may NOT be used in lieu of welding to fasten deck. Locate mechanical fasteners at side laps and install according to deck manufacturer's written instructions.
- G. Roof Deck Accessories: Install sump pans, ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
- H. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors.
- I. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- J. Repairs and Protection:
 - 1. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.02 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing agency to perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Shear connector stud welds will be tested and inspected according to AWS D1.1.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Miscellaneous steel framing and supports.
 - 2. Shelf angles.
 - 3. Loose bearing and leveling plates.
 - 4. Steel weld plates and angles.
 - 5. Miscellaneous steel trim.
 - 6. Metal bollards.
 - 7. Pipe guards
 - 8. Loose steel lintels.

1.02 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel Shapes used.
- B. Shop Drawings: Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
- B. Ferrous Metals:
 - 1. Steel Plates, Shapes, and Bars: ASTM A 36.
 - 2. Steel Tubing: ASTM A 500, cold-formed steel tubing.

3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.03 FASTENERS

- A. General: Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

2.04 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI #79.
- B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 1. Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for reglvanizing welds in steel.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- E. Concrete Materials and Properties: Comply with requirements in Division 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.05 FABRICATION

- A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
 1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
 3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 4. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 5. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches o.c.
- B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- C. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
1. Lintels in Exterior Walls: Prime with zinc-rich primer.
- D. Shelf Angles: Fabricate shelf angles of sizes indicated and for attachment to framing. Fabricate with horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c.
1. Shelf Angles in Exterior Walls: Prime with zinc-rich primer.
 2. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.
- E. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts.
- F. Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
1. Exterior Miscellaneous Steel Trim: Prime with zinc-rich primer.
- G. Metal Ladders: Comply with ANSI A14.3, unless otherwise indicated.
1. Elevator Pit Ladders: Comply with ASME A17.1.
 2. Space siderails 18 inches apart, unless otherwise indicated.
 3. Steel Ladder Construction: Flat bar siderails, with 3/4-inch-diameter steel bar rungs fitted in centerline of siderails, plug-welded, and ground smooth on outer rail faces. Provide nonslip surfaces on top of each rung.

4. Fabricate ladder safety cages to comply with ANSI A14.3. Fabricate from same metal as ladders to which safety cages are attached and assemble by welding or riveting.
- H. Metal Bollards: Fabricate from Schedule 40 steel pipe.
1. Cap bollards with 1/4-inch-thick steel plate.
 2. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch-anchor bolts.
 3. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve.
- I. Pipe Guards: Fabricate from 3/8-inch-thick by 12-inch-wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4 –inch anchor bolts.

2.06 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish metal fabrications after assembly.
- B. Steel and Iron Finishes:
1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below for environmental exposure conditions of installed metal fabrications:
 - a. Exteriors SSPC Zone 1B and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. Interiors SSPC Zone 1A: SSPC-SP 3, "Power Tool Cleaning."
 2. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting," for shop painting.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
1. Fit exposed connections accurately together. Weld connections that are not to be left as exposed joints but cannot be shop welded. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication.

2. Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
 3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack solidly with nonshrink, nonmetallic grout.
- C. Bollards:
1. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard.
 2. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout.
 3. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
 4. Fill bollards solidly with concrete, mounding top surface to shed water.
- D. Touch up surfaces and finishes after erection.
1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
 2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 05 52 13

METAL PIPE AND TUBE RAILING WITH INFILL PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. The work includes: Metal railings including handrails and guardrails for raised patios and walkways including as indicated on the Drawings:
 - 1. Wire mesh infill panels
 - 2. Wall-mounted handrail
- B. Related Work:
 - 1. Division 09: Painting and Coatings

1.02 SUBMITTALS

- A. Product Data: For mechanically connected railings, grout, anchoring cement, and paint products.
- B. Shop Drawings: Submit shop drawings for fabrication. Include plan view elevations and large scale details. Show necessary items. Provide templates as required.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.

1.03 HANDRAIL FOR ACCESSIBLE RAMPS

- A. Ramps that have a drop off of 30 inches or more on the side require guardrail, per above spec. Ramps with a rise greater than 6 inches shall have handrails on both sides.
- B. Handrail will be installed at a height of 34 – 38 inches above ramp surface
- C. Handrail shall be 1 ½ in nominal (1.90 in. OD) and shall have a continuous surface.
- D. Handrails shall return to a wall, guard or walking surface.
- E. All railings shall be supplied to conform to applicable sections of the following codes:
 - 1. International Building Code
 - 2. ADAAG

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 3. Infill Area of Guards:
 - a. Horizontal concentrated load of 50 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.
- B. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
- B. Qualifications for Welding Work:
1. Welding Procedures shall be in accordance with AWS D1.1/D1.1M.
 2. Test specimens shall be tested by an approved testing laboratory at the Contractor's expense.
- C. Welder Qualification shall be certified by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, tests shall be performed on test pieces in positions and with clearances equivalent to those

actually encountered. If a test weld fails to meet requirements, an immediate retest of two test welds shall be made and each test weld shall pass. Failure in the immediate retest will require that the welder be retested after further practice or training and a complete set of test welds shall be made.

- D. Field Measurements: Confirm field measurements before fabrication, where possible. Allow for adjustments and fittings where required.
- E. Inserts and Anchorage's: Furnish devices which must be set in concrete or built into masonry. Coordinate with other work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job-site in good condition and properly protected against damage to finished surfaces.
- B. Store material in a location and manner to avoid damage. Do not stack stair components. Lay out components on firm foundation material such that bending cannot occur.
- C. Store metal components in a clean dry location, away from uncured concrete, cement, or masonry products, acids, oxidizers, rain water, or any other chemical or substance that might damage the stair material or finish.
- D. Plan work and storage locations to keep on-site handling to a minimum.
- E. Exercise particular care to avoid damage to material finishes or unprotected surfaces when handling.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. California Wire Products, Corona, CA
- B. Julius Blum
- C. Sharpe Products
- D. Wagner Companies

2.02 MATERIALS

- A. Metals, General:
 - 1. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
3. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
4. Plates, Shapes, and Bars: ASTM A 36/A 36M.
5. Castings: Either gray or malleable iron, unless otherwise indicated.
 - a. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - b. Malleable Iron: ASTM A 47/A 47M.
6. Railing and Handrails:
 - a. Pipe:
 - 1) Pipe for horizontal and vertical railings and handrails shall be seamless steel pipe conforming to ASTM A53, Type S, Grade A, with special instructions to the manufacturer to provide Architectural Handrail Grade, of diameters and sizes indicated.
 - 2) Provide 1-1/2" O.D. sch 40 steel pipe when not otherwise detailed.
 - b. Handrail Brackets: Provide handrail brackets for handrails at walls, manufactured specifically for the purpose of cast, forged, or wrought steel, of configuration indicated or required to suit conditions, galvanized after fabrication.

B. Wire Mesh Railing Infill Panels:

1. Mesh: 10 ga 1-1/2" square woven wire mesh orientated as indicated on drawings; lock crimp in frames.
2. Frames: Rectangular and stair rake panels, 1-1/4" x 5/8" x 11 ga. "C" channel frame with a 1-1/4" x 11 ga. flat bar capping on four sides.
3. Attachment Frames shall have four 1-1/2" x 3/16" flat stand-off tabs and shall be welded to rail structure in field.
4. Finish: Plain steel painted prior to installation on railing.

2.03 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide concealed fasteners, unless unavoidable or standard for railings indicated.
 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Anchors: Provide anchors and anchorage type as detailed and noted on the drawings, Anchors shall be fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Shop Primers: Provide primers that comply with Division 09 painting Sections.

- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- F. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer compatible with finish paint systems indicated, and complying with SSPC-Paint 5.
- H. Grout and Anchoring Cement: Factory-packaged, nonshrink, nonmetallic grout complying with ASTM C 1107; or water-resistant, nonshrink anchoring cement; recommended by manufacturer for exterior use.

2.04 GALVANIZING

- A. Where certain components are indicated to be galvanized, comply with galvanizing requirements of Metal Fabrications section.

2.05 FABRICATION

- A. General: Fabricate railings to comply with design, dimensions, and details indicated, but not less than that required to support structural loads.
- B. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
- C. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings.
- D. Form changes in direction by bending.
- E. Form curves by bending in jigs to produce uniform curvature; maintain cross section of member throughout bend without cracking or otherwise deforming exposed surfaces.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
- I. Infill Panel Construction:
 - 1. Infill panels shall be prefabricated and preassembled in the factory or shop as far as practicable.

2. Panel Frame and Wire Mesh:
 - a. Wire: Woven or welded mesh in size and shape as indicated on Drawings.
 - b. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames.
 - c. Finish: Plain steel or hot dip galvanized as required. Finish type and color as selected by architect.
 - d. Attachment: Panels to be mechanically welded to rail structure in field.
3. Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be provided in members as required to permit connecting the work of other trades.

2.06 FINISHES

- A. Steel and Iron:
 1. Galvanized Railings: Hot-dip galvanize exterior railings, after fabrication, to comply with ASTM A 123/A 123M. Provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
 2. Shop-Primed Galvanized Railings: After galvanizing, clean railings, treat with metallic-phosphate process, and apply primer to comply with SSPC-PA 1.
 3. Shop-Primed Steel Finish: Prepare to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" and apply primer to comply with SSPC-PA 1.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation.
- B. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- C. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- D. Anchor posts in concrete as detailed on the drawings, grouting annular space.
- E. Anchor posts to metal surfaces with oval flanges.
- F. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- G. Attach handrails to wall with wall brackets.
 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. For steel-framed partitions, fasten to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
- 3.02 ADJUSTING AND CLEANING
- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting.
 - B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.
 - C. Finish as scheduled in Painting and Coatings Section.

END OF SECTION 05 52 13

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Wood framing.
2. Wood supports.
3. Wood blocking.
4. Wood cants.
5. Wood nailers.
6. Wood furring.
7. Wood grounds.
8. Plywood backing panels.

1.02 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product indicated.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses.

C. Research/Evaluation Reports: For the following:

1. Treated wood.
2. Power-driven fasteners.
3. Powder-actuated fasteners.
4. Expansion anchors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirement.

2.02 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
 - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Wood Structural Panels:
 - 1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 - 2. Oriented Strand Board: DOC PS 2.
 - 3. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC2 (lumber) and AWPAC9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
- C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood framing members less than 18 inches above grade.
4. Wood floor plates that are installed over concrete slabs directly in contact with earth.

2.04 DIMENSION LUMBER

- A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated. Must match existing wood at the existing building. Architect will approve wood used.
- B. Non-Load-Bearing Interior Partitions: No. 2 grade and any of the following species:
 1. Mixed southern pine; SPIB.
 2. Eastern softwoods; NELMA.
 3. Northern species; NLGA.
 4. Western woods; WCLIB or WWPA.
- C. Framing Load-Bearing Partitions: No. 2 grade and any of the following species:
 1. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
 2. Southern pine; SPIB.
 3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
- D. Framing Load-Bearing Partitions: Any species and grade with a modulus of elasticity of at least **1,300,000 psi or 1,100,000 psi** and an extreme fiber stress in bending of at least **850 psi** 2-inch nominal thickness and 12-inch nominal width for single-member use.
- E. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 1. Mixed southern pine, No. 2 grade; SPIB.
 2. Eastern softwoods, No. 2 grade; NELMA.
 3. Northern species, No. 2 grade; NLGA.
 4. Western woods, No. 2 Common grade; WCLIB or WWPA.

2.05 TIMBER AND MISCELLANEOUS LUMBER

- A. For timbers of 5-inch nominal size and thicker, provide material complying with the following requirements:
 1. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; No. 1 grade; NLGA, WCLIB, or WWPA.
 2. Species and Grade: Eastern hemlock, Eastern hemlock-tamarack, or Eastern hemlock-tamarack (north); No. 1 grade; NELMA or NLGA.
 3. Species and Grade: Southern pine, No. 1 grade; SPIB.

- B. Provide miscellaneous lumber for support or attachment of other construction, including the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Blocking.
 - 3. Cants.
 - 4. Nailers.
 - 5. Furring.
 - 6. Grounds.
- C. For items of dimension lumber size, provide No. 2 grade lumber with 19 percent maximum moisture content of any species.
- D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 2 grade; SPIB.
 - 2. Eastern softwoods, No. 2 grade; NELMA.
 - 3. Northern species, No. 2 grade; NLGA.
 - 4. Western woods, No. 2 Common grade; WCLIB or WWPA.

2.06 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.07 MISCELLANEOUS MATERIALS

- A. Fasteners:
 - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. Power-Driven Fasteners: CABO NER-272.
 - 3. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- B. Metal Framing Anchors: Made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Manufacturers:
 - a. Alpine Engineered Products, Inc.
 - b. Cleveland Steel Specialty Co.
 - c. Harlen Metal Products, Inc.
 - d. KC Metals Products, Inc.
 - e. Silver Metal Products, Inc.
 - f. Simpson Strong-Tie Company, Inc.
 - g. Southeastern Metals Manufacturing Co., Inc.

- h. United Steel Products Company, Inc.
 - 2. Research/Evaluation Reports: Provide products acceptable to authorities having jurisdiction and for which model code research/evaluation reports exist that show compliance of metal framing anchors, for application indicated, with building code in effect for Project.
 - 3. Allowable Design Loads: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Building Paper: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.
- D. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building wrap manufacturer for sealing joints and penetrations in building wrap.
- E. Sheathing Tape: Pressure-sensitive plastic tape for sealing joints and penetrations in sheathing and recommended by sheathing manufacturer for use with type of sheathing required.
- F. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Apply field treatment complying with AWPAC M4 to cut surfaces of preservative-treated lumber and plywood.
- C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. CABO NER-272 for power-driven fasteners.
 - 2. Published requirements of metal framing anchor manufacturer..
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in the Uniform Building Code.
 - 4. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.
 - 5. Table 2306.1, "Fastening Schedule," in the Standard Building Code.

6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in the International One- and Two-Family Dwelling Code.
- D. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
- E. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- F. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- G. Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
 1. Comply with "Code Plus" provisions in above-referenced guide.
- H. Apply building paper horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails. Cover upstanding flashing with 4-inch overlap.
- I. Apply sheathing tape to joints between sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION

SECTION 06 16 00

SHEATHING

PART 1 GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Model code evaluation reports for foam-plastic sheathing and building wrap.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- C. Material Certificates: For building sheathing specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.
- D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Preservative-treated wood.
 - 2. Engineered wood products.

PART 2 PRODUCTS

2.01 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: DOC PS 1.
- B. Oriented Strand Board: DOC PS 2.

2.02 TREATED PLYWOOD

- A. Preservative-Treated Plywood: AWPAC C9.
 - 1. Use treatment containing no arsenic or chromium.
 - 2. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- B. Provide preservative treated plywood for plywood in contact with masonry or concrete, vapor barriers, and waterproofing.

2.03 EXTERIOR WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.
- B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
- C. Gypsum Wall Sheathing: Cannot be used for structural sheathing, see above. Any of the following:
 - 1. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 79/C 79M or ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core.
 - 2. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 3. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.
- D. Fiberboard Wall Sheathing: Cannot be used for structural sheathing. AHA A194.1, Type IV, Grade 1 (Regular), 1/2 inch thick.
- E. Insulating Foam Wall Sheathing: any of the following that conforms with the local Building Codes:
 - 1. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C 578, Type IV.
 - 2. Foil-Faced, Polyisocyanurate-Foam Wall Sheathing: ASTM C 1289, Type I, Class 2. Foam-plastic core and facings shall have flame spread of 25 or less, when tested individually.

2.04 MISCELLANEOUS PRODUCTS

- A. Fasteners: Size and type indicated.
 - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. Power-Driven Fasteners: CABO NER-272.
- B. Sheathing Joint-and-Penetration Treatment Materials:
 - 1. Sealant for Gypsum Sheathing Board: Joint sealant recommended by sheathing manufacturer for application indicated.
 - 2. Sheathing Tape for Gypsum Sheathing Board: Self-adhering glass-fiber tape recommended by sheathing and tape manufacturers for application indicated.

- 3. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.
- C. Adhesives for Field Gluing Panels to Framing: APA AFG-01.
- D. Flexible Flashing: Adhesive rubberized-asphalt compound, bonded to polyethylene film, with an overall thickness of **0.030 inch**.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Securely attach to substrates, complying with the following:
 - 1. CABO NER-272 for power-driven fasteners.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2).
- B. Sheathing Joint-And-Penetration Treatment: Seal sheathing joints according to sheathing manufacturer's written instructions.

END OF SECTION

SECTION 06 19 20

WOOD TRUSSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Roof trusses.
 - 2. Truss accessories.

1.03 DEFINITIONS

- A. Metal-plate-connected wood trusses include planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer, fabricate, and erect metal-plate-connected wood trusses to withstand design loads within limits and under conditions required.
 - 1. Design Loads: As indicated.
 - 2. Design trusses to withstand design loads without deflections greater than the following:
 - a. Roof Trusses: Vertical deflection of 1/240 of span due to total load.
- B. Engineering Responsibility: Engage a fabricator who uses a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for metal-plate-connected wood trusses.

1.05 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for lumber, metal-plate connectors, metal framing connectors, bolts, and fasteners.

- C. Shop Drawings detailing location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber to be used; splice details; type, size, material, finish, design values, and orientation and location of metal connector plates; and bearing details.
 - 1. To the extent truss design considerations are indicated as fabricator's responsibility, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include truss Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation, registered in the State of New Mexico.
- D. Product certificates signed by officer of truss fabricating firm certifying that metal-plate-connected wood trusses supplied for Project comply with specified requirements and Shop Drawings.
- E. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- F. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
- G. Warranty of chemical treatment manufacturer for each type of treatment.
- H. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee (ALSC) Board of Review.
- I. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
 - 1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to truss fabricator.
 - 3. For fire-retardant-treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

- J. Research or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence the following products' compliance with building code in effect for Project.
 - 1. Fire-retardant-treated wood.
 - 2. Metal-plate connectors.
 - 3. Metal framing connectors.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed wood truss installation similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator's Qualifications: Engage a firm that complies with the following requirements for quality control and is experienced in fabricating metal-plate-connected wood trusses similar to those indicated for this Project and with a record of successful in-service performance:
 - 1. Fabricator participates in a recognized quality-assurance program that involves inspection by SPIB; Timber Products Inspection, Inc.; Truss Plate Institute (TPI); or other independent inspecting and testing agency acceptable to Architect and authorities having jurisdiction.
- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. ANSI/TPI 1, "National Design Standard for Metal-Plate-Connected Wood Truss Construction."
 - 2. TPI HIB "Commentary and Recommendations for Handling Installing & Bracing Metal Plate Connected Wood Trusses."
 - 3. TPI DSB "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
- D. Metal-Plate Connector Manufacturer's Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in ANSI/TPI 1.
- E. Single-Source Responsibility for Connector Plates: Provide metal connector plates from one source and by a single manufacturer.
- F. Wood Structural Design Standard: Comply with applicable requirements of AFPA's "National Design Specification for Wood Construction" and its "Supplement."
- G. Single-Source Engineering Responsibility: Provide trusses engineered by metal-plate connector manufacturer to support superimposed dead and live loads indicated, with design approved and certified by a qualified professional engineer.

- H. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated that have resulted in installing metal-plate-connected wood trusses similar to those indicated for this Project and with a record of successful in-service performance.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses with care and comply with manufacturer's written instructions, TPI recommendations, and latest edition of BCSI "Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses" to avoid damage and lateral bending.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.08 SEQUENCING AND SCHEDULING

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fire-Retardant-Treated Materials, Interior Type A:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corporation.
 - e. Hoover Treated Wood Products, Inc.
 - 2. Fire-Retardant-Treated Materials, Exterior Type:
 - a. American Wood Treaters, Inc.
 - b. Hoover Treated Wood Products, Inc.
 - 3. Metal Connector Plates:
 - a. Alpine Engineered Products, Inc.
 - b. Computrus, Inc.
 - c. Mitek Industries, Inc.
 - d. Robbins Manufacturing Company.
 - e. Tee-Lok Corporation.

- f. Truswal Systems Corporation.
- 4. Metal Framing Anchors:
 - a. Cleveland Steel Specialty Co.
 - b. Harlen Metal Products, Inc.
 - c. Silver Metal Products, Inc.
 - d. Simpson Strong-Tie Company, Inc.
 - e. Southeastern Metals Manufacturing Co., Inc.
 - f. United Steel Products Co.

2.02 DIMENSION LUMBER

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NLGA - National Lumber Grades Authority (Canadian).
 - 3. SPIB - Southern Pine Inspection Bureau.
 - 4. WCLIB - West Coast Lumber Inspection Bureau.
 - 5. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified, to comply with requirements indicated below:
 - 1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
 - 2. Provide lumber with 15 percent maximum moisture content at time of dressing.
- E. Grade and Species: Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specification for Wood Construction" and its "Supplement."
- F. Grade and Species: Provide visually graded dimension lumber for truss chord and web members, of the following grade and species:
 - 1. Grade for Chord Members: No. 2.
 - 2. Grade for Web Members: No. 2.
 - 8. Species: Any species graded per WWPA rules.

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where lumber is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPAC2 (lumber). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
- B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber to a maximum moisture content of 19 percent.
- C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPAC4 to cut surfaces. Inspect each piece of lumber after drying and discard damaged or defective pieces.

2.04 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPAC20 (lumber). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Research or Evaluation Reports: Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.
- B. Interior Type A: For interior locations, use chemical formulation that produces treated lumber with the following properties under conditions present after installation:
 - 1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.
 - 2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
 - 3. Contact with treated wood does not promote corrosion of metal fasteners.
- C. Exterior Type: Use for exterior locations and where indicated.
- D. Inspect each piece of treated lumber after drying and discard damaged or defective pieces.

2.05 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates from metal complying with requirements indicated below.
- B. Hot-Dip Galvanized Steel Sheet: Structural-quality steel sheet, zinc coated by hot-dip process complying with [ASTM A 653, G60](#) coating designation; Grade 33 and not less than [0.0359 inch](#) thick.
- C. Electrolytic Zinc-Coated Steel Sheet: [ASTM A 591](#), structural-(physical) quality steel sheet, zinc coated by electrodeposition; [33,000-psi](#) minimum yield strength, coating class C, and not less than [0.0474 inch](#) thick.
- D. Aluminum-Zinc Alloy-Coated Steel Sheet: Structural-(physical) quality steel sheet, aluminum-zinc alloy-coated by hot-dip process complying with [ASTM A 792, AZ50](#) coating designation; Grade 33 and not less than [0.0359 inch](#) thick.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304 or 316, chromium nickel steel sheet; [33,000-psi](#) minimum yield strength and not less than [0.035 inch](#) thick.

2.06 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified below for material and manufacture.
 - 1. Where truss members are exposed to weather or to high relative humidities, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of stainless steel, Type 304 or 316.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts and Screws: [ASME B18.2.1](#).
- F. Bolts: Steel bolts complying with [ASTM A 307, Grade A](#); with [ASTM A 563](#) hex nuts and, where indicated, flat washers.

2.07 METAL FRAMING ANCHORS

- A. General: Provide metal framing anchors of structural capacity, type, size, metal, and finish indicated that comply with requirements specified, including the following:
 - 1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having

jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for this Project.

2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with [ASTM A 653, G60](#) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304 or 316, chromium nickel steel sheet; [33,000-psi](#) minimum yield strength.

2.08 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Protective Coatings: Provide one of the following coating systems:
1. SSPC-Paint 22, epoxy-polyamide primer.
 2. SSPC-Paint 16, coal-tar epoxy-polyamide black or dark red paint.
 3. SSPC-Paint 27 and SSPC-Paint 12, basic zinc chromate-vinyl butyral wash primer and cold-applied asphalt mastic.

2.09 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to size, configuration, thickness, and anchorage details required to withstand design loadings for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances of ANSI/TPI 1. Position members to produce design camber indicated.
1. Fabricate wood trusses within manufacturing tolerances of ANSI/TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously into both sides of wood members by air or hydraulic press.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not install wood trusses until supporting construction is in place and is braced and secured.
- B. Before installing, splice trusses delivered to Project site in more than one piece.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to recommendations of TPI and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space, adjust, and align trusses in location before permanently fastening and as follows:
 - 1. Truss Spacing: As indicated on drawings.
- G. Anchor trusses securely at all bearing points using metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- J. Install wood trusses within installation tolerances of ANSI/TPI 1.
- K. Do not cut or remove truss members.
- L. Return wood trusses that are damaged or do not meet requirements to fabricator and replace with trusses that do meet requirements.
 - 1. Do not alter trusses in the field.

3.02 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

- B. Protective Coating: Clean and prepare exposed surfaces of embedded-metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
1. Apply materials to provide minimum dry film thickness recommended by manufacturer of coating system.

END OF SECTION

SECTION 06 41 00

CUSTOM CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated and finished casework.
- B. Casework Includes:
 - 1. Custom Fabricated Cabinet Units
 - 2. Countertops
 - 3. Hardware and Accessories
 - 4. Shelf and Countertop Supports
 - 5. Coordination with other trades and installation
- C. Related Work:
 - 1. Division 06: Rough Carpentry – Blocking
 - 2. Division 09: Porcelain Slab Countertops at Kitchen

1.02 SUBMITTALS

- A. Shop Drawings:
 - 1. Show casework elevations, plans, cross sections and installation details. Note surface finishes, materials, dimensions, sinks, fittings, hardware, supports and other accessories.
 - 2. Locate equipment for guidance of other trades.
 - 3. Show connections of cases to each other and adjacent work.
 - 4. Propose keying schedule for review and approval by the Owner.
- B. Samples:
 - 1. Laminates shall be selected by the A/E from the Full Plastic Laminate Lines offered by Wilsonart, Formica and Nevamar.
- C. Quality Assurance: Provide AWI Quality Certification Program Certificate indicating that the woodwork, including installation, complies with requirements of grades specified. The Contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program.

1.03 QUALITY ASSURANCE

- A. Workmanship: Unless otherwise indicated, comply with the AWI's Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

- B. Competence:
 - 1. The approved woodwork manufacturer must have a minimum of three years of documented experience specializing in the Work of this Section, must have a reputation for doing satisfactory work on time, and shall have successfully completed comparable work. The A/E has the right to approve the woodwork manufacturer selected.
 - 2. Installer shall be trained in the methods and skilled in the installation of woodwork.
- C. Standards for Materials:
 - 1. Particleboard: ANSI 208.1
 - 2. Softwood plywood: US Product Standards PS1
 - 3. Hardwood plywood: ANSI-HPVA, Hardwood Plywood and Veneer Association
 - 4. Hardboard: ANSI-AHA 135.484 American Hardboard Association
 - 5. National Electric Manufacturers Association (NEMA): High Pressure Decorative Laminates
 - 6. PVA Adhesive (polyvinyl acetate) white glue, Type III – ASTM-D3110
 - 7. Aliphatic Adhesive (carpenters glue) Type II – ASTM-D3110
 - 8. Solvent based contact cement: MMM-A-J130B
 - 9. ANSI/BHMA A156.9: Cabinet Hardware

1.04 FIELD MEASUREMENTS

- A. Verify dimensions of cabinet, countertop and shelf locations on site.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect all surfaces subject to damage while in transit.
- B. Deliver only when building is completely enclosed and heated and wet-type construction is finished.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. During and after installation of Work of this section, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

1.07 DEFINITIONS

- A. Exposed Portions:
 - 1. All surfaces visible when doors and drawers are closed including interiors of open cabinets and interiors of accessible base cabinets including interior faces of retractable doors.
 - 2. Cabinet tops less than 72" above finish floor, or greater than 72" above finish floor if visible from an upper building level, and sloping cabinet tops.
 - 3. Visible edges of cabinet ends, door and drawer fronts.

- B. Semi-Exposed Portions:
1. All surfaces visible when doors and drawers are open including interior faces of hinged doors.
 2. Interior faces of doors on accessible base cabinets where doors are designed to be removed for accessible use.
 3. The underside bottoms of wall hung cabinets.
 4. The visible surfaces in open cabinets or behind glass doors.
 5. Visible portions of bottoms, tops, and ends in front of sliding doors in closed position.
 6. Front and back edges of adjustable shelves.
- C. Concealed Portions:
1. Toe space unless otherwise noted.
 2. Sleepers
 3. Web frames, stretchers.
 4. Security panels.
 5. Underside of bottoms of cabinets less than 30" above the finished floor.
 6. Flat tops of cabinets 72" or more above the finished floor, except if visible from an upper building level.
 7. The underside of countertops, knee spaces and drawer aprons.
 8. Faces of cabinet ends of adjoining units that butt together.

PART 2 PRODUCTS

2.01 PLASTIC LAMINATED CASEWORK

- A. Casework Exposed Portions:
1. Exposed material shall be patterns and colors as selected by the A/E.
 2. High pressure laminates, laminated with PVA adhesive under 50 PSI pressure, meeting NEMA LD-3 standards.
 3. Provide general purpose grade plastic laminate in the following thickness:
 - a. Horizontal Grade .050" = GP50
 - b. Vertical Grade .028" = VG28
 - c. Postforming Grade .042" = PF42
 - d. Cabinet Linear Grade .020" = CL20
 - e. Chemical Resistant Grade .036"
 4. Decorative laminate manufacturers include:
 - a. Formica
 - b. Wilsonart
 - c. Nevamar
 5. Woodgrain patterns shall run vertically on doors, ends and fixed panels, and horizontally on drawer fronts and sink fronts unless noted otherwise.
- B. Semi-Exposed Portions:
1. Interior faces of cabinet doors, drawer fronts and finished ends are to be laminated with high pressure plastic laminate, color to match cabinet interior.

2. Interior faces of tops, bottoms, ends, partitions and shelves shall be overlaid with low pressure thermofused melamine.
 3. Semi-exposed materials:
 - a. High pressure plastic laminate at .028" thickness, laminated with PVA adhesive under 50 PSI pressure, meeting NEMA LD-3 standards where indicated above.
 - b. Low pressure thermofused melamine or polyester laminate achieved through self-bonding of the resin under 300 PSI at 320 degrees, meeting ALA standards where indicated above.
 - c. Color shall be consistent throughout semi-exposed surfaces and shall be as selected by the A/E to closely match the shade of cabinet exteriors. Colors from which A/E will select from shall include a minimum of four choices including white, almond, grey and black.
 4. Cabinet backs and drawer bottoms shall have factory applied coating to both faces. Interior face to match cabinet interior color.
 5. Small vertical or horizontal dividers shall be ¼" thick tempered hardboard where noted on the Drawings.
- C. Concealed Portions, Cores, and Substrates:
1. Concealed materials shall be any species or sound dry solid stock, plywood, particleboard, medium density fiberboard, or a combination thereof.
 2. All materials shall be securely glued with Type II adhesive.
 3. Laminate core material shall be 45 lb density composition premium grade particleboard or AB exterior rotary cut Douglas fir plywood as specified herein.
- D. Visible Edges, Exposed and Semi-Exposed:
1. Exposed edges of cabinet ends, doors and drawer fronts shall be edgebanded with .018" PVC, color to be selected by the A/E or match the existing face color if contrasting edgeband is not specified on the Drawings.
 2. Exposed edges of cabinet shelves, sub-tops, bottoms and partitions shall be edgebanded with .024" PVC to match cabinet interior.
 3. Edges at underside of upper cabinets and drawer parts shall be edgebanded with .024" PVC to match cabinet interior.

2.02 PLASTIC LAMINATED CASEWORK CONSTRUCTION

- A. Drawers:
1. Drawer fronts shall be 11/16" thick particle board overlaid with high pressure laminate on both faces equal to ¾" thickness. Inside color shall match drawer interior.
 2. Drawer sides shall be ½" thick particle board overlaid with thermofused melamine on two sides to match cabinet interior. Drawer parts shall be joined together with hardwood dowels.
 3. Drawer bottoms, subfronts and backs shall be ½" particle board, bottoms tongued into backs and sides, glued and clamped to produce a rigid drawer.

4. Drawers shall be mounted with positive “in” and “out” stops to provide permanent and quiet operation. Drawer fronts that impact cabinet body shall not be allowed.
 5. All drawers shall have ball bearing slides as specified.
 6. Full depth security panel shall be provided between drawers when individual drawer locking is required.
- B. Doors:
1. Doors shall be 11/16” thick particle board overlaid with high pressure laminate equal to 3/4” thickness. Inside faces shall match cabinet interior.
- C. Cabinet Ends:
1. Exposed or finished ends shall be 11/16” thick particle board overlaid with high pressure laminate on both faces equal to 3/4” thickness. Inside faces shall match cabinet interior.
 2. Semi-exposed ends shall be 3/4” particle board overlaid with thermofused melamine on both faces.
 3. Ends shall be drilled for adjustable shelf supports with 5mm holes on 1” centers.
- D. Cabinet Tops and Bottoms:
1. Semi-exposed ends shall be 3/4” particle board overlaid with thermofused melamine on both faces.
 2. Exposed or finished ends shall be 11/16” thick particle board overlaid with high pressure laminate on both faces equal to 3/4” thickness. Inside faces shall match cabinet interior.
- E. Fixed and Adjustable Shelves:
1. Shelves shall be designed to support uniform loading of up to 50lb/sf with no more than .080” per lineal foot deflection of unsupported span.
 2. Spans up to 31” shall be 3/4” particle board overlaid with thermofused melamine on both faces.
 3. Spans over 31” and up to 41” long shall be 1” thick particle board overlaid with thermofused melamine on both faces.
 4. Spans over 41” to 48” long shall be 1” plywood core overlaid with thermofused melamine on both faces.
 5. Spans over 48” are not permitted.
 6. Adjustable shelves shall be supported on 4 shelf clips up to 21” deep, and 6 shelf clips at 22” deep and over.
 7. Adjustable shelves for wall-mounted standards shall be 1” thick particle board overlaid with thermofused melamine on both faces and edged banded on all four edges.
- F. Cabinet Backs:
1. Semi-exposed backs shall be 1/2” particle board with thermofused melamine on exposed faces.

2. Exposed backs shall be 11/16" thick particle board overlaid with high pressure laminate on both faces equal to 3/4" thickness, inside color to match cabinet interior.

G. Cabinet Bases:

1. Cabinet bases shall be 4" standard height made in continuous lengths to ensure straight, level and true line of casework. Base material is 3/4" particle board unless otherwise noted.

H. Filler Panels:

1. Panels shall be of 11/16" thick particle board overlaid with high pressure laminate on both faces to equal to 3/4" thick and be fitted to adjacent surfaces.
2. Exposed faces shall have laminate matching adjacent cabinets.

2.03 COUNTERTOPS

A. Decorative laminate countertops shall be GP50 NEMA grade laminate with .020" backing sheet bonded to 3/4" particleboard substrate.

1. 3/4" thick plywood shall be used in all areas of prolonged high humidity.
2. Overall thickness of finished edges shall be 1 1/2" with build-up added to the substrate.
3. Backsplashes shall be 3/4" thick and 4" high unless otherwise specified and assembled with waterproof sealant and #6 x 2" screws at 6" oc.

2.04 HARDWARE AND ACCESSORIES

A. Supply product listed or submit equivalent product as a "substitution" through process outlined in Division 1.

1. Hinges: Concealed Blum Modul 170, typical and Blum Clip where accessible or removable are noted on the Drawings.
2. Wire Pulls: Doors and Drawers: Amerock 867 Series Brushed Steel.
3. Catches: Magnetic, Lawrence #SC-1364, or approved 7 lb. pull rating.
4. Light to Medium Duty Drawer Slides on Max. 24" Wide Drawers: Accuride 7432 all ball bearing, rail-mount, full-extension slides, 100 lb/pr load rating.
5. Heavy Duty Drawer Slides on Max. 24" Wide Drawers: Accuride 4032 all ball bearing, rail-mount, full-extension slides, 150 lb/pr load rating.
6. Heavy Duty Storage Drawer Slides on Max. 30" Wide Drawers: Accuride 3640 all ball bearing, rail-mount, full-extension slides, 200 lb/pr load rating.
7. Countertop Support Brackets: Shall be constructed of 16 ga, 1 1/2" tube steel with welded construction designed to support countertops off finished wall at heights indicated on the drawings, ground smooth, primed.
 - a. 18" x 21" for up to 26" deep countertops.
 - b. 21" x 27" for up to 32" deep countertops.
8. Single Shelf Support Brackets: Shall be constructed of 1/4" flat bar with 1/4" wire rod gusset, welded construction designed to support up to 15" deep shelf, ground smooth, primed.

9. Wire Grommets: Provide with removable and adjustable caps in color selected by the Architect from manufacturer's standard color selection, 2 3/8" diameter, Hafele #429.99-60mm.
 10. National Disc Tumbler Door and Drawer Lock, Surface Mounted, Dead bolt-type where indicated on the Drawings. Finish shall match door and drawer pulls.
- B. Accessories:
1. Adhesive for High Pressure Decorative Laminates: Type recommended by laminate manufacturer to suit application.
 2. Fasteners: Size and type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. General:
1. All components shall be neatly assembled and clamped together with adhesive, dowels, screws and other fasteners to form a complete system.
 2. All casework shall be installed in accordance with AWI Custom Grade Quality Standards.
- B. Attachment:
1. Set casework accurately in place, level, scribe, and secure to floor or walls.
 2. Primary anchorage of base and wall cabinets shall be through the 1/2" thick cabinet backs into the wall framing or blocking furnished under other sections.
 3. Additional anchorage will be made into cabinet bases and adjacent side walls where they occur.
 4. All installations shall be in strict accordance with seismic codes.
 5. At free-standing countertops and work surfaces, steel support brackets shall be provided at a maximum spacing of 32" oc or less if shown on the drawings. Support brackets shall be designed to allow for knee space clearance and attach to wall framing for support.
- C. Workmanship:
1. Erect casework straight, level, plumb and true.
 2. Neatly scribe casework to walls, soffits and columns. Fillers to color match adjacent surfaces and will not be permitted in excess of 1 1/2" wide unless specified otherwise.
 3. Joints are not permitted in continuous countertops. Joints, where approved, are to be tight, in perfect alignment, and not allowing excessive deflection.

D. Coordination:

1. Provide cutting and fitting as necessary to accommodate mechanical and electrical work built into casework units.
2. Provide alterations to casework to keep devices accessible when they are covered by casework. This includes mechanical and electrical switches, receptacles, panels, access doors and other devices.

3.03 CLEAN AND ADJUST

- A. Install items complete with all accessories.
- B. Adjust moving parts to operate properly.
- C. Leave surfaces clean and free from debris at time of final acceptance.

END OF SECTION 06 41 00

SECTION 07 11 13

DAMPPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cold applied water based emulsified asphalt dampproofing for exterior below grade foundations.
- B. Related Sections:
 - 1. Division 3 - Cast-in-Place Concrete
 - 2. Division 4 – Masonry Assemblies Unit Masonry
 - 3. Division 7 – Perimeter Insulation

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide material complying with the following requirements:
 - 1. Nonflammable
 - 2. VOC Content:
 - a. 0.25 pounds per gallon (30 g/L) less water and exempt solvents.
 - 3. Service Temperature Range:
 - a. Minus 40 degrees F to 150 degrees F.
 - 4. Compliance:
 - a. Brush, roller and spray applied short fiber reinforced complying with ASTM D1227, Type 2, Class I, and ASTM D1187, Type 1.

1.03 SUBMITTALS

- A. Comply with Section 01 33 00.
- B. Product Data: Submit manufacturer's technical bulletins and MSDS on each product.
- C. Quality Control Submittals:
 - 1. Provide protection plan of surrounding areas and surfaces not to receive dampproofing.

1.04 QUALITY ASSURANCE

- A. Comply with Section 01 43 00.
- B. Qualifications:
 - 1. Manufacturer Qualifications: Company with minimum 15 years of experience in manufacturing of specified products and systems.

2. Applicator Qualifications: Company with minimum of 5 years experience in application of specified products and systems on projects of similar size and scope, and is acceptable to product manufacturer.
 - a. Successful completion of a minimum of 5 projects of similar size and complexity to specified Work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00.
- B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
 1. Keep from freezing in the container.
 2. Do not apply at temperatures below 40 degrees F or when temperatures are expected to fall to 40 degrees F within 24 hours.
 3. Protect from rain until coating has set.
 4. Application shall be protected or covered within 7 days of application.
 5. Do not expose to long-term UV.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from the following manufacturer:
 1. Dampproofing: BASF Building Systems
 2. Extruded Polystyrene Protection Board:
 - a. Dow Chemical Company
 - b. Pactive GreengardA PB4
- B. Substitutions: Comply with Section 01 60 00.
- C. Specifications and Drawings are based on manufacturer's proprietary literature from BASF Building Systems. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Architect will be sole judge of appropriateness of substitutions.

2.02 MATERIALS

- A. Cold Applied Water Based Emulsified Asphalt:
 - 1. Short-fiber Fibrated Product: Hydrocide 700B by BASF Building Systems.
- B. Extruded Polystyrene Protection Board: Fan-folded
 - 1. Thickness - 1/4"
 - 2. ASTM D1621- Minimum compressive strength 8 psi.
 - 3. ASTM C272 - Maximum 0.6 % water absorption % by volume.
 - 4. ASTM E96 – Maximum water vapor transmission rate 0.8 g/m/24hrs.
 - 5. ASTM E84 – Fire Characteristics – 25 Flame Spread/250 Smoke Developed.
- C. Chemical Cleaner: Reducer 990 by BASF Building Systems.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Protect adjacent Work areas and finish surfaces from damage during damproofing application.
- B. Surface should be free of oil, grease, dirt, laitance, and loose material. Dry surfaces shall be dampened with water and kept damp until application.

3.02 APPLICATION

- A. Exterior Surfaces Below Grade—Dense Surfaces:
 - 1. Apply short fiber fibrated material in 2 coats by brush or spray.
 - 2. Fill in crevices and grooves, providing continuous coating and free from breaks and pinholes. Carry coating over exposed top and outside edge of footing. Spread around joints, grooves, and slots, and into chases, corners, reveals, and soffits. Bring coating to finished grade.
 - 3. Install Waterproofing Protection Board after applying the waterproofing membrane to exterior foundation walls to prevent damage from backfilling.
 - 4. Place backfill at least 24 to 48 hours after application, but within 7 days. Do not rupture or displace coating or protection board.
- B. Exterior Surfaces Below Grade—Porous Surfaces:
 - 1. Apply short fiber fibrated material in 2 coats by brush and spray. Allow first coat to dry tacky before applying second coat. Allow material to set before backfilling.
 - 2. Fill in crevices and grooves, providing continuous coating free from breaks and pinholes. Carry coating over exposed top and outside edge of footing. Spread around joints, grooves, and slots, and into chases, corners, reveals, and soffits. Bring coating to finished grade.
 - 3. Install Waterproofing Protection Board after applying the waterproofing membrane to exterior foundation walls to prevent damage when backfilling.

4. Place backfill at least 24 to 48 hours after application, but within 7 days. Do not rupture or displace coating or protection board.

3.03 CLEANING

- A. Clean tools and equipment immediately with hot, soapy water. Cured material can be removed with solvent.
- B. Clean up and properly dispose of debris remaining on Project site related to application.
- C. Remove temporary coverings and protection from adjacent Work areas.

3.04 PROTECTION

- A. Protect application from damage during construction.

END OF SECTION 07 11 13

SECTION 07 20 00

INSULATION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This section specifies thermal and acoustical insulation for buildings:
 - 1. Acoustical insulation is identified by thickness and words "Acoustical Insulation or Sound Attenuation Batts".
- B. Related Sections:
 - 1. Division 3 - Concrete
 - 2. Division 4:
 - a. Unit Masonry
 - 3. Division 7:
 - a. Dampproofing
 - b. Exterior Insulation and Finish System

1.02 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM C553 Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 2. ASTM C578 Rigid, Cellular Polystyrene Thermal Insulation.
 - 3. ASTM C591 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - 4. ASTM C612 Mineral Fiber Block and Board Thermal Insulation.
 - 5. ASTM C665 .Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 6. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
 - 7. ASTM E84, Surface Burning Characteristics of Building Materials.
 - 8. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

1.03 SUBMITTALS

- A. Product Data for each type of insulation used.
- B. Manufacturer's Installation Instructions.

- C. Certificates: Stating the type, thickness and “R” value (thermal resistance) of the insulation to be installed.

1.04 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - 2. Where such materials are installed in Construction Type III, Type IV, and Type V, the flame spread and smoke developed limitations do not apply to facings that are installed behind and in substantial contact with the unexposed surface of the ceiling wall or floor finish.
- B. Insulation Installed in Exposed Locations Surface Burning Characteristics:
 - 1. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - 2. Attic Floor Insulation (directly above ceiling): Minimum 0.12 watt per sq cm critical radiant flux when tested in accordance with ASTM E970.

1.05 STORAGE AND HANDLING

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Concrete Block Insulating Systems
- B. CfiFOAM, Inc
- C. Dow Chemical Co.
- D. Firestone Building Products
- E. GAF Materials Corporation
- F. Owens Corning
- G. Approved Equal

2.02 MATERIALS

A. Insulation – General:

1. Where thermal resistance (“R” value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
2. Where “R” value is not specified for insulation, use the thickness shown on the Drawings.

B. Rigid Insulation for wall furring, perimeter/foundation, and sheathing applications:

1. Type IV: Extruded cellular polystyrene; thermal resistance “R” per inch of 5.0; minimum compressive strength of 25 psi; water absorption by volume in accordance with ASTM C272, 0.10 percent; square edges; thickness indicated on Drawings.
2. Adhesive: Type recommended by insulation manufacturer for application.

C. Exterior Roof/Ceiling and Wall:

1. Where framing is not faced with gypsum board and insulation is exposed to space provide Flame Spread 25 Insulation.
 - a. Type: FRK (foil) walls or PSK (white) ceilings, faced glass fiber thermal insulation complying with ASTM C 665, Type III for FRK (foil) and Type II for PSK (white), Class A.
2. Where metal framing is faced with gypsum board and insulation is friction fit in cavity provide fiber glass building insulation for friction fit in walls which complies with ASTM C 665; preformed glass fiber batt insulation:
 - a. Facing: ASTM C 665 Type II, Class C, Category 1, faced on one side with Kraft paper providing a vapor barrier of 1.0 or less.
3. Where wood framing is faced with gypsum board provide fiberglass building insulation with vapor barrier which complies with ASTM C 665; preformed glass fiber batt insulation, Section 7.4, Water Vapor Permeance and ASTM E 96, Class A or 1 Fire Resistance rating.
4. Schedule:
 - a. Roof Framing Thermal Batt Insulation: R-Value: As indicated on Drawings. See Building Criteria.
 - b. Wall Framing or Furring Thermal Batt Insulation: R-Value: As indicated on Drawings. See Building Criteria.

D. Interior Acoustical Insulation/Sound Attenuation Batts:

1. Fiberglass Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
2. Thickness 3” unless otherwise shown on the Drawings; and of widths and lengths to fit tight against framing.

E. Accessories:

1. Expanding Insulating Foam Sealant for filling gaps around sealing around windows and doors.
2. Separate Vapor and Air Barrier: Translucent polyethylene film, Type 1, Class 1; 6 mil thick.
3. Nails or Staples: Steel wire, electroplated or galvanized; type and size to suit application.
4. Tape: As recommended by insulation manufacturer.
5. Fasteners:
 - a. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
 - b. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
 - c. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.
 - d. As recommended by the manufacturer of the insulation.
6. Protection Board: 1/2" EPS protection board for perimeter foundation insulation.
7. Wire Mesh (for applications of batt insulation greater than 6-1/2" thick): Galvanized steel hexagonal wire mesh.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation for Perimeter Insulation:

1. Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.
2. Verify substrate surface is flat, free of irregularities and materials that will impede adhesive bond.
3. Verify insulation boards are unbroken, free of damage.

B. Perimeter Insulation:

1. Install in full conformance with manufacturer's instructions and recommendations.
2. Where insulation is to be installed on exterior face of foundation wall, install insulation boards over dampproofing or waterproofing specified in other sections.
3. Where insulation is to be installed on interior face of foundation wall, install vapor barrier between soil and insulation.
4. Install boards on foundation wall in a method to maximize contact bedding; stagger joints. Butt edges and ends tight to adjacent board and to protrusions. Assure full contact of tongue and groove edges.

5. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
 6. Where insulation is installed on exterior face of foundation wall, adhere protection boards immediately following insulation board installation.
- C. Exterior Framing or Furring Thermal Batt Insulation:
1. Install separate vapor/air barrier on warm side of insulation when noted on the Drawings.
 2. Install faced insulation with the vapor retarder facing the heated side, unless specified otherwise. Tape seal tears or cuts in vapor retarder. Extend vapor retarder tight to full perimeter of adjacent window and door frames and other items interrupting plane of membrane. Tape seal in place.
 3. Install batt or blanket insulation in exterior walls, roof, and ceiling spaces from wall-to-wall without gaps or voids with tight joints and filling framing void.
 4. Pack or install foam insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack or install foam behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
 5. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
 6. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
 7. Fasten blanket insulation between wood studs or framing with nails or staples through flanged edges on face of stud. Space fastenings not more than six inches apart.
 8. Roof Rafter Insulation: Place mineral fiber blankets between framing to provide not less than a two inch air space between insulation and roof sheathing.
 9. Ceiling Insulation and Soffit Insulation:
 - a. Fasten blanket insulation between wood framing or joists with nails or staples through flanged edges of insulation.
 - b. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
 - c. In areas where suspended ceilings adjoin areas without suspended ceilings, install blankets, batts, or mineral fiberboard extending from the suspended ceiling to underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position.
 10. Retain roof batt insulation in place with wire mesh secured to framing members. Tape seal tears or cuts in barrier.

D. Acoustical Insulation:

1. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
2. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition.
3. Hold insulation in place with pressure sensitive tape or adhesive. Do not compress insulation below required thickness except where embedded items prevent required thickness.
4. Where acoustical insulation is installed above suspended ceilings, install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.

END OF SECTION

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH AND ARCHITECTURAL COATING FINISH SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Provide Standard Class PB Exterior Insulation and Finish System (EIFS) consisting of:
 - 1. Adhesive, Expanded Polystyrene Insulation (EPS) Board
 - 2. Base Coat with embedded Reinforcing Fabric Mesh
 - 3. Finish Coat
 - 4. Installed over roll-on water-resistive barrier applied over structural sheathing
- B. Provide an Architectural Coating Finish System consisting of basecoat with embedded reinforcing fabric mesh, and finish coat on exterior concrete and masonry walls as noted on the drawings.

1.02 RELATED SECTIONS

- A. Division 04: Concrete Unit Masonry
- B. Section 06 16 00 - Sheathing
- C. Section 07 62 00 - Sheet Metal Flashing and Trim
- D. Section 07 90 00 – Elastomeric Sealants

1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. EIFS assembly materials must be manufactured or sold by a single-source manufacturer and shall be purchased direct from the manufacturer or its authorized distributor.
- B. Applicator:
 - 1. Must have attended manufacturer's Educational Seminar.
 - 2. Must possess a current manufacturer's certificate of education.
 - 3. Must be experienced and competent in installation of plaster-like materials.
- C. Regulatory Requirements:
 - 1. Insulation Board: Shall be produced and labeled under a third party quality program as required by applicable building code

2. ASTM Standards: 2.1.1 E2430 – Expanded Polystyrene (EPS) Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems (EIFS)
3. C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

D. Sealant Contractor:

1. Shall be the approved applicator, or a subcontractor to and under the direct supervision of the approved applicator.
2. Shall be experienced and competent in the installation of high performance industrial and commercial sealants.

1.04 SUBMITTALS

A. Product Data:

1. The Contractor shall submit to the owner/architect Manufacturer's product data sheets describing products which will be used on this project.

B. Samples:

1. The Contractor shall submit to the owner/architect two 2' x 4' samples of the EIF/ACF System showing finish, texture, and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used.

C. Test Reports:

1. When requested, the Contractor shall submit to the owner/architect copies of selected test reports verifying the performance of the EIF System.

D. Installer's Certificate

E. Maintenance Kit

F. System Warranty Documents

1.05 PROJECT / SITE CONDITIONS

A. Installation Ambient Air Temperature: Minimum of 40°F (4°C) and rising, and remain so for 24 hours thereafter.

B. Substrate Temperature: Do not apply materials to substrates whose temperature are below 40°F (4°C) or contain frost or ice.

C. Inclement Weather: Do not apply materials during inclement weather unless appropriate protection is employed.

D. Sunlight Exposure: Avoid, when possible, installation of the materials in direct sunlight. Application of Acrylic Finishes in direct sunlight in hot weather may adversely affect aesthetics.

- E. Materials shall not be applied if ambient temperature exceeds 120°F (49°C) or falls below 40°F (4°C) within 24 hours of application. Protect materials from uneven and excessive evaporation during hot, dry weather.
- F. Prior to installation, the wall shall be inspected for surface contamination, or other defects that may adversely affect the performance of the materials and shall be free of residual moisture.

1.06 WARRANTY

- A. Provide Manufacturer's standard written material and labor warranty for EIFS Systems.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in original packaging with manufacturer's identification.
- B. Storage: Store materials in a cool, dry location, out of sunlight, protected from weather and other harmful environment, and at a temperature above 40°F (4°C) and below 110°F (43°C) in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807 Contact: Architectural Sales (866.516.0061) or Technical Support (800.226.2424).
- B. Systems by other manufacturers, i.e. Dry-vit, Sto, Teifs may be acceptable if systems required for project are equivalent in performance and appearance.
- C. All components of the system shall be obtained from the system manufacturer or its authorized distributors. No substitutions of, or additions of, other materials shall be permitted without prior written permission from the system manufacturer.

2.02 EIFS FUNCTIONAL CRITERIA

- A. Impact Resistance Classification:
 - 1. High Impact Resistance, 90-150 in-lbs Impact Range from base to 4 feet above finish floor.
 - 2. Standard Impact Resistance, 25-49 in-lbs Impact Range from 4 feet above finish floor to top of wall where finish terminates.
- B. Manufacturer's Details:
 - 1. EIFS latest published information shall be followed for standard detail treatments.

2.03 MATERIALS

- A. Secondary Water-Resistive Barrier:
 - 1. Roll-on water resistive barrier coating.
 - 2. Non-woven synthetic fiber tape to reinforce Water-resistive barrier at sheathing board joints, into rough openings and other terminations into dissimilar materials.
 - 3. Flashing Membrane: Self sealing, Polyester faced, rubberized asphalt membrane, 30 mils thick.
- B. Adhesives:
 - 1. 100% acrylic polymer based, requiring the addition of Portland cement; used as an adhesive to laminate EPS Insulation Board to the water-resistive barrier, or
 - 2. Copolymer based, factory blend of cement and proprietary ingredients; requiring the addition of water only, used as an adhesive to laminate EPS Insulation Board to the water-resistive barrier.
- C. Insulation Board:
 - 1. Produced and labeled under a third party quality program as required by applicable building code; and produced by a manufacturer approved by Primary EIFS Manufacturer.
 - 2. ASTM C578 and ASTM E2430, Type I molded expanded polystyrene insulation board.
 - 3. Maximum size shall be 2 ft x 4 ft.
 - 4. Thickness: to provide the "R" value for Continuous Insulation of R7.5.
- D. EIF and ACF System Base Coat:
 - 1. Base Coat & Adhesive: 100% acrylic polymer base, ready to use, applied without the addition of cement.
- E. Reinforcing Mesh:
 - 1. Standard Mesh: Weight 4.5 oz. per sq. yd.; coated for protection against alkali.
 - 2. Short Detail Mesh: Reinforcing mesh used for backwrapping and details.
 - 3. High Impact 14 Mesh: Weight 15 oz. per sq. yd. Reinforcing mesh used with a Standard System; to achieve ASTM E2486 high impact strength.
- F. EIF and ACF System Finish Coat:
 - 1. Standard Finish: Factory blended, 100% acrylic polymer based finish, integrally colored. Finish type, texture and color as selected by the A/E
- G. Sealant Systems: Refer to Section 07 92 00, sealant Type K
- H. Pre-cleaning solutions for existing finish as approved by re-coat system manufacturer.
- I. Accessories: Portland cement, drainage strips, flashings, and sealants as required by manufacturer's details and recommendations.

2.04 SOURCE QUALITY CONTROL

- A. Provide products specified herein from a single source.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to installation of the system, the substrate shall be examined as follows:
 - 1. Substrate shall be free of foreign materials such as oil, dust, dirt, form-release agents, paint, wax, glazing, water, moisture, frost, dust, dirt, laitance, efflorescence, and other harmful contaminants.
 - 2. Substrate construction in accordance with substrate material manufacturer's specifications and applicable building codes.
 - 3. Substrate shall be cured concrete (28 days minimum)
 - 4. Substrate shall have no irregularities greater than 1/4".
 - 5. The substrate shall be examined for soundness, such as tightness of connections, crumbling or looseness of surface, voids and projections, etc.
 - 6. The substrate shall be examined for dimensional correctness per this specification.
 - 7. Work shall not proceed until unsatisfactory conditions are corrected.
- B. Sealants and Backer Rod: To be installed, where required, in accordance with the sealant manufacturer's specifications and published literature, and using the sealant manufacturer's recommended primers.
- C. Advise Contractor of discrepancies preventing proper installation of the EIFS materials. Do not proceed with the work until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Protection: Protect surrounding material surfaces and areas during installation of system.
- B. Clean surfaces thoroughly prior to installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 MIXING

- A. Mix materials in accordance with manufacturer's instructions.

3.04 INSTALLATION

- A. Install System in accordance with the system manufacturer's written installation instructions and details.

- B. EIFS Drainage Accessories and Water Resistive Barrier:
1. Plywood and OSB substrates cut edges (non-factory edges) must be sealed with a water-resistive coating.
 2. Install drainage tracks (limited to terminations at foundations), back-wrap mesh, or edge-wrap mesh at system terminations. Treat sheathing joints with water-resistive barrier and embed Sheathing Tape.
 3. Flash all rough openings with water-resistive barrier and embed Sheathing Tape or Flashing Membrane.
 4. Apply Water-resistive barrier to the surface of the appropriate substrate (in accordance with product data sheet).
 5. Treat the heads of all window, door and similar openings with back-wrap mesh to allow for drainage at these locations.
- C. Insulation Board:
1. Install back-wrap mesh or edge-wrap mesh at system terminations.
 2. Apply EIFS adhesive to backs of insulation boards with a notched trowel, with ribbons of adhesive oriented in a vertical direction (parallel to the 2 ft (61 mm) dimension of the EPS board).
 3. Install insulation board without gaps in a running bond pattern and interlocked at corners.
 4. Rasp irregularities off insulation board after adhesive has dried a minimum of 24 hours.
- D. Apply base coat and fully embed mesh in base coat; include diagonal mesh patches at corners of openings and reinforcing mesh patches at joints of track sections.
1. Apply multiple layers of base coat and mesh where required for specified impact resistance classification
 2. If leveling is required, apply up to 3/8" thick in a single pass when used as a leveler.
- E. Bond supplemental EPS shapes as indicated on the drawings. Bond shapes to EPS or to dry reinforced base coat using system adhesive. Allow 24 hours to dry.
- F. Finish Coat: Apply finish coat to match specified finish type, texture, and color. Do not apply finish coat to surfaces to receive sealant. Keep finish out of sealant joint gaps.

3.05 REPAIR AND RECOATING

- A. Clean existing finish as recommended by manufacturer of recoating system. The existing finish should be clean and dry
- B. Remove loose sealants around window and door perimeters, expansion joints, abutments to dissimilar materials, penetrations around fixtures, hose bibs, outlets, etc; terminations at top and bottom of walls, sidewall and roof line intersections.
- C. Patch missing insulation.

- D. Use skim coat where existing texture is missing.
- E. Damage, such as dents, punctures, holes, etc., may require removal and replacement of finish, base coat, reinforcing mesh, and even insulation board. Contact the Parex USA Technical Services Department for specific information on repairs of this nature.
- F. Apply coating with either a brush, roller, or suitable spray equipment (follow the product data sheet for application). Generally coatings exhibit good surface coverage in single applications over existing finishes. However, depending on the texture and/or color of the existing finish, it may be necessary to apply two coats. Apply per recoat manufacturer's installation instructions.
- G. Repair/replace sealant joints.

3.06 CLEAN UP

- A. Remove and legally dispose of finish systems materials from job site.
- B. Clean work area and surfaces of foreign materials resulting from work.

3.07 PROTECTION

- A. Provide protection of installed materials from water infiltration into or behind them.
- B. Provide protection of installed materials from dust, dirt, precipitation, and freezing during installation and continuous high humidity until fully cured and dry.
- C. Clean exposed surfaces using materials and methods recommended by the manufacturer of the material or product being cleaned. Remove and replace work that cannot be cleaned to the satisfaction of the A/E.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Weather barrier membranes for:
 - 1. EIFS Systems
- B. Accessories:
 - 1. Seam Tape
 - 2. Flexible Flashings
 - 3. Fasteners
- C. Related Sections:
 - 1. Section 07 24 00: Exterior Insulation Finish Systems

1.02 REFERENCES

- A. ASTM International:
 - 1. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C 1193 - Standard Guide for Use of Joint Sealants
 - 3. ASTM D 882 - Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D 1117 - Standard Guide for Evaluating Non-woven Fabrics
 - 5. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E 96 - Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
 - 8. ASTM E 1677 - Specification for Air Retarder Material or System for Framed Building Walls
 - 9. ASTM D903 - Test Methods for Peel or Stripping Strength of Adhesive Bonds
- B. AATCC – American Association of Textile Chemists & Colorists
 - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI:
 - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
 - 2. Test Method T-460; Air Resistance of Paper (Gurley Hill Method)

1.03 DEFINITIONS

- A. Weather Barrier: A combination of materials and accessories that do the following:
 - 1. Prevents the accumulation of water as a water-resistive barrier.
 - 2. Minimizes the air leakage into or out of the building envelope as a continuous air barrier.
 - 3. Provides sufficient water vapor transmission to enable drying as a vapor-permeable membrane.
- B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly per International Building Code.
- C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 section 5.4.3.1.
- D. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).
- E. Vapor Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E 96 per definition in International Building Code. Vapor permeable material permits the passage of moisture vapor through vapor diffusion

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer current technical literature for each component.
- B. Samples: Weather Barrier Membrane, minimum 8-1/2 inches by 11 inch.
- C. Quality Assurance Submittals:
 - 1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
 - 2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
- D. Closeout Submittals
 - 1. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
 - 2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.

3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

B. Mock-up:

1. Install mock-ups required by other sections using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store weather barrier materials as recommended by weather barrier manufacturer.

1.07 SCHEDULING

- A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.
- B. Schedule installation of weather barrier materials and exterior cladding within nine months of weather barrier assembly installation.

1.08 PROJECT CONDITIONS

- A. Do not apply flexible flashing on wet or damp surfaces.
- B. Apply to surfaces free of dirt, oils, lubricants and other debris.
- C. Install flexible flashing materials at temperatures above 40°F. At temperatures below 40°F, apply primer in accordance with flashing manufacturer recommendations, prior to installation of flashing.

1.09 WARRANTY

- A. Special Warranty:
 1. Weather barrier manufacturer's warranty for weather barrier for a period of ten years from date of Substantial Completion.
 2. Approval by weather barrier manufacturer for warranty is required prior to assembly installation.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. DuPont Building Innovations; 4417 Lancaster Pike, Chestnut Run Plaza 721, Wilmington, DE 19805; 1.800.44TYVEK (8-9835); <http://construction.tyvek.com>

- B. W.R. Grace & Co: Grace Construction Products
- C. Products specified by naming only one product or manufacturer shall be considered to be the “Basis of Design”. Manufacturers may submit equivalent products, if products comply with or are superior to specified requirements, functional design and warranty. Product must also meet aesthetic characteristics of specified product in the opinion of the Architect, wherever appearance is critical. Refer to Section 01 60 00.

2.02 MATERIALS

- A. Weather Barriers
 - 1. Beneath EIFS:
 - a. Single-Layer weather barrier with integral drainage, including flashing and sealing of penetrations and seams.
 - 2. Beneath Adhered Stone Cladding System and Stucco Systems:
 - a. Double-layer weather barrier with integral drainage, including flashing and sealing of penetrations and seams,
 - 3. Physical Characteristics
 - a. High-performance, flash spun-bonded olefin, non-woven, non-perforated, secondary weather barrier.
 - b. High tear and wind load resistance
 - c. UV Resistant
 - 4. Performance Characteristics:
 - a. Air Penetration: 0.004 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677.
 - b. Water Vapor Transmission: 50 perms, when tested in accordance with ASTM E96, Method B.
 - c. Water Penetration Resistance: Minimum 210 cm when tested in accordance with AATCC Test Method 127.
 - d. Basis Weight: Minimum 2.1 oz/yd², when tested in accordance with TAPPI Test Method T-410.
 - e. Air Resistance: Air infiltration at 300 seconds, when tested in accordance with TAPPI Test Method T-460.
 - f. Tensile Strength: Minimum 30/30 lbs/in., when tested in accordance with ASTM D882, Method A.
 - g. Tear Resistance: 7/9 lbs, when tested in accordance with ASTM D1117.
 - h. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 5, Smoke Developed: 25.

2.03 ACCESSORIES

- A. Seam Tape: As approved manufactured by weather barrier manufacturer.
- B. Fasteners: Manufacturer approved fasteners for substrate conditions.

- C. Sealants:
 - 1. Refer to Section 07 92 00 Joint Sealants.
 - 2. Provide sealant that complies with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.
- D. Adhesives:
 - 1. Provide adhesive recommended by weather barrier manufacturer.
 - 2. Products: Adhesives recommend by the weather barrier manufacturer.
- E. Primers:
 - 1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
 - a. Primers recommended by the flashing manufacturer.
- F. Flexible Flashings:
 - 1. Flexible membrane flashing materials for window openings and penetrations.
 - a. Face Material Composition: Conformable textured polyethylene laminate barrier.
 - b. Face color: White.
 - c. Adhesive composition: Butyl adhesive
 - d. Thickness: 70 mil
 - e. Release liner: 2-part siliconized paper.
 - f. Elastic Elongation: >230% at 70°F.
 - g. Performance Characteristics:
 - 1) Water intrusion: No leakage at 75 Pa, when tested in accordance with ASTM E331.
 - 2) Water Vapor Permeability: < 1 perm, when tested in accordance with ASTM E96.
 - 2. Straight flashing membrane materials for flashing windows and doors and sealing penetrations such as masonry ties, etc.
 - a. Face Material Composition: Textured polyethylene laminate barrier
 - b. Face color: White
 - c. Release Liner: 1 piece siliconized paper
 - d. Adhesive composition: Butyl adhesive
 - e. Thickness: 30 mil
 - 3. Dual-sided flashing membrane materials for brick mold and non-flanged windows and doors.
 - a. Face Material Composition: Spunbonded polyethylene
 - b. Face Color: White
 - c. Release liner: 2-piece siliconized paper
 - d. Adhesive Composition: Dual-sided butyl adhesive
 - e. Thickness: 30 mil
 - 4. Thru-Wall Surface Adhered Membrane with Integrated Drip Edge: Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angles, foundations, etc.) and at transitions between different assembly materials.

5. Preformed Inside and Outside Corners and End Dams: Preformed three-dimensional shapes to complete the flashing system used in conjunction with Thru-Wall Flashing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.02 WEATHER BARRIER INSTALLATION -

- A. General: Comply with weather barrier manufacturer's written instructions and warranty requirements.
- B. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- C. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
- D. Apply wrap with grooved surface pattern in vertical direction.
- E. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface. Maintain weather barrier plumb and level
- F. Shingle weather barrier over back edge of weep screed. Seal weather barrier with sealant or tape to weep screed. Ensure weeps are not blocked.
- G. Subsequent layers shall overlap lower layers a minimum of 6 inches horizontally in a shingling manner.
- H. Window and Door Openings: Extend weather barrier completely over openings.
- I. Weather Barrier Attachment
 1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.
 2. Attach weather barrier to masonry. Secure using weather barrier manufacturer recommended fasteners, space 12 -18 inches vertically on center and 24 inches maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24 inches on center, when coordinated on the project site.

- J. Seams: Seal seams with building wrap tape per manufacturer's recommended installation instructions.
 - 1. Shiplap horizontal seams in weather barrier to facilitate proper drainage.
- K. Fasteners: Use weather barrier manufacturer's recommended fasteners to secure weather barrier and install fasteners according weather barrier manufacturer's installation guidelines.
 - 1. Do not use temporary fasteners to permanently attach weather barrier.
 - 2. Do not place fasteners with gasketing washers where weather barrier flashing will be installed.
 - 3. Install fasteners with gasketing washers through flashing where recommended by manufacturer.
- L. Openings: Completely cover openings with weather barrier, then cut weather barrier membrane to openings according to weather barrier manufacturer's installation guidelines.
 - 1. Provide head and jamb flaps and seam overlaps to maintain continuous drainage.
 - 2. Repair damage to weather barrier using method recommended by weather barrier manufacturer.
 - 3. Install flashing according to weather barrier manufacturer's installation guidelines.

3.03 WEATHER BARRIER FLASHING INSTALLATION

- A. Installation: Remove wrinkles and bubbles, reposition weather barrier as necessary to produce a uniform, smooth surface.
 - 1. Ensure that ambient and substrate surface temperatures are acceptable in accordance with manufacturer instructions and recommendations.
 - 2. Wipe surfaces to remove moisture, dirt, grease and other debris that could interfere with adhesion.
 - 3. Apply weather barrier manufacturer's recommended primer over concrete, masonry, and glass-mat gypsum wall sheathing substrates to receive weather barrier flashing.
 - 4. Lap weather barrier flashing a minimum of 2 inches onto weather barrier.
 - 5. Apply pressure over entire surface using roller or firm hand pressure
- B. Rough Openings: Shiplap flashing with weather barrier in a shingle manner to maintain a continuous downward drainage plane and air and water barrier in accordance with manufacturer's written instructions.
 - 1. Apply 9-inch- wide conformable weather barrier flashing at door and window sills.
 - 2. Ensure that sill flashing does not slope to the interior.
 - 3. Install backer rod in joint between frame of opening product and flashed rough opening on the interior.

4. Apply sealant or closed-cell polyurethane foam insulation around entire opening/fenestration product to create air seal around interior perimeter of window openings in accordance with weather barrier manufacturer's instructions.
 5. Around door and window openings, apply butyl-based flashing to flaps of weather barrier.
 6. Use strip flashing with wrap cap screws to secure head flap of the windows.
- C. Penetrations: Apply weather barrier manufacturer's recommended weather barrier flashing patches behind fastening plates, such as brick-tie base plates, metal-flashing clips, and metal channels.
1. Seal weather barrier around each penetration with weather barrier manufacturer's recommended self-adhered flashing product or sealant. Integrate products with flanges into the weather barrier.
- D. Terminations: Provide minimum 2 inches overlap using strip flashing on adjoining roof and base of wall systems to maintain continuous downward drainage plane.
1. Secure weather barrier with fasteners and weather-barrier flashing.
- 3.04 CLEANING
- A. Immediately remove release paper and scrap from work area and dispose of material
- 3.05 PROTECTION
- A. Protect installed weather barrier from damage.

END OF SECTION

SECTION 07 54 23

THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes labor, materials, and equipment and supervision to install the following fully adhered roof systems including wall terminations, curb and wall flashings, corners, roof edges/parapets, and penetrations:
 - 1. TPO Roof System: TPO membrane over coverboard over insulation over wood sheathing
- B. Related Work
 - 1. Section 06 10 00 – Rough Carpentry: Wood Nailers
 - 2. Section 07 60 00 – Flashing and Sheet Metal
 - 3. Division 23: Mechanical Units

1.02 REFERENCE STANDARDS

- A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards are deemed mandatory and applicable to the Work.
- B. ASTM American Society for Testing and Materials
- C. NRCA National Roofing Contractors Association
- D. UL Underwriters Laboratories, Inc.
- E. PIMA Polyisocyanurate Insulation Manufacturers Association
- F. SMACNA Sheet Metal and Air Conditioning National Contractor's Association
- G. OSHA Occupational Safety and Health Administration
- H. SPRI Single Ply Roofing Industry

1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 "Terminology Relating to Roofing and Waterproofing"; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute Glossary of Roofing Terms for definition of terms related to roofing work in this Section.

- B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Jobsite Safety: Execute all operations and provide a safe work environment in accordance with OSHA standards and regulations. This requirement applies to all Contractor personnel, associated subcontractors, workers in other trades, and jobsite visitors.
 - 1. Follow all industry fire prevention guidelines for storage of materials, staging areas, roof access, and application means and methods.
 - 2. Any applicable local fire codes supersede industry guidelines.
- D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7-02.

1.05 SUBMITTALS

- A. Submittals Package – General:
 - 1. Submit the Shop Drawings, Product Data, Samples, and Quality Control Submittals specified below at the same time as a package.
 - 2. All submittal packages must be submitted prior to the Pre-Installation Conference.
- B. Product Data:
 - 1. Catalog sheets, Specifications and installation instructions for each material specified.
 - 2. Submit an intent to warrant, executed by authorized representative of system manufacturer, indicating that manufacturer has reviewed drawings, specifications and conditions affecting the work and, and proposes to provide warranties as referenced herein without further stipulation.
 - 3. Manufacturer's Warranty: Submit a sample copy of the membrane manufacturer's warranty covering workmanship and materials.
- C. Shop Drawings:
 - 1. When there is a proposed deviation from the Contract Documents, submit the revised detail labeled as such for approval. On the revised detail show existing conditions and referenced directly to the related details on the Contract Drawings.

2. Submit an accurate layout of the tapered insulation, designed and provided by the membrane manufacturer, showing the slopes to the drains.
 - a. Show cross-section drawings illustrating the location and thickness of tapered insulation pieces and filler pieces.
 - b. Show the thickness of the insulation system at high and low points.
 3. Submit an accurate layout of the wood nailers showing their required locations, and required spacing between nailers. Show the direction of the laps in relation to the slope of the deck and the wood nailers.
- D. Samples:
1. All submitted samples must be labeled and supplied by manufacturer:
 - a. Roofing Membrane
 - b. Insulation
 - c. Coverboard
 - d. Fasteners: Three each type
- E. Certificates:
1. Indicating materials and methods of application of roofing systems meet requirements of Warranty.
 2. Indicating compliance with energy performance requirement.
 3. Sample Warranty: As specified.
- F. Documentation of installers' and inspectors' qualifications.
- G. Field reports of roofing inspector.
- H. Temporary protection plan for buildings being re-roofed. Include list of proposed temporary materials.
- I. Contract Close-out Submittals:
1. Maintenance Manuals.
 2. Warranty signed by installer and manufacturer.
- 1.06 QUALITY ASSURANCE
- A. Certifications:
1. Provide letter from the roofing membrane manufacturer certifying the proposed roofing assembly, compatibility of materials and total R-value of the insulation system.
- B. Membrane Manufacturer's Certifications:
1. Submit a letter certifying that the manufacturer has been actively marketing the submitted system for a minimum of five years.
 2. Submit written certification that the manufacturer subscribes to a quality assurance process, or equivalent, in order to optimize product quality.

3. Roofing system manufacturer must provide inspection of guaranteed roofing systems by company employed, salaried personnel dedicated to Technical Services.
 4. Sales representatives or sales agents will not be permitted to conduct quality assurance inspections or grant final manufacturer's acceptance.
- C. Contractor's Certification:
1. Provide a letter from the membrane manufacturer certifying that the installer is licensed or approved to install the roof system.
 2. Provide names, addresses, and telephone numbers of five buildings where the applicator has installed similar roof systems that have the manufacturer's guarantee issued. Include the types of systems installed, the manufacturer's name, and the guarantee numbers.
 3. Letter certifying that the job foreman or crew chief and at least one other member of the roofing crew have installed at least similar systems and are thoroughly familiar with all aspects of the installation.
- D. Contractor's Qualifications – Roofing Firm Qualifications:
1. Installation of a minimum of ten roofs of comparable size, scope, and complexity as the roofing system specified in the Contract Documents, including all related sheet metal work, if applicable. (List last five such jobs within 50 miles of the job site, including address, type of system and number of plies, if applicable, square footage, date installed and owner/agent with whom contracted).
 2. In continuous operation of installing such roofing systems for two years or more.
- E. Installer Qualifications:
1. Licensed or approved in writing by manufacturer to perform work under warranty requirements of this Section.
 2. Employ full-time supervisors knowledgeable and experienced in roofing of similar types and scopes, and able to communicate with owner and workers.
- F. Inspector Qualifications:
1. Inspection of work by third-party technical inspector or technical representative of manufacturer experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
 - a. An authorized full-time technical employee of the manufacturer, not engaged in the sale of products.
 - b. An independent party certified as a Registered Roof Observer by the Roof Consultants Institute (RCI), retained by the Contractor or the Manufacturer and approved by the Manufacturer.

G. Preliminary Roofing Conference:

1. Before starting roof deck construction, conduct conference at Project site. Comply with requirements for pre-installation conferences. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
 - a. Meet with Owner's Representative, A/E, Owner's insurer (if applicable), testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 - b. Review means, methods, and procedures related to roofing installation, including manufacturer's written instructions.
 - c. Review Project Safety Plan for site conditions, enforcement, compliance, or Owner imposed restrictions that may be required.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Examine site for approved staging areas, disposal sites, and document existing conditions prior to contractor mobilization. Establish scope of work for site restoration and responsibilities.
 - f. Examine site for condition and completion of areas adjacent to work area. Establish protection required for existing surfaces.
 - g. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - h. Review structural loading limitations of roof deck during and after roofing operations.
 - i. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - j. Review governing regulations and requirements for insurance and certificates if applicable.
 - k. Review temporary protection requirements for roofing system during and after installation.
 - l. Review work limitation by contractor including; start times, end times, days of the week, noise mitigation, fume control and any part of the work that would effect normal building operations.
 - m. Review trade coordination necessary for job completion.
 - n. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, HANDLING, AND DISPOSAL

- A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption

- B. Storage and Handling:
1. Store materials a minimum of 6" off the ground, in a dry, well-ventilated place protected from the weather.
 - a. Enclosed trailers are recommended.
 - b. Temperature conditioned storage is required for temperature sensitive items.
 2. Mark for clear and evident identification all material that has been subject to moisture.
 - a. Remove such materials from the site.
 3. Handle roll goods with care.
 - a. Do not use roll goods which have been damaged.
 - b. Leave materials in their packaging until ready for use.
 4. Allow no unlabeled materials on site.
- C. Disposal:
1. All removed materials become the property of the Contractor.
 2. Inspect ground areas surrounding roof on a daily basis for loose debris.
 3. Immediately move all debris off roof and into approved dumpster.
 4. Dumpster staging areas must be kept neat and tidy.
 - a. Do not allow to overflow.
 5. All debris must be transported to a legal dumpsite or recycling facility and documentation of each load must be maintained by the Contractor.

1.08 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to Manufacturer's written instructions and guarantee requirements.
1. Do not start roofing if rain is imminent, or ambient temperature is below 45°F.
 2. If rain occurs during roof membrane application, cease operations and protect deck, insulation, penetrations and membrane from water damage and intrusion.
- B. Comply with all fire regulations. Ensure properly rated, charged, and inspected fire extinguishers are on the roof and staging area.

1.09 WARRANTY

- A. Provide manufacturer's 20-year total System Warranty covering both labor and material with no dollar limitation. Warranty shall include coverage for:
1. Leaks caused by hail damage for hail up to 1" diameter
 2. Wind damage from peak gusts up to 110 mph gusts measured at 10 meters above the ground
- B. Installer's Guarantee:
1. Special Project Warranty: Submit Roofing Installer's warranty, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation,

fasteners, cover boards, substrate boards, and walkway products, for a period of two (2) years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Versico TPO, fully adhered system meeting the stated 20 year warranty requirements.
 - 1. Alternate manufacturers may submit equivalent systems to the A/E for evaluation and approval following the procedure for substitutions.

2.02 MATERIALS

- A. Provide only those products covered under the manufacturer's warranty.
- B. Products, including insulation, fasteners, fastening plates, prefabricated accessories and edgings must be manufactured, supplied and/or approved by the roof system manufacturer and covered by the Warranty.
- C. Thermal Layer:
 - 1. Insulation shall be installed in multiple layers. The first and second layers of insulation shall be mechanically fastened to the substrate in accordance with the manufacturer's published specifications.
 - 2. Provide polyisocyanurate foam core insulation board covered on both sides with a medium weight fiber-reinforced felt facer meeting ASTM C 1289-06, Type II, Class 1, Grade 3 (25 psi), available in 4' x 8' standard size with a thickness to achieve a minimum long-term thermal resistance factor of 20 overall.
- D. Coverboard:
 - 1. ½" rigid insulation panel composed of a high-density, closed-cell polyisocyanurate foam core laminated to moisture resistant coated-glass fiber-mat facer for use as a cover board or recover board meeting ASTM 1289-06, Type II, Class 2 (100 psi).
- E. Membrane Layer:
 - 1. VersiWeld 60 mil tan reinforced TPO membrane as needed to complete the roofing system. Membrane thickness over the reinforcing scrim shall be nom 15 mil thick or greater.
 - 2. Color: Tan
 - 3. Membrane Layer Attachment: Adhesive
- F. Vapor Barrier: Vapor Barrier Membrane comprised of SBS modified bitumen adhesive factory laminated to a tri-laminate woven, high-density polyurethane top surface and compatible water-based primer.

- G. Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.
- H. TPO Walk Pad Protective surfacing for roof traffic shall be
 - 1. VersiWeld TPO Walkway Rolls installed per manufacturer's requirements or concrete pavers loose laid over an approved slip sheet
 - 2. As walkway on roof around rooftop equipment, as shown on the Drawings.
- I. Roof Edging System: Of types detailed on the Drawings.
- J. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- K. Bonding Adhesive: Manufacturer's standard, water-based.
- L. Metal Termination Bars: Manufacturer's standard, pre-drilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- M. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, pre-punched.
- N. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening membrane to substrate.
- O. Miscellaneous Accessories: Provide sealers, preformed flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories acceptable to manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions with roofing installer and roofing inspector to verify compliance with project requirements and suitability to accept subsequent roofing work. Correct unsatisfactory conditions before proceeding with roofing work.
- B. Do not apply roofing if roof surface will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon, unless system is protected.

3.02 PREPARATION

- A. Complete roof deck construction prior to commencing roofing work:
 - 1. Install curbs, blocking, edge strips, nailers, cants, and other components where insulation, roofing, and base flashing is attached to, in place, ready to receive insulation and roofing.

2. Complete deck and insulation to provide designed drainage to working roof drains.
 3. Document installation of related materials to be concealed prior to installing roofing work.
- B. Dry out surfaces, including the flutes of metal deck that become wet from any cause during progress of the work, before roofing work is resumed. Apply materials to dry substrates.
- C. Sweep decks to broom-clean condition. Remove all dust, dirt or debris.
- D. Remove projections that might damage materials.
- E. Fill surface voids of the immediate membrane substrate greater than 1/4" wide.
- F. Existing Roofs:
1. Remove and dispose of existing roofing, roof edging, and roof drains to deck.
 2. Correct substrate defects.
 - a. Defects shall be corrected before work commences.
 - b. Assure conditions are satisfactory to commence with the project as designed.

3.03 TEMPORARY PROTECTION

- A. Install temporary protection at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent. Comply with approved temporary protection plan.
- B. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
- C. Provide for removal of water or drainage of water away from the work.
- D. Provide temporary protection over installed roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by A/E for roof areas that are to remain intact and that are subject to foot traffic and damage.

3.04 INSTALLATION, GENERAL

- A. NRCA Installation Standard: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations.
- B. Manufacturer Recommendations: Comply with roofing system manufacturer's written installation recommendations.

- C. Coordination with Related Work: Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.
- D. Installation Conditions:
 - 1. Apply dry roofing materials. Apply roofing work over dry substrates and materials.
 - 2. Apply materials within temperature range and surface and ambient conditions recommended by manufacturer.
 - 3. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
- E. Do not apply materials when the temperature is below 40 deg. F.
- F. Do not apply materials to substrate having temperature of 40 deg. F or less.

3.05 WOOD NAILER LOCATION AND INSTALLATION

- A. If nailers are required, the following requirements apply:
 - 1. Refer to the appropriate Roofing Manufacturer's Design Guide for the appropriate fastener to be used for securing membrane onto wood nailers.
 - 2. Nails penetrating treated wood nailers must be hot-dipped galvanized, meeting ASTM A653, Class G185 or as currently recommended by industry associations.
 - 3. Aluminum fasteners, flashings and accessory products must not make direct contact with treated wood nailers.
 - 4. Uncoated metal and painted metal flashing and accessories, except for 300-series stainless steel, must not make direct contact with treated wood nailers.
 - 5. When in doubt of the type of treatment of the wood nailer or its compatibility with a metal component, use EPDM membrane as a separator.
- B. Because of recent EPA regulations regarding treated wood, new treatments for lumber may be highly corrosive to fasteners. Contact the fastener manufacturer for their recommendations on fasteners if attaching nailers that have been treated with corrosive materials. Wood nailers must be installed as specified or as noted in Roofing Manufacturer's Design Guide. Install wood nailers as follows:
 - 1. Wood Nailer Grade: kiln-dried (Southern Pine, Douglas Fir) structural grade #2 or better, unless otherwise noted.
 - 2. Nailers shall be a minimum thickness of 2" x 4" nominal and exceed the width of any metal flange attached to it by a minimum of ½".

- C. Position Wood Nailer
 - 1. Total wood nailer height must match the total thickness of insulation being used and should be installed with a 1/8" gap between each length and each change of direction.
 - 2. When more than one nailer thickness is used end joints should be staggered a minimum of 12" from the prior layer in straight runs.
- D. Secure Wood Nailer:
 - 1. Wood nailers must be firmly fastened to the deck or building. Mechanically fasten wood nailers to resist a minimum force of 200 lb/f in any direction.
- E. Taper Wood Nailer:
 - 1. The wood nailer must be tapered (if applicable) so that it will always be flush at the point of contact with the insulation.

3.06 VAPOR BARRIER INSTALLATION

- A. Install vapor retarder per Roofing manufacturer's installation instructions.

3.07 INSTALLATION OF TPO ROOFING

- A. Install Insulation, Coverboard and Membrane in accordance with roofing manufacturer's published installation instructions for a fully adhered system.

3.08 INSTALLATION OF FLASHING

- A. Install flashings as the membrane is being installed. If the flashing can not be completely installed in one day, complete the installation until the flashing is in a watertight condition and provide temporary covers or seals.
- B. Install TPO flashing membranes to pipes, wall or curbs to a height not less than eight-inches above roof surfaces and four inches on roof membrane.
 - 1. Adhere flashing to pipe, wall, or curb with adhesive.
 - a. Form inside and outside corners of TPO flashing membrane in accordance with NRCA manual.
 - b. Form pipe flashing in accordance with NRCA manual use pipe boot.
 - c. Lap ends not less than four inches.
 - d. Heat weld flashing membranes together and flashing membranes to roof membranes. Finish exposed edges with sealant as specified.
 - e. Install flashing membranes in accordance with NRCA manual.
 - 2. Anchor top of flashing to walls or curbs with fasteners spaced not over eight inches on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
 - 3. Apply sealant to top edge of flashing.

3.09 WALKWAY PADS

- A. Use reinforced sheet not less than three feet wide.
- B. Heat weld walkway sheet to roof sheet at edges. Weld area two inches wide by the entire length of the walkway sheet.
- C. Finish edges of laps with sealants as specified.

3.10 DAILY SEAL

- A. When the completion of flashings and terminations is not achieved by the end of the workday, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements

3.11 CLEAN UP

- A. Perform daily clean up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking

END OF SECTION

SECTION 07 61 00

SHEET METAL ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet Metal Panel Roofing and Trim:
 - 1. Related roofing accessories, rakes, miscellaneous flashing and attaching devices, and drip flashings.
 - 2. Metal roof shall be installed over steel structure.
- B. Related Sections
 - 1. Division 7: Sheet Metal Flashing and Trim

1.02 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each system.
- B. Installer Certification: Submit certificate that the panel or roof system installer has been regularly engaged in the installation of systems of the same or equal construction to the system specified.

1.03 REFERENCES

- A. ASTM A-525 Steel Sheet, Zinc-coated (Galvanized)
- B. ASTM 792-86, AZ 55, Galvalume
- C. SMACNA – Architectural Sheet Metal Manual.

1.04 QUALITY ASSURANCE

- A. Field Measurements: Where possible, prior to fabrication of prefabricated panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.
- B. Manufacturer: Company with 10 years minimum of experience, specializing in Architectural Sheet Metal Products.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.
- B. Storage and Handling: Store materials in a clean, dry location before and during application. Outside storage must be off ground and protected by a breathable waterproof covering.
- C. Metal panels should be stored with one end of panels elevated to allow moisture to run off. Panels with strippable film must not be stored in the open, exposed to the sun.

1.06 WARRANTY

- A. Provide manufacturer's standard written paint film warranty for twenty (20) years on finish film integrity and color retention. The finish will not crack, check, peel, flake, or blister, or chalk in excess of ASTM D659, number 8 rating, or fade in excess of five units per ASTM D2244, under normal atmospheric conditions. Metal panel system manufacturer shall sign warranty.

PART 2 PRODUCTS

2.01 SHEET METAL MANUFACTURERS

- A. Metal Building Components, Inc.
- B. Berridge Manufacturing Co.
- C. Metal Sales Corporation

2.02 SHEET METAL MATERIALS

- A. Base Metal: Roof panels shall be formed from 24 gauge base steel conforming to ASTM A792, Gr50 with a minimum yield strength of 50,000 PSI or 26 gauge conforming to ASTM A792, Gr80 with a minimum yield strength of 80,000 PSI with a coating of hot-dipped zinc-aluminum alloy in accordance with AZ50 and Az55.
- B. Panel Style:
 - 1. Net coverage 36" wide factory formed ribbed roof "R" Panels 1-1/4 inch high ribs at 12 inches on center, roll formed, continuous length, with exposed self tapping fasteners.

2.03 METAL FINISHES

- A. Panel coating will be applied before forming and fabricating panels.
- B. Coating: Factory-applied Kynar 500 or approved equal fluoropolymer coating:
 - 1. Primer Both Sides: A corrosion inhibiting, water-base prime coat applied to a dry film thickness of no less than 0.25 mils and no more than 0.30 mils, shall be oven cured, water quenched and dried.
 - 2. Finish: An inorganically pigmented 70% polyvinylidene fluoride coat applied to a dry film thickness of no less than 0.75 mils and no more than 0.90.
 - 3. Humidity Test: No blistering, cracking, peeling, loss of gloss or softening of the finish after 3000 hours of exposure to 100% humidity at $100^{\circ}\text{F} \pm 5^{\circ}\text{F}$ per Federal Test Method Standard 141, Method 6201 or ASTM D 2247-87.
 - 4. Strippable film shall be applied to the topside of the painted coil to protect the finish during fabrication, shipping and field handling. Remove film before installation.

2.04 MISCELLANEOUS MATERIALS

- A. Sealing Tape: 99% solids, pressure sensitive polyisobutylene/isoprene elastomer based sealing compound tape with release paper backing. Not less than 1/2" wide and 1/8" thick, non-sag, nontoxic, nonstaining and permanently elastic.
- B. Joint Sealant: Off-white single component, solvent release type, non-skinning, butyl based pumpable sealant designed to be used in joints between metal panels and other parts on roofs where air, dust and water seals are required as recommended by roof manufacturer.
- C. Accessories: Provide components supplied and warranted by the panel manufacturer which are required for a complete system, including trim, flashings, sealant, gaskets, and similar items. Match material and finish of preformed panels.

2.05 PANEL FABRICATION: PERFORMANCES

- A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, and as required to fulfill indicated performance requirements which have been demonstrated by factory testing. Comply with indicated profiles and dimensional requirements, and with structural requirements.
- B. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials which are incompatible or could result in corrosion or deterioration of either material or finishes.

- C. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact in a manner which will minimize noise from movements within panel system.
- D. Condensation: Fabricate panels for control of condensation, including vapor inclusion of seals and provisions for breathing, venting, weeping, and draining.
- E. Panels shall be one piece in length of roof slope; no joints in the slope direction will be allowed.

PART 3 EXECUTION

3.01 INSPECTION

- A. General: Comply with panel fabricator's and material manufacturer's instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal/structural movement.
- B. Joint Sealers:
 - 1. Install gaskets, joint fillers and sealants where indicated and where required for weatherproof performance of panel systems.
 - 2. Provide types of gaskets and sealants/fillers indicated or if not otherwise indicated, types recommended by panel manufacturer.
 - 3. Refer to other sections of these specifications for product and installation requirements applicable to indicated joint sealers.

3.02 INSTALLATION

- A. Comply with manufacturer's standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.
- B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.
- C. Install starter and edge trim before installing roof panels.
- D. Remove protective strippable film prior to installation of panels.
- E. Attach panels using manufacturer's standard fasteners, spaced in accordance with approved shop drawings.
- F. Install tape sealant along panel sidelaps and endlaps.

- G. Do not allow panels or trim to come into contact with dissimilar materials.

3.03 CLEANING AND PROTECTION

- A. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
- B. Protect installed panels and trim from damage caused by adjacent construction until completion of installation.
- C. Damaged Units: Replace panels and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
- D. Cleaning: Remove temporary protective coverings and strippable films (if any) as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Flashings, sheet metal work and related items including, but not limited to:
 - 1. Metal counterflashing at vertical surfaces.
 - 2. Flashing at roof penetrations.
 - 3. Roof drainage systems: Scuppers.
 - 4. Exposed metal trim/fascia units.
 - 5. Parapet copings.
 - 6. Miscellaneous sheet metal accessories.
- B. Extent of each type of flashing and sheet metal work is indicated on Drawings and by provisions of this Section.
- C. Finished sheet metalwork will form a weathertight construction without waves, warps, buckles, fastening stresses or distortion, which allows for expansion and contraction. Sheet metal mechanic shall be responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous roofing operations.
- D. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.
- E. Roofing accessories which are installed integral with roofing membrane are specified in roofing system sections as roofing work.

1.02 RELATED WORK

- A. Division 7 - Roofing Systems

1.03 SUBMITTALS

- A. Product Data, Flashing, Sheet Metal, Accessories: Submit manufacturer's product data, installation instructions, and general recommendations for each specified sheet material and fabricated product.
- B. Shop Drawings, Flashing, Sheet Metal, Accessories: Submit Shop Drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter

flashings, trim/fascia units, gutters, downspouts, scuppers, and expansion joint systems; layouts at 1/4" scale, details at 3" scale.

1.04 QUALITY ASSURANCE

A. Standards:

1. Comply with design and installation methods of SMACNA Architectural Sheet Metal Manual.
2. Comply with The NRCA Roofing and Waterproofing Manual installation details.
3. Materials supplied under this Section shall be installed under the Roofing Warranty Requirements of Section 07 54 23 – Thermoplastic-Polyolefin (TPO) Roofing Systems.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
- B. Storage: Adequately protect against damage while stored at the site.
- C. Handling: Comply with Manufacturer's instructions.

1.06 JOB CONDITIONS

- A. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

PART 2 PRODUCTS

2.01 FLASHING AND SHEET METAL MATERIALS

A. Sheet Metal Flashing/Trim:

1. Zinc-Coated Steel: Commercial quality with 0.20% copper, ASTM A 525 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359" thick (24 gage) except as otherwise indicated.

B. Conductor Head/Scupper:

1. 24 ga. Kynar 500 coated galvanized steel.

C. Parapet Copings:

1. 24 ga. Kynar 500 coated galvanized steel.
2. Face height: outside height 4" min or greater if indicated on the Drawings; slope 1/2" to 3/4" down to inside.
3. Lengths: 10'-0" min.

4. Joints – splice in accordance with manufacturer’s product data.
 5. Nailers: When required by roofing manufacturer.
 6. Provide splice plates, anchor plates, fasteners.
- D. Reglets and Counterflashings: Fry Reglet Corporation, Type ST at stucco, Type MA at masonry.

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Solder: For use with steel or copper, provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.
- B. Fasteners: Same metal as flashing/sheet metal or, other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- C. Bituminous Coating: FS TT-C-494 or SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- D. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- E. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed; comply with FS TT-S-0027, TT-S-00230, or TT-S-001543.
- F. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.
- G. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.
- H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- I. Gutter and Conductor-Head Guards: 24 gage bronze or nonmagnetic stainless steel mesh or fabricated units, with selvaged edges and noncorrosive fasteners. Select materials for compatibility with gutter and downspouts.
- J. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed-cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
- K. Roofing Cement: ASTM D 2822, asphaltic.

2.03 FABRICATION

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA “Architectural Sheet Metal Manual” and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
- B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1” deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansive type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Aluminum Extrusion Units: Fabricate extruded aluminum running units with formed or extruded aluminum joint covers, for installation behind main members where possible. Fabricate mitered and welded corner units.
- G. Conductor Heads: Fabricate conductor heads to not less than 10” wide by 8” deep by 8” from front to back unless shown otherwise on the Drawings. Form front and side edges channel shape not less than 1/2” wide flanges with edge hemmed. Slope bottom to sleeve to downspout at not less than 60 degree angle. Extend wall edge not less than 1” above front edge. Solder joints for water tight assembly. Fabricate outlet tube or sleeve at bottom not less than 2” long to insert into downspout.
- H. Prefabricated counterflashing and reglet system: Form upper edge of counterflashing with an approved snap lock flange to engage reglet receiver and to provide a spring action at bottom edge against built-up flashing.

2.04 FINISH

- A. Shop prepare and prime exposed ferrous metal surfaces.
- B. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 1.5 mil.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams which will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof polyethylene underlayment.
- D. Metal Edgings:
 - 1. Provide metal drip edgings designed to allow water run-off to drip free of underlying construction at exposed edges of roofs indicated.
 - 2. Fabricate from 24 gage galvanized iron, profile indicated.
 - 3. Extend flanges of metal edgings out on top of roofing or base flashing (as applicable) not less than 4". Set in full bed of plastic cement. Spread full bed of plastic cement between sheets at laps. Nail flanges to wood nailer when nailers are under the membrane or flashing (as at roof edge or gravel stops). Nail as shown in the referenced quality standards.
- E. Eave Flashing:
 - 1. One piece in width, applied in 8 to 10 foot lengths. Provide a 3/4" continuous fold in the upper edge of the sheet to engage cleats spaced not more than 10" on center.
 - 2. Locate the upper edge of flashing not less than 18" from the outside face of the building, measured along the roof slope.
 - 3. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia.
 - 4. Where eave flashing intersects metal valley flashing, secure with 1" flat locked joints with cleats that are 10" on center.

- F. Sheet Metal Covering on Flat, Sloped, or Curved Surfaces:
1. Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 16" x 18".
 2. Fasten sheets to sheathing with metal cleats.
 3. Lock seams and solder. Lock aluminum seams as recommended by aluminum manufacturer.
 4. Provide an underlayment of roofing felt for all sheet metal covering.
- G. Flashing at Roof Penetrations and Equipment Supports:
1. Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck.
- H. Install reglets to receive counter-flashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 Sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 Sections.
- I. Counterflashing:
1. Provide metal counterflashing at top edges of base flashings and at other locations indicated.
 2. Lap end joints a minimum of 3". Do not solder or weld joints. Make flashing continuous at angles. Counterflashing shall overlap base flashing a minimum of 4", unless otherwise indicated.
 3. Where counterflashing terminates in reglets, fasten flashing with lead wedges every 12". Fill reglets continuously with synthetic rubber type sealant.
- J. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6". Fabricate seams at joints between units with minimum 3" overlap, to form a continuous waterproof system.
- K. Install prefabricated coping system in accordance with roofing manufacturer's product data.
- L. Scuppers: Line interior of scupper openings with sheet metal. Extend the lining through and project outside of the wall to form a drip on the bottom edge and form to return not less than 1" against the face of the outside wall at the top and sides. Fold outside edges under 1/2" on all sides. Provide the perimeter of the lining approximately 1/2" less than the perimeter of the scupper. Join the top and sides of the lining on the roof deck side to a closure flange by a locked and soldered joint. Join the bottom edge by a locked and soldered joint to the closure flange, where

required, form with a ridge to act as a gravel stop around the scupper inlet. Provide surfaces to receive the scupper lining and coat with bituminous plastic cement.

- M. Conductor Heads: Set the depth of top opening equal to two-thirds of the width. Provide outlet tubes not less than 4" long. Flat-lock solder the seams. Where conductor heads are used in conjunction with scuppers, set the conductor a minimum of 2" wider than the scupper. Attach conductor heads to the wall with fasteners; provide conductor heads with screens of the same material. Securely fasten screens to the heads.

3.02 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substrates which might cause corrosion of metal or deterioration of finishes.
- B. Protection: Protect flashings and sheet metal work during construction from damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 DESCRIPTION OF THE WORK

- A. Provide tested firestop systems as noted on the drawings (details) and in specific locations as follows:
 - 1. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 - 2. Sealant joints in fire-rated construction.
 - 3. Gaps between the top of walls and ceilings or roof assemblies.
 - 4. Openings and penetrations in fire-rated partitions or walls containing fire doors.
- B. Related work:
 - 1. Sealants required or specified in other Sections.

1.02 REFERENCES

- A. Definitions
 - 1. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in, or construction joints between, fire rated wall and floor assemblies.
- B. Reference Standards
 - 1. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops."
 - 2. Test Requirements: UL 1479, "Fire Tests of Through-Penetration Firestops."
 - 3. Test Requirements: UL 2079, "Tests for Resistance of Building Joint Systems."
 - 4. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
 - 5. Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
 - 6. Applicable current editions of the building codes: IBC, IFC, NMCBC.

1.03 SUBMITTALS

- A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions

- B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- C. Include material safety data sheets with product delivered to job-site.

1.04 QUALITY ASSURANCE

- A. Firestop System installation must meet requirements of ASTM E814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- B. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- C. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.05 INSTALLER QUALIFICATIONS

- A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacture's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with systems listed in Volume II of the UL Fire Resistance Directory; provide products of the following manufacturers as identified below:
 - 1. Hilti, Inc., Tulsa, Oklahoma 800-879-8000/www.us.hilti.com.
 - 2. Tremco Inc., Beachwood, OH, telephone 216.292.5000.
 - 3. 3M Fire Protection Products, St. Paul, MN, telephone 612.736.0203.
- B. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.02 FIRESTOPPING, GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- C. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
- D. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.
- E. Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.
- F. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E1966, or ANSI/ UL 2079.
- G. Provide penetration firestop systems, fire-resistive joint systems, or perimeter fire barrier systems subjected to an air leakage test conducted in accordance with Standard, ANSI/ UL1479 for penetrations and ANSI/UL2079 for joint systems with published L-Ratings for ambient and elevated temperatures as evidence of the ability of firestop system to restrict the movement of smoke.
- H. Provide T-Rating Collar Devices tested in accordance with ASTM E814 or ANSI/UL1479 for metallic pipe penetrations requiring T-Ratings per the applicable building code.
- I. Provide a fire-rated grommet for all individual or small grouped cable applications up to 0.53 in.
- J. Provide moisture-curing products where inclement weather or greater than transient water exposure is expected.

- K. Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.03 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance:
1. Through penetration firestop systems (XHEZ)
 2. Continuity Head-of-Wall Joint Systems (XHBO)
 3. Fill, Void or Cavity Materials (XHHW)
 4. Joint systems (XHBN),
 5. Perimeter firestop systems (XHDG)
- B. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.
- C. All through penetrations shall be labeled on both sides of the wall to indicate the appropriate UL system number, product used, installation date, hour rating installer, location number and telephone contact for the corresponding manufacturer. Material installed shall be as required for installation conditions and to achieve the required fire resistance.
- D. Use only firestop products that have been UL 1479, ASTM E814, or UL2079 tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
- E. For penetrations by non combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant
 2. Hilti FS ONE High Performance Intumescent Firestop Sealant
 3. 3M Fire Stop Sealant 2000
 4. 3M Fire Barrier CP25 WB
 4. Tremco Tremstop Fyre Sil Sealant
- F. For fire rated construction joints and other gaps, the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant
 2. Hilti CP 601 s Elastomeric Firestop Sealant
 3. Hilti CP 606 Flexible Firestop Sealant
 4. Hilti CP 672 Firestop Joint Spray
 5. 3M Firestop Sealant 2000
 6. Tremco Tremstop Fyre Sil Sealant

- G. For penetrations by combustible items (penetrants consumed by high heat aflame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe (closed piping systems) the following materials are acceptable:
 - 1. Hilti FS ONE High Performance Intumescent Firestop Sealant
 - 2. Hilti CP 618 Firestop Putty
 - 3. Hilti CP 642 Firestop Jacket
 - 4. Hilti CP 643 Firestop Jacket
 - 5. 3M Fire Barrier CP25 WB
 - 6. 3M Fire Barrier FS 195 Wrap/Strip
 - 7. Tremco Tremstop WBM Intumescent Firestop Sealant
- H. For penetrations by combustible plastic pipe (open piping systems), the following materials are acceptable:
 - 1. Hilti CP 642 Firestop Jacket
 - 2. Hilti CP 643 Firestop Jacket
 - 3. Hilti FS ONE High Performance Intumescent Firestop Sealant
 - 4. 3M Fire Barrier PPO Plastic Pipe Device
- I. Firestopping at Electrical Boxes and Utility Outlets:
 - 1. Hilti CP 618 Firestop Putty Stick
 - 2. Hilti CP 617 and CP 617L Firestop Putty Pad

PART 3 EXECUTION

3.01 PREPARATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Verify penetrations are properly sized and in suitable condition for application of materials.
 - 2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
 - 3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
 - 4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
 - 5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

- A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

- B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.03 INSTALLATION

- A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
 - 1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 - 2. Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
 - 3. Protect materials from damage on surfaces subjected to traffic.
- C. Masking:
 - 1. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed and that would be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials.
 - 2. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.04 IDENTIFICATION

- A. Identify firestopping with pressure sensitive, self adhesive preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestopping installation where the labels will be visible to anyone seeking to remove penetrating items or firestopping. Include the following information on the labels:
 - 1. The words: "WARNING DO NOT DISTURB FIRESTOPPING".
 - 2. Contractor's name, address and phone number.
 - 3. Firestopping system designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Firestopping manufacturer's name
 - 6. Installer's name.

3.05 FIELD QUALITY CONTROL

- A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- B. Keep areas of work accessible until inspection by applicable code authorities.

- C. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.06 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
 - 1. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 07 92 00

ELASTOMERIC SEALANTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide elastomeric joint sealants, joint fillers and joint backer materials for complete and durable seal at all locations scheduled and as indicated on the Drawings.

1.02 RELATED WORK

- A. Included Elsewhere to be Performed in Compliance with this Section:
 - 1. Division 03: Concrete
 - 2. Division 04: Masonry
 - 3. Division 05: Metals
 - 4. Division 06: Wood, Plastics and Composites
 - 5. Division 07: Thermal and Moisture Protection
 - 6. Division 08: Openings
 - 7. Division 09: Finishes
 - 8. Division 10: Specialties
 - 9. Division 11: Equipment
 - 10. Division 22: Plumbing
 - 11. Division 23: Heating, Ventilating and Air-Conditioning
 - 12. Division 26: Electrical
 - 13. Division 32: Exterior Improvements
- B. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.03 REFERENCES

- A. ASTM C 321 - Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
- B. ASTM C 834 - Standard Specification for Latex Sealants.
- C. ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
- D. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications.
- E. ASTM C 920 - Standard Specification for Elastomeric Joint Sealant.
 - Type S Single-component sealant.
 - Type M Multi-component sealant.

Grade P	Pourable or self-leveling for horizontal applications.
Grade NS	Non-sag for vertical applications.
Class 100/50	Sealant shall withstand an increase of at least 100% and a decrease of least 50% of the joint width
Class 50	Sealant shall withstand an increase and decrease of at least 50% of the joint width.
Class 25	Sealant shall withstand an increase and decrease of at least 25% of the joint width.
Use T	Pedestrian and vehicular traffic areas such as walkways, plazas, decks, and parking garages
Use NT	Non-traffic areas, horizontal and vertical surfaces.
Use M	Sealant meets this specification when tested on mortar.
Use G	Sealant meets this specification when tested on glass.
Use A	Sealant meets this specification when tested on aluminum.
Use I	Sealant meets this specification when immersed in non-chlorinated water
Use O	Sealant meets this specification when tested on substrates other than the above. Specify substrates types in project specification

- F. ASTM C 1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

1.04 SUBMITTALS

- A. Comply with pertinent provisions of SUBMITTALS SECTION.
- B. Product Data: Materials list of items proposed to be provided under this Section.
- C. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- D. Shop Drawings or catalog illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades.
- E. Manufacturer's current recommended installation procedures which, when reviewed by Engineer/Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- F. Color Charts of Sealants: Colors shall be selected by the Architect/Engineer from the range of manufacturer's standard colors.
- G. Qualification Data: For qualified applicator

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company regularly engaged in manufacturing and marketing of products specified in this section.

- B. Applicator Qualifications:
 - 1. Applicator shall have at least three years experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.
- C. Single Source Responsibility for Joint Sealants:
 - 1. Obtain joint sealants from single manufacturer for each different product required to ensure compatibility.
 - 2. Manufacturer shall instruct applicator in procedures for intersecting sealants.
- D. Perform work in accord with ASTM C-1193 guidelines except where more stringent requirements are indicated or specified.
- E. Schedule applications of waterproofing, water repellents and preservative finishes after sealant installation unless sealant manufacturer approves otherwise in writing. Cure installed sealant sufficiently prior to subsequent applications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets for each product.
- B. Store products in a location protected from freezing, damage, construction activity, precipitation, and direct sunlight in strict accordance with manufacturer's recommendations.
- C. Condition products to approximately 60 to 70 degrees F (16 to 21 degrees C) for use in accordance with manufacturer's recommendations.
- D. Handle all products with appropriate precautions and care as stated on Material Safety Data Sheet.

1.07 SUBSTRATE CONDITIONS

- A. General:
 - 1. Provide joints properly dimensioned to receive the approved sealant system.
 - 2. Provide joint surfaces that are clean, dry, sound and free of voids, deformations, protrusions and contaminants that may inhibit application or performance of the joint sealant.
 - 3. Provide a reservoir to accept sealant at expansion joints with preformed joint fillers.

1.08 PROJECT CONDITIONS

- A. Do not use products under conditions of precipitation or freezing weather. Use appropriate measures for protection and supplementary heating to ensure proper curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.
- B. Ensure substrate is dry.
- C. Protect adjacent work from contamination due to mixing, handling, and application of flexible epoxy joint filler.

1.09 WARRANTY

- A. Deliver to the Engineer/Architect signed copies of the following written warranties against adhesive and cohesive failure of the sealant and against infiltration of water and air through the sealed joint for a period of 3 years from date of completion.
 - 1. Manufacturer's standard warranty covering sealant materials.
 - 2. Applicator's standard warranty covering workmanship.
 - 3. Defective work shall include, but not be restricted to, joint leakage, cracking, crumbling, melting, running, loss of adhesion, loss of cohesion, or staining of adjoining or adjacent work or surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers may be from those listed or an A/E approved equal:
 - 1. Tremco, Inc
 - 2. Pecora
 - 3. Sonneborn(R) Building Products, ChemRex, Inc.
 - 4. General Electric
 - 5. Dow Corning
 - 6. A/E approved equal
- B. Compatibility:
 - 1. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with adjacent materials, as demonstrated by sealant manufacturer using ASTM C 1087 testing and related experience.
 - 2. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each joint sealant
 - 3. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates specified.
 - 4. Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600

2.02 MATERIALS

- A. Sealant A: High Performance, medium-modulus, low VOC, UV-Stable, non-sag sealant; ASTM C920 compliant, Grade NS, Class 50, Use NT. Acceptable sealants:
1. Single-Component Silicones Type S
 - a. Spectrem 1, 2 or 3
 - b. Pecora 860
 - c. A/E approved equal
 2. Single Component Urethane Type S
 - a. Sonolastic(R) NP 1
 - b. Vulkem 116, 911, 921 or 931
 - c. Tremflex 25
 - d. Pecora Dynatrol I XL
 - e. A/E approved equal
 3. Multi Component Urethane Type M
 - a. Sonolastic(R) NP 2
 - b. Dymeric 511
 - c. Vulkem 227 or 922
 - d. Pecora Dynatred
 - e. A/E approved equal
- B. Sealant B: Self-leveling sealant having a Shore A hardness of not less than 25 or more than 50 and plus-or-minus 25 percent joint movement capability; comply with ASTM C920, Grade P or NS, Class 25. Acceptable sealants:
1. Single-Component Urethane, Type S, comply with TT-S-00230C
 - a. Sonolastic SL 1
 - b. Vulkem 45
 - c. Tremflex SL
 - d. Pecora Urexpan NR-201
 - e. A/E approved equal
 2. Multi-component Urethane, Type M, comply with TT-S-00227E
 - a. Sonolastic SL 2
 - b. THC-900/901
 - c. Vulkem 227 or 245
 - d. Pecora Urexpan NR-200
 - e. A/E approved equal
- C. Sealant Type C: Non-skinning and non-staining flexible sealant designed for buttering or bedding application between non-porous substrates, including galvanized steel, unpainted steel and coated metals that are squeezed together by fastening.
1. Butyls:
 - a. Tremco JS-773
 - b. Tremco Butyl Sealant
 - c. Pecora
 - d. A/E approved equal

- D. Sealant Type D: Non-sag, high-performance sealant for perimeter caulking and glazing. Acceptable products
1. Urethanes:
 - a. Vulkem 1, 911, 921 or 931
 - b. Dymonic
 - c. Tremflex 25
 - d. A/E approved equal
 2. Silicones:
 - a. Spectrem 2 or 3
 - b. Proglaze
 - c. A/E approved equal
 3. Other:
 - a. JS-773
 - b. Tremco Butyl Sealant
 - c. Tremco Acoustical
 - d. A/E approved equal
- E. Sealant Type E: Comply with United States Department of Agriculture (USDA) guidelines for incidental food contact with the cured sealant; comply with ASTM C920, Type S or M, Grade P or NS, Class 25; select color from listing of those approved. Acceptable Sealants:
1. Urethanes:
 - a. Vulkem 116, 911, 921, or 931
 - b. Dymonic
 - c. Tremflex 25
 - d. Pecora Dynatrol I XL or II
 - e. A/E approved equal
 2. Silicones:
 - a. Proglaze
 - b. Spectrem 1, 2 or 3
 - c. Tremsil 600
 - d. Pecora 860
 - e. A/E approved equal
- F. Sealant Type F: Certified by National Sanitation Foundation as conforming to the requirements of NSF Standard 61-Drinking Water System Components-Health Effects; comply with ASTM C920, Type S or M, Grade P or NS, Class 25; select color from the NSF listing. Acceptable sealants:
1. Single Component Urethane:
 - a. Vulkem 45 or 921
 - b. Dymonic
 - c. A/E approved equal
 2. Multi Component Urethane:
 - a. Vulkem 245
 - b. A/E approved equal

3. Polysulfide:
 - a. Pecora Synthacalk GC2+
 - b. A/E approved equal

- G. Sealant G:
 1. Two-part moisture curing, low modulus polyurethane sealant. Immersible for continuous water immersion in non-chlorinated water; ASTM C920 compliant, Type M, Grade P for Pourable semi-self-leveling, Class 35, Use T, O and I. Acceptable sealants:
 - a. **Tremco, Inc., Vulkem 445SSL**
 - b. Pecora Dynatred
 - c. A/E approved equal
 2. Multi-component, chemically curing, epoxidized polyurethane sealant low modulus polyurethane sealant. Immersible for continuous water immersion in non-chlorinated water; ASTM C920 compliant, Type M, Grade NS, Class 50 Use I. Acceptable sealants:
 - a. **Tremco, Inc., Dymeric 240 FC**
 - b. Pecora Dynatred
 - c. A/E approved equal
 - d.

- H. Sealant Type H: Cold-applied self-leveling modified elastomeric sealant designed specifically for sealing joints in airport runways, terminal ramps, hangars and transportation storage areas; meeting Federal Specification SS-S-200E; SS-S-195B & TT-S-00227E; ASTM D-1850; ASTM C-920 & PA DOT 408/90.
 1. Multi-Component Urethane:
 - a. Vulkem 202
 - b. Pecora Urexpan NR-300
 - c. A/E approved equal

- I. Sealant Type I: Non-sag polyurethane pick-resistant flexible security sealant having a Shore A hardness of 55. Acceptable sealants:
 1. Urethane:
 - a. Vulkem 617
 - b. Pecora Dynaflex
 - c. A/E approved equal
 2. 2-component Epoxy, gunnable
 - a. Sonneborn/Chem Rex Epolith(R)-G
 3. 2-component Epoxy, pourable
 - a. Sonneborn/Chem Rex Epolith(R)-P

- J. Sealant Type J: Silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT. Acceptable products:
 1. Silicones:
 - a. Spectrem 1 or 3
 - b. Pecora 890NST
 - c. A/E approved equal

- K. Sealant Type K: Comply with ASTM C920, Type M, Grade NS, Class 50, Use NT, G, M, A and O. Acceptable Products
 - 1. Silicone: Tremco Spectrem 4-TS
- L. Joint Cleaner: Non-corrosive and non-staining type recommended by sealant manufacturer and compatible with joint forming materials.
- M. Joint Primer: As recommended by sealant manufacturer for substrates, conditions and exposures indicated.
- N. Bond Breaker: Polyethylene tape or other adhesive faced tape as recommended by sealant manufacturer to prevent sealant contact where it would be detrimental to sealant performance.
- O. Joint Backer: Polyethylene foam rod:
 - 1. Soft: Non-gassing, reticulated closed-cell for use with cold-applied joint sealants. Comply with ASTM C 1330
 - 2. Closed-cell: Designed for use with cold-applied joint sealants for on-grade or below-grade applications
- P. Joint Filler: Closed-cell polyethylene joint filler designed for use in cold joints, construction joints, or isolation joints wider than 1/4 inch (6 mm).
 - 1. Size required for joint design.
 - 2. Masking Tape: Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces that is suitable for masking.
- Q. Expanding Insulating Foam Sealant for filling gaps and sealing around windows and doors.

2.03 OTHER MATERIALS

- A. Provide other materials as selected by the Contractor and approved by the sealant manufacturer as compatible, which not specifically described but are required for a complete and proper installation.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.
- B. Applicator shall examine the areas and conditions under which work of this Section will be performed.
 - 1. Verify conformance with manufacturer's requirements.
 - 2. Report unsatisfactory conditions in writing to the Engineer/Architect.
 - 3. Do not proceed until unsatisfactory conditions are corrected.

- C. Preformed joint fillers in joints to be sealed should provide a reservoir to accept the sealant such as by a molded breakaway joint cap or a removable block out. Preformed joint fillers that may contact the sealant should not be impregnated with oil, bitumen, non-curing polymers or similar contaminants.

3.02 PREPARATION

- A. Prepare surfaces to receive sealants in accord with sealant manufacturer's instructions and recommendations except where more stringent requirements are indicated.
- B. Thoroughly clean joint surfaces using cleaners approved by sealant manufacturer whether primers are required or not.
 - 1. Remove all traces of previous sealant and joint backer by mechanical methods, such as by cutting, grinding and wire brushing, in manner not damaging to surrounding surfaces.
 - 2. Remove paints from joint surfaces except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer.
 - 3. Remove wax, oil, grease, dirt film residues, temporary protective coatings and other residues by wiping with cleaner recommended for that purpose. Use clean, white, lint-free cloths and change cloths frequently.
 - 4. Remove dust by blowing clean with oil-free, compressed air.
- C. Back-Up Material:
 - 1. Install appropriate size backer rod, larger than joint where necessary according to manufacturer's recommendations.
 - 2. Install polyethylene joint filler in joints wider than 1/4 inch (6 mm) to back-up material per manufacturer's recommendations.
 - 3. Do not install epoxy joint filler over backer rod.
- D. Bond Breaker: Install bond-breaker strip in joint to be sealed on top of back-up material to prevent adhesion of sealant to back-up material; install per manufacturer's recommendations.
- E. Prime Joint Substrates Where Required:
 - 1. Use and apply primer according to sealant manufacturer's recommendations.
 - 2. Confine primers to sealant bond surfaces; do not allow spillage or migration onto adjoining surfaces.
- F. Taping:
 - 1. Use masking tape where required to prevent sealant or primer contact with adjoining surfaces that would be permanently stained or otherwise damaged by such contact or the cleaning methods required for removal.
 - 2. Apply tape so as not to shift readily and remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

- A. Provide the approved sealant system indicated in the schedule, and in strict accord with the manufacturer's recommendations as approved by the A/E.
- B. Install sealants immediately after joint preparation.
- C. Mix and apply multi-component sealants in accord with manufacturer's printed instructions.
- D. Install sealants to fill joints completely from the back, without voids or entrapped air, using proven techniques, proper nozzles and sufficient force that result in sealants directly contacting and fully wetting joint surfaces.
- E. Install sealants to uniform cross-sectional shapes with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer.
- F. Tool sealants in manner that forces sealant against back of joint, ensures firm, full contact at joint interfaces and leaves a finish that is smooth, uniform and free of ridges, wrinkles, sags, air pockets and embedded impurities.
 - 1. Dry tooling is preferred; tooling liquids that are non-staining, non-damaging to adjacent surfaces and approved by sealant manufacturer may be used if necessary when care is taken to ensure that the liquid does not contact joint surfaces before the sealant.
 - 2. Provide concave tooled joints unless otherwise indicated to provide flush tooling or recessed tooling.
 - 3. Provide recessed-tooled joints where the outer face of substrate is irregular.
- G. Remove sealant from adjacent surfaces in accord with sealant and substrate manufacturer recommendations as work progresses.
- H. Protect joint sealants from contact with contaminating substances and from damages. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of substantial completion.

3.04 UNACCEPTABLE SEALANT USE

- A. Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories; or to close gaps between walls, floors, roofs, windows and doors that exceed acceptable installation tolerances; or to fill gaps where materials have been misfit such as where door frames meet wall base and flooring, around switch plate and receptacle covers, around light fixture back plates.
- B. Remove sealants that have been applied in an unacceptable manner and correct building enclosure deficiencies.

3.05 INSTALLATION SCHEDULE

- A. Sealant Type A: For exterior and interior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
1. Control and expansion joints in cast-in-place concrete.
 2. Joints on precast beams and planks.
 3. Joints between architectural precast concrete units.
 4. Control and expansion joints in unit masonry.
 5. Control and expansion joints on exposed interior surfaces of exterior walls.
 6. Joints between different materials listed above.
 7. Perimeter joints between materials listed above and frames of exterior and interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
 8. Control and expansion joints in ceiling and overhead surfaces.
 9. Perimeter joints of exterior openings.
 10. Trim or finish joints subject to movement.
- B. Sealant Type B: For exterior and interior joints in horizontal and sloped traffic surfaces such as, but not limited to:
1. Control, expansion and isolation joints in cast-in-place concrete.
 2. Control, expansion and isolation joints in structural precast concrete units.
 3. Joints between architectural precast concrete paving units.
 4. Tile control and expansion joints.
 5. Joints between different materials listed above.
- C. Sealant Type C: For interior or exterior joints in vertical surfaces between laps in fabrications of sheet metal:
1. Metal building roof panels.
 2. Between dissimilar metals to prevent galvanic action.
 3. Air ducts.
- D. Sealant Type D: For general architectural sealing and caulking not listed above such as:
1. Under metal thresholds and saddles.
 2. Bedding sealant for sheet metal flashing.
 3. For frames of metal or wood and glazing.
 4. Silicone only around plumbing fixtures.
- E. Sealant Type E: For interior joints in vertical and horizontal surfaces in kitchen and food preparation areas where incidental food contact occurs.
- F. Sealant Type J: For exterior vertical joints in Exterior Insulation and Finish Systems.

END OF SECTION

SECTION 08 11 00

METAL DOORS FRAMES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish metal door frames as specified and shown on plans and schedules.
- B. Metal Frames:
 - 1. Fire-rated and non-rated door frames.

1.02 RELATED WORK

- A. Division 7:
 - 1. Insulation
 - 2. Elastomeric Sealants
- B. Division 8:
 - 1. Wood Doors
 - 2. Glass And Glazing
 - 3. Finish Hardware
- C. Division 9:
 - 1. Gypsum Board Systems
 - 2. Painting

1.03 REFERENCE STANDARDS

- A. SDI Standards:
 - 1. SDI-111-2000 Recommended Details and Guidelines for Standard Steel Doors, Frames, and Accessories
 - 2. SDI-112-1997 Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames
 - 3. SDI-117-2000 Manufacturing Tolerances for Standard Steel Doors and Frames
 - 4. SDI-118-2002 Basic Fire Door Requirements
 - 5. SDI-124-1998 Maintenance of Standard Steel Doors and Frames
- B. ANSI Standards:
 - 1. ANSI/SDI A250.3-1999 Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
 - 2. ANSI/SDI A250.4-2001 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings
 - 3. ANSI/SDI A250.6-1997 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames

4. ANSI/SDI A250.7-1997 Nomenclature for Standard Steel Doors and Steel Frames
 5. ANSI/SDI A250.10-1998 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
 6. ANSI/SDI A250.11-2001 Recommended Erection Instructions for Steel Frames (Formerly SDI-105)
 7. A115 Hardware Preparation in Steel Doors and Steel Frames
 8. A115.IG Installation Guide for Doors and Hardware
- C. ASTM Standards:
1. ASTM A1008-2003 Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 2. ASTM A568-2003 Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
 3. ASTM A1011-2001 Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 4. ASTM A591-1998 Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Applications
 5. ASTM A653-2002 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 6. ASTM A924-1999 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

1.04 QUALITY ASSURANCE

- A. Manufacturer shall meet or exceed all standards as noted in Section 2.01 references.
- B. Fire and smoke rated assemblies shall be manufactured in accordance with Underwriters Laboratories established procedures and shall bear the appropriate labels for each application.
- C. No product shall be manufactured prior to receipt of approved hardware schedule and templates.

1.05 SUBMITTALS

- A. Submit shop drawings indicating each type of:
 1. Frame
 2. Material thickness
 3. Mortises
 4. Reinforcements
 5. Anchorages
 6. Locations of exposed fasteners
 7. Arrangement of standard hardware

- B. Submit Schedule:
 - 1. Identify each unit marks and numbers.
 - 2. Relate numbers to Architect's door schedule.

1.06 SIZES

- A. Standard frames shall be sized to fit openings as scheduled on the Drawings and may include:
- B. Custom Frames shall be fabricated for special applications to fit openings as scheduled on the Drawings.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Products shall be marked with architects opening number on frames, misc. parts and cartons.
- B. All frames shall be stored vertically under cover. The units shall be placed on at least 4" high wood sills or in a manner that will prevent rust or damage.
- C. ANSI/SDI A250.8-200317: The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steels used to manufacture frames, anchors, and accessories shall meet at least one or more of the following requirements:
 - 1. Cold rolled steel shall conform to ASTM designations A1008, "Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability" and A568, "Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for."
 - 2. Hot rolled, pickled and oiled steel shall comply with ASTM designations A1011, "Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability" and A568, "Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for."
 - 3. Hot dipped zinc coated steel shall be of the alloyed type and comply with ASTM designations A924, "Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process" and A653, "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."

2.02 FRAMES

- A. Interior frames shall be 16 gauge: Face welded type.
- B. Finish: Factory primed, for field finishing.
- C. Provide frames, other than slip-on drywall type with a minimum of three anchors per jamb suitable for the adjoining wall construction. Provide anchors of not less than 0.042" in thickness or 0.167" diameter wire. Frames over 7'-6" shall be provided with an additional anchor per jamb.
- D. Base anchors shall be provided, other than slip-on drywall type, with minimum thickness of 0.042". For existing masonry wall conditions that do not allow for the use of a floor anchor, an additional jamb anchor shall be provided.
- E. Welding shall conform to ANSI/AWS-101-94:
 - 1. Welded joints shall be ground to a smooth uniform finish.
- F. Butt joints of mullions, transom bars, center rails and sills shall be coped accurately and securely welded.
- G. Fire labeled frame products shall be provided for those openings requiring fire protection ratings as indicated on the Drawings.
- H. Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.03 HARDWARE PREPARATION

- A. Mortise, reinforce drill and tap frames as required for mortised hardware furnished under Division 08 Sections, Finish Hardware in accordance with a final reviewed and accepted hardware schedule and templates provided by the hardware supplier.
- B. Minimum hardware reinforcing gages shall comply with Table 4 of ANSI/SDI A250.8, "SDI-100, Recommended Specifications for Standard Steel Doors and Frames".
- C. Follow SDI 127C for Frame cutout limits.
- D. Obtain templates from hardware suppliers.
- E. Interior frames shall be prepared for single stud door silencers, three (3) per frame.
- F. Drilling and tapping for surface door closers, door closer brackets, and adjusters shall be done in the field by the installer.

2.04 FINISH

- A. Apply mineral filler to eliminate weld scars and other blemishes.

- B. Prime Finish:
 - 1. Frames shall be thoroughly cleaned, and chemically treated to insure maximum paint adhesion.
 - 2. Surfaces of the frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on.
 - 3. Finish shall meet the requirements for acceptance stated in ANSI/SDI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

PART 3 EXECUTION

3.01 INSTALLATION

- A. Verify that rough openings are no less than 3/16" larger on all 3 sides than the intended overall frame size.
- B. Frames shall be installed plumb, level, rigid and in true alignment as recommended in ANSI/SDI A250.11, "Recommended Erection Instructions for Steel Frames" and A115.IG, "Installation Guide for Doors and Hardware".
- C. Frames other than slip-on types shall be fastened to the adjacent structure so as to retain their position and stability. Dry-wall slip-on frames shall be installed in prepared wall openings in accordance with manufacturer's instructions.
- D. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction.
- E. Install fire rated frames in accordance with NFPA 80 shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance.
- F. Installation of hardware items shall be in accordance with the hardware manufacturer's recommendations and templates. A115.IG, "Installation Guide for Doors and Hardware" and ANSI/SDI A250.6, "Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames" shall be consulted for other pertinent information.
- G. Seal around frames in place.

3.02 PRIME COAT TOUCH-UP

- A. Immediately after erection, sand smooth and touch up with same primer as applied at shop areas where prime coat has been damaged.
- B. Remove rust before above specified touch-up is applied.
- C. Touch-up shall not be obvious.

- D. Before job painting is started, finish on frame and doors shall comply with finish on approved sample.

3.03 PROTECTION

- A. Protect installed metal work against damage from other construction work.

3.04 SCHEDULE

- A. As indicated on Drawings.

END OF SECTION 08 11 00

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood doors, non-rated and fire-rated:
 - 1. Flush
 - 2. Glazed
 - 3. With louver inserts
 - 4. Prefinished

1.02 RELATED SECTIONS

- A. Division 8:
 - 1. Metal Door Frames
 - 1. Finish Hardware and Access Control
 - 2. Glazing

1.03 REFERENCES AND REGULATORY REQUIREMENTS

- A. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies
- B. UL 10 C- Fire Tests of Door Assemblies - Positive Pressure.
- C. NFPA 80 - Fire Doors and Windows.
- D. Quality Standards:
 - 1. ANSI/WDMA Industry Standard I.S. 1A-04 (Window & Door Manufacturer's Association)
 - 2. ANSI A115. W Series, Wood Door Hardware Standards. (American National Standard Institute)
- E. Labeling Agencies:
 - 1. Underwriter's Laboratories (UL) (Neutral pressure and Positive pressure rated doors)
 - 2. Intertek Testing Services-Warnock Hersey (ITS-WH) (Ratings for both Neutral pressure and Positive pressure rated doors)

1.04 SUBMITTALS

- A. Submit under provisions of DIVISION 1 Submittals Section.
- B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts, special beveling, blocking for hardware in mineral core doors, identify cutouts.

- C. Product Data: Indicate door core materials, thickness, construction, veneer species, cut and matching requirements, factory machining and factory finishing criteria.
- D. Construction Samples: Submit one or more of manufacturer's standard samples demonstrating door construction.
- E. Finish Samples:
 - 1. When requested, submit a set of 3 illustrating the range of color and grain of the specified door face materials.
 - 2. Submit Color Selection Samples, showing standard range of finishes
- F. Manufacturer's Full Lifetime Warranty

1.05 QUALITY ASSURANCE

- A. Meet or exceed WDMA I.S.1A Premium Grade
- B. Labeled Doors: Listed and conform to the requirements of:
 - 1. Underwriters Laboratories (UL).
 - 2. Intertek Testing Services-Warnock Hersey (ITS-WH)
- C. Manufacturer: Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction, unless otherwise indicated.

1.06 DELIVERY, STORAGE, HANDLING, AND SITE CONDITIONS

- A. Deliver, store, protect and handle products under provisions of WDMA and manufacturer's instructions.
- B. Accept doors on site in manufacturer's standard packaging. Inspect for damage upon receipt.
- C. Certain wood species are light sensitive. Protect doors from exposure to natural and artificial light after delivery. Do not store in damp or wet areas or in areas where light might cause oxidization.
- D. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% nor greater than 55%.
- E. Break seal on packages while at site to permit ventilation.

1.07 COORDINATION

- A. Coordinate Work Under Provisions of Division 1: Coordinate the work with door opening construction, door frame and door hardware installation.
- B. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

- A. Provide manufacturer's warranty to the following term:
 - 1. Interior Solid Core Doors: "Full Life of Original Installation" including rehang and refinish if door(s) do not comply with Warranty tolerance standards.
 - 2. Include coverage for delamination, warping, bow, cup and telegraphing of core construction beyond warranty tolerances
 - 3. Replace doors where construction work contributed to damage or to voiding of manufacturer's warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available manufacturer's: Subject to compliance with requirements, manufacturer's offering products which may be incorporated in the work include, but are not limited to, those listed.
 - 1. Graham Wood Doors/ASSA ABLOY
 - 2. Marshfield Door Systems, Inc.
 - 3. Eggers Industries, Architectural Door Division
 - 4. VT Industries

2.02 MATERIALS

- A. Workmanship
 - 1. Comply with WDMA workmanship for veneer faces, vertical edges, crossbands, horizontal edges and dimensional tolerances.
 - 2. Meet or exceed Extra Heavy Duty Performance Level:
 - a. Adhesive Bond: Test to determine the resistance of a glue line to separation and failure for interior doors. WDMA TM-6, 1988: Adhesive Bond Durability Test Method.
 - b. Cycle Slam: This test method is to establish a standard method of testing the physical performance of a wood door and associated hardware connections under accelerated actual operating conditions. WDMA TM-7, 1990: Cycle-Slam Test method.
 - c. Hinge-Loading: Test to determine the ability of a wood door stile to resist the horizontal withdrawal of an attached hinge. This is a small scale test designed to simulate the application of a downward force to the knob area on the leading edge of a hinged swinging door. WDMA TM- 8, 1990: Hinge-Loading Test method.
 - d. Door Finishes: Test to determine the effectiveness of a wood door finish to resist wear due to abrasion under conditions which accelerate actual in-service wear. Various ASTM Door Finishes test methods.
 - e. Screw Holding: Test to determine the ability of a wood door component to resist the withdrawal of a screw perpendicular to the component. WDMA TM-10, 1990: Screw holding Test method.

- f. Telegraph: Test to determine minimum differential offset of core components that are visible on the face of the door. Telegraphing of vertical and horizontal edges and cores is considered a defect when the face of the door varies from a true plane in excess of 0.010 inch in any 3.0 inch span, using a straight edge and feeler gauge or other accurate measuring methods.
 - 1) WDMA I.S.1A T1: Telegraph. Warp Tolerance - Test to determine the allowable variation from a flat plane within the door surface.
 - 2) WDMA I.S.1A T2: Warp.
- g. Squareness: Test to determine the allowable differential in squareness. WDMA I.S.1A T3: Squareness.

2.03 PERFORMANCE STANDARDS

- A. Door Construction Grade: Except as may be otherwise shown on the drawings fabricate the work of this section to WDMA "Premium Grade" for PC-5, Hot Pressed, bonded particleboard core assemblies

2.04 VENEERS

- A. Grade: Premium, with A Grade Faces
 - 1. Veneer Matching: Book match
 - 2. Assembly of spliced veneers: Center balance match
 - 3. Pair and Set match: Provide for doors hung in same opening or separated only by mullions.
- B. Wood Veneer Species: White Birch, Plain Sliced, color to be selected.

2.05 ACCESSORIES

- A. Glazing Stops:
 - 1. Non-Rated: Wood, of the same species/compatible with door species, with mitered corners.
 - 2. Fire-Rated: Metal Vision Frames.
- B. Louvers:
 - 1. Louvers to be supplied and fully integrated into door by door manufacturer, species and finish to match door.
 - 2. Louver blade shall be sight-proof V-slat.

2.06 FABRICATION

- A. Door and Core Construction:
 - 1. Non-rated:
 - a. ANSI A208.1-LD-2 Urea-Formaldehyde Free, FSC Certified, Particleboard
 - 2. 20-minute fire-rating:
 - a. Positive Pressure:
 - b. Category A (concealed intumescent)

- c. ANSI A208.1-LD-2, Urea-Formaldehyde Free, FSC Certified Particleboard
- B. Lite, Louver and Astragal Details:
 - 1. Lite openings shall be furnished with same species wood lite beads.
 - 2. Louvers in non-rated doors shall be wood.
 - a. Wood louvers shall be manufacturer's standard construction.
 - b. Louvers shall be the same species lumber as the door face and be factory installed.
 - c. Wood louvers shall be V-slat chevron.
- C. Door Panel Core Construction:
 - 1. Veneer Faces: Transparent Finish:
 - a. Joints must be tight.
 - b. Veneer faces must be completely glued to substrate.
 - c. Veneer faces shall be thoroughly sanded without manufacturing defects.
 - d. Veneer faces shall meet quality standards set forth in WDMA.
 - e. Veneer faces may not exhibit glue bleed-through at joints or through veneer.
 - 2. Vertical Edges, Opaque or Transparent Finish:
 - a. Vertical edges shall be smoothly sanded, free of knife and saw marks.
 - b. Voids are not permitted between veneer layers and solid wood edges.
 - c. Vertical edges shall have the same aesthetic appearance as the door face.
 - d. Where allowed, the hinge edge may be jointed. Joints must be tight.
 - e. Vertical edges shall have a sanded eased edge at intersections of edges and face veneers.
 - 3. Crossbands:
 - a. Crossbands, when used, shall be full piece or edge glued without voids.
 - b. For non fire doors exceeding standard size limitations (4 feet in width and or 10 feet in height), tight butt joints are allowed.
 - 4. Horizontal Edges:
 - a. Joints in horizontal edges shall be without gaps.
 - b. Horizontal edges shall be sound without splits, shake, or doze.
 - c. There shall be no gaps between veneer layers and solid horizontal edges.
- D. Non-rated and 20 minute Fire-Rated, Wood Veneer Particleboard Core:
 - 1. Top and Bottom Horizontal Edges: Wood or composite material meeting the minimum performance standards
 - 2. Vertical Edges: Wood or Composite material, one piece, laminated, or veneered. Specific configuration per manufacturer's standard. Meet minimum performance and fabrication standards.
 - 3. Core: Particleboard, ANSI A208.1, minimum grade LD-2
 - 4. Core Edge Interface: Bonded: Vertical and horizontal edges of solid core doors must be securely bonded to the core with adhesives and then the entire core assembly machine calibrated before veneering to achieve minimal telegraphing.
 - 5. Back Veneer: (3-ply skin)

6. Crossband: Crossbands shall be one piece or edge glued without voids
 7. Veneer Face: Face veneer thickness shall be a minimum of 1/50 in at a moisture content of 12% or less.
- E. Glue lines for assembly between the plies of face, crossbanding and core are to be Type 1 polyvinyl acetate
 - F. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 1. WDMA prefit clearances for factory fit doors.
 2. NFPA 80 for fire rated doors.
 - G. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standard for kind(s) of doors(s) required.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Louvers: Factory install louvers in prepared openings.
 - H. Apply appropriate labels.
- 2.07 **HARDWARE PREPARATION**
- A. Mortise and prepare doors as required for hardware furnished under Finish Hardware Division 08 Section in accordance with a final approved hardware schedule, with templates provided by the hardware supplier and security supplier, and in accordance with NFPA 80, Standard for Fire Doors and Fire Windows, including a minimum 3/8" raceway for electrical hardware, electric hinges and power transfers, door position switches, and other electrified hardware.
 - B. Hardware reinforcement: Fabricate doors with WDMA Quality Standards hardware blocking as follows:
 1. Provide HB-1 head and HB-2 sill rails and HB-4 lockblock on all doors.
 2. Provide HB-6 only when exit devices are scheduled.
 3. Provide HB-8 for pivots or when floor bolts are scheduled under Finish Hardware Section.
 - C. Obtain templates from hardware and security suppliers.
 - D. Drilling and tapping for surface door closers, door closer brackets, and adjusters shall be done in the field by the installer.
- 2.08 **FACTORY FINISH**
- A. Factory Finish Doors in Accordance with WDMA G-17 Finish System Description.
 1. Factory finish to be water based stain and ultraviolet (UV) cured polyurethane sealer to comply with EPA Title 5 guidelines for Volatile Organic Compounds (VOC) emissions limitations.

2. Finish must meet or exceed performance standards of TR-6 catalyzed polyurethane.
 3. Color shall be as selected by the A/E from manufacturer's standard colors.
- B. Factory finished doors to be installed just prior to substantial completion.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify substrate opening conditions.
- B. Verify that opening sizes and tolerances are acceptable and ready to receive this work.
- C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION

- A. Coordinate installation of doors with installation of frames and hardware.
- B. Install fire-rated and non-rated doors in accordance with NFPA 80, manufacturer's instructions and fire rated labeling requirements.
 1. Trim fire door height at bottom edge only, in accordance with fire rating requirements. Allow a fitting clearance of 1/8" at each side and at top of door.
 2. Do not trim Positive Pressure rated doors for width.
 3. Trim non-rated door height by cutting bottom edges to a maximum 3/4 inch.
 4. Trim non-rated door width by cutting equally on both jamb edges.
- C. Pilot drill screw and bolt holes using templates provided by hardware manufacturer. (Use threaded through bolts for half surface hinges).
- D. Coordinate installation of glass and glazing with installation of frames and hardware
- E. Install door louvers and light kits plumb and level.
- F. Reseal or refinish any doors that required site alteration.

3.03 GLAZING

- A. Factory-install glass and glazing. Refer to schedule on the drawings for glazing type

3.04 WARRANTY TOLERANCES

- A. Conform to WDMA standards and testing methods for warp, cup, bow and telegraphing.

3.05 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Operation: Rehang or replace doors that cannot be adjusted to swing or operate freely.
- C. Finished Doors: Refinish or replace doors damaged during installation, as directed by the A/E.
- D. Institute protective measures as recommended and accepted by door manufacturer to assure that wood doors will be without damage or deterioration at time of subsequent completion.

3.06 SCHEDULE

- A. Refer to Drawings.

END OF SECTION

SECTION 08 41 13

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish and install all necessary materials, labor and equipment for the complete installation of components as shown on the Drawings and specified herein.
- B. Section Includes:
 - 1. Aluminum Storefronts
 - 2. Aluminum Entrances
 - 3. Manufacturer's supplied and hardware
- C. Related Work:
 - 1. Division 07: Elastomeric Sealants
 - 2. Division 08:
 - a. Glazed Aluminum Curtain Walls
 - b. Finish Hardware
 - c. Glazing
 - d. Sliding Automatic Entrances
 - 3. Division 10: Exterior Sun Control Devices, Sunshades
 - 4. Division 12: Window Shades

1.02 DEFINITIONS

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.03 SUBMITTALS

- A. Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections.
- B. Quality Assurance: Submit certified test reports showing compliance with specified performance characteristics.
- C. Shop Drawings: Drawings shall indicate in detail all system parts including elevations, full-size sections, framing, jointing, panels, types and thickness of metal, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, and erection details.
- D. Design Data: Submit structural and thermal calculations for complete wall assembly.

- E. Test Reports: Submit certified test reports showing compliance with specified performance characteristics.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer capable of providing structural calculations, applicable independent product test reports, installation instructions, a review of the application method, customer approval and periodic field service representation during construction.
- B. Installer qualifications: Installer shall be a company specializing in installation of aluminum framing, entrances and storefront systems with glazing and have a minimum of three (3) years experience.

1.05 PRE-INSTALLATION CONFERENCE

- A. Hold a pre-installation conference, two weeks prior to start of installation. Attendees shall include Contractor, Architect, Manufacturer's representative, installer, Owner's Representative, and glazing manufacturer's representative.
- B. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation.

1.06 WARRANTY

- A. Manufacturer's Product warranty agreeing to replace doors which fail in materials or workmanship within two years from date of substantial completion.
- B. Lifetime limited warranty for welded door corner construction.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- B. Materials shall be delivered in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store materials protected from exposure to harmful weather conditions. Handle entrance doors and components to avoid damage. Protect entrance doors against damage from elements, construction activities, and other hazards before, during, and after installation.

1.08 PROJECT / SITE CONDITIONS

A. Field Measurements

1. Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings.
2. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

PART 2 PRODUCTS

2.01 GENERAL

A. This specification was developed to ensure a minimum standard of quality. Provide aluminum framing, entrance doors and storefront systems from a single source manufacturer.

B. Fit and Finish:

1. Finish to be: Class I, Clear Anodic Finish: AA-M10-C21-A31 complying with AAMA 611.
2. All exposed framing surfaces shall be free of scratches and other serious blemishes.
3. All door and frame members shall be accurately fitted to flush hairline joints.

2.02 MATERIALS

A. Aluminum shall be ASTM B 221; 6063-T5 alloy and temper.

B. Tolerances shall be in compliance with the Aluminum Association, Aluminum Standards and Data.

2.03 ENTRANCES

A. Entrance Performance Requirements:

1. Air Infiltration: For single acting offset pivot or butt hung entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 6.24 psf for single doors and 1.567 psf for pairs of doors. A single 3' 0" x 7' 0" entrance door and frame shall not exceed 0.50 cfm per linear foot of perimeter crack. A pair of 6' 0" x 7' 0" entrance doors and frame shall not exceed 1.0 cfm per linear foot of perimeter crack.
2. Structural: Corner strength shall be tested per Kawneer's dual moment load test procedure and certified by an independent testing laboratory to ensure weld compliance and corner integrity.

- B. Entrances feature welded corner construction with deep penetration and fillet welds, and corner mechanical fastenings. Door operation is single or double acting with 1" round bent bar push/pull hardware. Door frames shall have polymeric weather-stripping.
 - 1. Door stile and face rail dimensions, medium stile entrance door, 3-1/2 inch vertical stiles and top rail, and a 10-1/4 inch bottom rail, 1 3/4 inch depth, for high traffic applications; major portions of the door members shall be 0.125" nominal thickness.
 - 2. Glazing:
 - a. Adjustable glass jacks to center the glass in the door opening.
 - b. Provide horizontal and vertical intermediate rails as detailed on the drawings
- C. Hardware: Refer to Section 08 71 00 – Door Hardware.
 - 1. Supply items indicated to be provided by the Aluminum storefront Manufacturer.
 - 2. Hardware furnished by others shall be sent to the door manufacturer for application.
- D. Fabrication:
 - 1. Carefully fit and match work with continuity of line and design. Rigidly secure members with hairline joints, unless otherwise indicated. Reinforce members and joints for rigidity and strength as needed to fulfill performance requirements.
 - 2. Door glazing shall be by means of an interior and exterior fixed gasket of high quality extruded elastomeric material.
 - 3. Conceal fasteners unless otherwise indicated.
 - 4. Separate dissimilar materials with a heavy coating of epoxy paint or other suitable permanent separation as required to prevent galvanic action.

2.04 STOREFRONT SYSTEM PERFORMANCE REQUIREMENTS

- A. Wind loads: Provide framing system; include anchorage, capable of withstanding wind load design pressures inward and outward according to the current International Building Code.
- B. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft² at a static air pressure differential of 6.24 psf.
- C. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf as defined in AAMA 501.

- D. Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of $L/175$ of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

2.05 STOREFRONT FRAMING SYSTEMS

- A. Thermal Framing System:
1. 2" x 4-1/2" nominal dimension.
 2. Screw Spline, Shear Block, Stick or Punched Opening Fabrication
 3. Thermal Barrier: Thermal Break with a 1/4" separation consisting of a two part chemically curing, high density polyurethane which is mechanically and adhesively joined to aluminum storefront sections.
 - a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
 4. Glazing:
 - a. Back.
 - b. Inside glazed at storefront.
 - c. Outside glazed at low rise.
 - d. Structural Silicone or Weatherseal Glazed (Type B).
 - e. 1" double glazing without projecting stops.
- B. Non-Thermal Framing System:
1. 2" x 4 1/2" nominal dimension
 2. Screw Spline, Shear Block, Stick or Punched Opening Fabrication
 3. Glazing:
 - a. Back.
 - b. Inside glazed at storefront.
 - c. Outside glazed at low rise.
 - d. Structural Silicone or Weatherseal Glazed (Type B).
 - e. 1" double glazing without projecting stops.

2.06 ACCESSORIES

- A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- B. Fasteners: Where exposed all screws and miscellaneous fasteners shall be aluminum, stainless steel or zinc plated steel.
- C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- D. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants".

- E. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.
- F. Entrance Door Hardware:
 - 1. Weather-stripping:
 - a. In the door and frame consisting of a dense, bulb polymeric material, which remains resilient and retains its weathering ability under temperature extremes.
 - 2. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners.
 - 3. Threshold: ½" x 4" extruded aluminum mill finish, one piece per door opening, with ribbed surface.
 - 4. Door Hardware: See Section 08 71 00 – Door Hardware.

2.07 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing".
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
 - 1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
 - a. Color: Black
 - 2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
 - a. Color: Matching structural sealant.

2.08 FABRICATION

- A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fit joints; make joints flush, hairline and weatherproof.
 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 6. Provisions for field replacement of glazing.
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- D. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- 2.09 FACTORY FINISHING
- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
1. AA-M10C22A44, AAMA 611, Architectural Class I Color Anodic Coating.
- 2.10 SOURCE QUALITY CONTROL
- A. Provide aluminum entrances and storefront framing specified herein from a single source.
- PART 3 EXECUTION
- 3.01 EXAMINATION
- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum storefront system installation.
1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
 3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected

3.02 INSTALLATION

- A. General: Install entrances and framing in accordance with manufacturer's instructions and AAMA storefront and entrance guide specifications manual.
1. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
 2. Provide alignment attachments and shims to permanently fasten system to building structure.
 3. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances aligning with adjacent work.
 4. Install sills and other members in a bed of sealant or with joint filler or gaskets to provide weathertight construction. Coordinate installation with wall flashings and other components of construction.
 5. Seal joints between entrance framing and the building structure in order to secure a watertight installation.
 6. Glazing: refer to Division 08 Section "Glazing
 7. Set thresholds in bed of mastic and secure.
 8. Adjusting: Adjust operating hardware for smooth operation.
- B. Related Products Installation Requirements:
1. Sealants (Perimeter): Refer to Joint Treatment (Sealants) Section.
 2. Glass: Refer to Glass and Glazing Section.
- C. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

3.03 ADJUSTING, CLEANING AND PROTECTION

- A. Touch-up: Immediately after installation, touch-up scratched, nicked, abraded, chipped, or otherwise damaged areas of the finish so as to be unnoticeable.
- B. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- C. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum entrances from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants. Remove and replace damaged aluminum entrances at no extra cost.

3.04 SCHEDULE

A. On Drawings

END OF SECTION

SECTION 08 62 23

TUBULAR DAYLIGHTING DEVICE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tubular daylighting device, consisting of roof dome, reflective tube, and diffuser assembly and accessories. Contractor shall coordinate the exact location of the tubular skylights after laying out the mechanical system ductwork and devices, and the roof valleys and directions of slope.
- B. Related Sections:
 - 1. Division 07: TPO Roofing

1.02 REFERENCES

- A. ASTM:
 - 1. B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 2. E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008a
 - 3. A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; 2006
 - 4. A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; 2007
 - 5. E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004
 - 6. E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System; 2006
 - 7. E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors; 2002
 - 8. E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000
 - 9. E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
 - 10. E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane
 - 11. D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position; 2006
 - 12. D-1929 - Test Method for Ignition Properties of Plastics; 1996 (2001)
- B. UL 181 - Factory Made Air Ducts and Air Connectors

- C. ICC AC-16 - Acceptance Criteria for Plastic Skylights; 2008

1.03 PERFORMANCE REQUIREMENTS

- A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:
 - 1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
 - 2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.
 - 3. Uniform Load Test:
 - a. No breakage, permanent damage to fasteners, hardware parts, or damage to make system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 60 psf (2.87 kPa) in accordance with ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPa) if tested per ICC AC-16 Section B.
 - b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.
- C. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

- A. Daylighting Device: Manufacturer's standard warranty for 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Solatube International, Inc., which is located at: 2210 Oak Ridge Way, Vista, CA 92081; Toll Free Tel: 888-765-2882; Tel: 760-477-1120; Email: [requestinfo \(commsales@solatube.com\)](mailto:requestinfo@commsales@solatube.com); Web: www.solatube.com

2.02 DAYLIGHTING DEVICES

- A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.
- B. Brighten Up Series: Solatube Model 160 DS, 10 Inch Daylighting System.
 - 1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
 - a. Outer Dome Glazing: Type DA, 0.125 inch minimum thickness injection molded acrylic classified as CC2 material.
 - b. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.
 - 2. Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
 - a. Base Material: Sheet steel, corrosion resistant, meeting ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch thick.
 - b. Base Pitched: Pitched Type FP, 22.5 degrees slope from horizontal, 4 inches high.
 - c. Metal Roof Flashing Kit: Type MR. Includes Butyl tape, flashing screws, speed nuts, corner washers and polyurethane sealant.
 - 3. Extension Tubes: provide lengths and angles required for installation after locations have been coordinated with the mechanical and roof systems and can be determined
 - 4. Ceiling Ring: Injection molded, impact resistant acrylic. Nominal thickness 0.110 inches.
 - 5. Dual Glazed Diffuser Assembly:
 - a. Upper glazing: PET GAG plastic with EPDM low density sponge seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. nominal thickness 0.039 inches; Natural Effect Lens: Type LN.

- b. Lower glazing: Molded polycarbonate plastic classified as CC1 material; nominal thickness 0.022 inches
- c. Diffuser Trim Ring: Injection molded acrylic.
- d. Stainless-tone Trim Type L5.

2.03 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.
- C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify A/E of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 08 62 23

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
 - 2. Door hardware for aluminum doors.
 - 3. Door hardware for wood doors.
 - 4. Door hardware for other doors indicated.
 - 5. Keyed cylinders as indicated.
- B. Related Sections:
 - 1. Division 6: Rough Carpentry.
 - 2. Division 8: Aluminum Doors and Frames
 - 3. Division 8: Hollow Metal Doors and Frames.
 - 4. Division 8: Wood Doors.
 - 5. Division 26 Electrical
 - 6. Division 28: Electronic Security
- C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
 - 1. Builders Hardware Manufacturing Association (BHMA)
 - 2. NFPA 101 Life Safety Code
 - 3. NFPA 80 -Fire Doors and Windows
 - 4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
 - 5. UL10C – Positive Pressure Fire Test of Door Assemblies
 - 6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
 - 7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
 - 8. ICC – International Building Code
- D. Intent of Hardware Groups
 - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
 - 2. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
- E. Allowances
 - 1. Refer to Division 1 for allowance amount and procedures.
- F. Alternates
 - 1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

- A. Comply with Division 1.

1.3 SUBMITTALS:

- A. Comply with Division 1.
- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
- C. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
 - 3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
 - 4. Submit 6 copies of catalog cuts with hardware schedule.
 - 5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2
- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
 - 1. List groups and suffixes in proper sequence.
 - 2. Completely describe door and list architectural door number.
 - 3. Manufacturer, product name, and catalog number.
 - 4. Function, type, and style.
 - 5. Size and finish of each item.
 - 6. Mounting heights.
 - 7. Explanation of abbreviations and symbols used within schedule.
 - 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.
- E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
 - 1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.
- F. Samples: (If requested by the Architect)
 - 1. 1 sample of Lever and Rose/Escutcheon design, (pair).
 - 2. 3 samples of metal finishes
- G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
 - 1. Operating and maintenance manuals: Submit 3 sets containing the following.
 - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Name, address, and phone number of local representative for each manufacturer.
 - d. Parts list for each product.
 - 2. Copy of final hardware schedule, edited to reflect, "As installed".

3. Copy of final keying schedule
4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
 2. Statement of compliance with regulatory requirements and single source responsibility.
 3. Distributor's Qualifications: Firm with 3 years experience in the distribution of commercial hardware.
 - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
 - b. Hardware Schedule shall be prepared and signed by an AHC.
 4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
 5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".
4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
 - 1. Closers: Lifetime
 - 2. Exit Devices: Lifetime
 - 3. Locksets & Cylinders: Lifetime
 - 4. All other Hardware: Two years.

1.8 OWNER'S INSTRUCTION:

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
 - 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 - 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 - 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>	<u>Approved:</u>
Hinges	Stanley	Bommer, McKinney
Continuous Hinges	Stanley	Select, ABH
Locksets	Stanley	Dorma
Cylinders	as Required	
Exit Devices	Stanley	Dorma
Closers	Stanley	Dorma 8900
Push/Pull Plates	Trimco	Don-Jo, Hager
Push/Pull Bars	Trimco	Don-Jo, Hager
Protection Plates	Trimco	Don-Jo, Hager
Overhead Stops	ABH	Rixson
Door Stops	Trimco	Don-Jo, Hager
Flush Bolts	Trimco	Don-Jo, Hager
Coordinator & Brackets	Trimco	Don-Jo, Hager
Threshold & Gasketing	National Guard	Reese, Pemko

2.2 MATERIALS:

A. Hinges: Shall be Five Knuckle Ball bearing hinges

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.
4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3 hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Cylindrical Grade 2 Type Locks and Latchsets:

1. Certified by BHMA for ANSI A156.3, Series 4000, Operational Grade 2.
2. Fit modified ANSI A115.3 door preparation
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
4. 2-3/4 inch (70mm) backset, or 2 3/8 inch backset as needed
5. 1/2 inch (14mm) throw latchbolt
6. Provide locksets with 7-pin core.
7. Functions and design as indicated in the hardware groups

D. Exit Devices shall:

1. Tested and approved by BHMA for ANSI 156.3, Grade 1
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Furnish UL or recognized independent laboratory certified mechanical operational testing to 10 million cycles minimum.
4. Provide a deadlocking latchbolt
5. Non-fire rated exit devices shall have cylinder dogging.
6. Touchpad shall be "T" style
7. Exposed components shall be of architectural metals and finishes.
8. Lever design shall match lockset lever design

9. Provide strikes as required by application.
 10. Fire exit devices to be listed for UL10C
 11. UL listed for Accident Hazard
 12. Shall consist of a cross bar or push pad, the actuating portion of which extends across, shall not be less than one half the width of the door leaf.
 13. Provide vandal resistant or breakaway trim
 14. Aluminum vertical rod assemblies are acceptable only when provide with the manufacturers optional top and bottom stainless steel rod guard protectors.
- E. Door Closers shall:
1. Tested and approved by BHMA for ANSI 156.4, Grade 1
 2. UL10C certified
 3. Provide 9001-Quality Management and 14001-Environmental Management.
 4. Closer shall have extra-duty arms and knuckles
 5. Conform to ANSI 117.1
 6. Maximum 2 7/16 inch case projection with non-ferrous cover
 7. Separate adjusting valves for closing and latching speed, and backcheck
 8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
 9. Full rack and pinion type closer with 1½" minimum bore
 10. Mount closers on non-public side of door, unless otherwise noted in specification
 11. Closers shall be non-handed, non-sized and multi-sized.
- F. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
 4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- G. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
 2. Surface overhead stops shall be heavy duty bronze or stainless steel.
- H. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- I. Mop plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- J. Door Bolts: Flush bolts for wood or metal doors.
1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
 2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
 3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
 4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.
- K. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.
1. Coordinator, Certified ANSI/BHMA A1156.3 Type 21A for full width of the opening.
 2. Provide mounting brackets for soffit applied hardware.
 3. Provide hardware preparation (cutouts) for latches as necessary.

- L. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
 - 1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 - 2. UL10C Positive Pressure rated seal set when required.
- M. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
 - 1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
 - 2. UL10C Positive Pressure rated seal set when required.
- N. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

2.3 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders-match existing keyway.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a. Verify levers are free from binding.
 - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

Manufacturer List

<u>Code</u>	<u>Name</u>
AB	ABH Manufacturing Inc.
AL	Alarm Lock
NA	National Guard
SH	Stanley Commercial Hardware
ST	Stanley
TR	Trimco

Finish List

<u>Code</u>	<u>Description</u>
AL	Aluminum
626	Satin Chromium Plated
630	Satin Stainless Steel
689	Aluminum Painted
US26D	Chromium Plated, Dull
US32D	Stainless Steel, Dull

Option List

<u>Code</u>	<u>Description</u>
CSK	Counter Sunk Screw Holes
B4E	Beveled 4 Edges

Hardware Sets

SET #1

Doors: 109, 110

3 Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 Exit Device	QED111	626	ST
1 Exit Device Trim-Passage	QET130 E	626	ST
1 Door Closer - Rw/PA	QDC111	689	SH
1 Kick Plate	KO050 10" x 2" LDW B4E CSK	630	TR
1 Wall Bumper	1270CVSV	626	TR
1 Gasketing	5050B Head & Jambs	NA	

SET #2

Doors: 101A, 101B, 113B

1 Continuous Hinge	661HD UL	AL	ST
1 Exit Device	QED211	626	ST
1 Exit Device Trim	QET260 E	626	ST
1 Rim Cylinder	Match Existing	626	
1 Door Closer - Cush Stop	QDC119	689	SH
1 Integral Seals	by Door/Frame Mfg.		BY
1 Handicap Threshold	513A	AL	NA

SET #3

Doors: 111

3 Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 Privacyset	QCL240 E	626	SH
1 Door Closer - Rw/PA	QDC111	689	SH
1 Kick Plate	KO050 10" x 2" LDW B4E CSK	630	TR
1 Wall Bumper	1270CVSV	626	TR
1 Gasketing	5050B Head & Jambs	NA	

SET #3.1

Doors: 113A

3 Hinges	FBB179 4 1/2 X 4 1/2	US26D	ST
1 Passage	QCL230 E	626	SH
1 Door Closer - Rw/PA	QDC111	689	SH
1 Kick Plate	KO050 10" x 2" LDW B4E CSK	630	TR

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1 Wall Bumper	1270CVSV	626	TR
1 Gasketing	5050B Head & Jambs		NA

SET #4

Doors: 121

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Lockset	QCL270 E (match existing keyway)	626	SH
1 Door Closer - Rw/PA	QDC111	689	SH
1 Kick Plate	KO050 10" x 2" LDW B4E CSK	630	TR
1 Wall Bumper	1270CVSV	626	TR
1 Gasketing	5050B Head & Jambs		NA

SET #5

Doors: 114, 115, 116, 117, 118

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Passage Set	QCL230 E	626	SH
1 Wall Bumper	1270CVSV	626	TR
2 Gasketing	5050B Head & Jambs		NA
1 Auto Door Bottom	220NA		NA

SET #6

Doors: 112

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Passage	QCL230 E	626	SH
1 Overhead Stop	4420 Series	US32D	AB
1 Gasketing	5050B Head & Jambs		NA

SET #7

Doors: 107, 108

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Occupancy Indicator	QDB285	626	SH
1 Privacy Set	QCL240 E	626	SH
1 Wall Bumper	1270CVSV	626	TR
1 Gasketing	5050B Head & Jambs		NA

SET #8

Doors: 119

3 Hinges	FBF179 4 1/2 X 4 1/2	US26D	ST
1 Passage Set	QCL230 E	626	SH
1 Overhead Stop	4420 Series	US32D	AB
1 Gasketing	5050B Head & Jambs		NA

SET #9

Doors: 102, 120

6 Hinges	FBF179 4 1/2 X 4 1/2 NRP	US26D	ST
1 Flush Bolt (top only)	3917-12	626	TR
1 Passage	QCL230 E	626	SH
2 Overhead Stop	4420 Series	US32D	AB
1 Astragal	158NA		NA

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Section includes glazing for:
 - 1. Aluminum Entrances and Storefronts.
 - 2. Wood Doors.
- B. Section includes Glazing Materials and Glazing Installation Requirements for Sections listing this Section as a Related Section.

1.02 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.
- B. ASTM International:
 - 1. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
 - 3. ASTM C1036 - Standard Specification for Flat Glass.
 - 4. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 5. ASTM C1193 - Standard Guide for Use of Joint Sealants.
 - 6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 7. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 - 8. ASTM E546 - Standard Test Method for Frost Point of Sealed Insulating Glass Units.
 - 9. ASTM E576 - Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position.
 - 10. ASTM E773 - Standard Test Methods for Seal Durability of Sealed Insulating Glass Units.
 - 11. ASTM E774 - Standard Specification for Sealed Insulating Glass Units.
- C. Glass Association of North America:
 - 1. GANA - FGMA Sealant Manual.
 - 2. GANA - Glazing Manual.

3. GANA - Laminated Glass Design Guide.
- D. National Fire Protection Association:
1. NFPA 80 - Standard for Fire Doors, Fire Windows.
 2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.
 3. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.
- B. Provide glazing systems capable of withstanding normal thermal movements, windloads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation.
- C. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing.
- D. Safety glass products in the US are to comply with CPSC 16 CFR Part 1201 for Category II materials.
- E. Insulating Glass products shall be permanently marked either on spacers or at least one insulating unit component with certification label of Insulating Glass Certification Council (IGCC).
- F. Single-source fabrication responsibility: All glass fabricated for each type shall be processed and supplied by a single fabricator

1.04 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this Section with minimum three years documented experience.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL or WHI certifying it for use in tested and rated fire protective assemblies.

1.05 PRODUCT HANDLING

- A. Use all means necessary to protect glass and glazing materials before, during, and after installation and to protect the installed work and material of all other trades.
- B. In the event of damage including chips, cracks, fractures, and other gross flaws, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
- C. Store glass indoors and take necessary precautions to protect it from direct exposure to rain, standing water, direct sunlight and other adverse weather conditions.

- D. Protect all edges from impact and use a clean, dry separating material.

1.06 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each glass and glazing material required, including installation and maintenance instructions.
- B. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
- C. Product Test Listings: From a qualified testing agency indicating insulated units, fire-rated and security glass complies with requirements, based on comprehensive testing of current product.

1.07 WARRANTIES

- A. All glass products of architectural quality produced within normal industry tolerances and standards as set forth in each manufacturer's published literature and catalog data shall warrant the following products meet the conformance listed in the references Section.
- B. Provide a 10-year limited warranty for insulating glass. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to glass manufacturer's printed instructions.
- C. Provide a 10-year limited warranty for reflective coating. Warranty covers deterioration due to normal conditions of use and not to handling, installing, protecting and maintaining practices contrary to glass manufacturer's printed instructions.
- D. The Contractor shall warrant the installation of all glass and glazing products against defects in material or workmanship for a period of 2 years.

PART 2 PRODUCTS

2.01 PRIMARY GLASS MANUFACTURERS

- A. Guardian Industries Corporation; Carleton, Michigan; www.guardian.com.
- B. Interpane Glass Company; Clinton, North Carolina; www.interpane.com.
- C. Pilkington; Toledo, Ohio; www.pilkington.com.
- D. PPG Industries, Inc., Pittsburgh, Pennsylvania; www.ppgglass.com

2.02 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

2.03 FLAT GLASS TYPE FG

- A. Clear Float Glass Type FG-CF shall be:
 - 1. ASTM C1036 Type I transparent flat
 - 2. Class 1: Clear.
 - 3. Quality: q3 glazing select for architectural fenestrations
 - 4. Thickness: 1/4" unless otherwise noted on the Drawings or other Sections of this specification.
- B. One-Way Reflective Mirror Glass Type FG-OM:
 - 1. ASTM C1036 Type 1 transparent flat.
 - 2. Class 1: Clear.
 - 3. Quality: q2 mirror.

2.04 SAFETY GLASS TYPE SG

- A. Conform to ANSI Z97.1, thickness 1/4" unless otherwise indicated.
 - 1. Permanent logo, which signifies conformance with the Consumers Product Safety Commission 16 CFR-1201 and the Safety Glass Test Requirements of ANSI Z-97.
- B. Clear Tempered Glass Type SG-CT:
 - 1. ASTM C1048, Kind FT Fully tempered.
 - 2. Condition A, uncoated.
 - 3. Type 1 transparent flat.
 - 4. Class 1 clear.
 - 5. Quality q3 glazing select.
 - 6. Thickness: 1/4" unless otherwise noted on the Drawings or other Sections of this specification.

2.05 INSULATED GLASS UNITS TYPE IG

- A. Total unit thickness 1";
 - 1. insulated glass in doors spaced minimum 5/8".

B. Double Pane Insulated Glass Units Type G-DP: ASTM E774 Class A and E773: silicone sealant edge seal; purge interpane space with dry hermetic air.

1. SunGuard Coating (#2 surface): SNX 62/27
2. SunGuard Coating (#4 surface): SunGuard IS 20
3. Product Series: SuperNeutral Low-E
4. Outboard Substrate: Clear
5. Inboard Substrate: Clear
6. Exterior Appearance: Clear

C. Performance Values:

- | | |
|--------------------------------------|------|
| 1. Visible Light Transmission %: | 60 |
| 2. UV Transmission %: | 6 |
| 3. Solar Energy Transmission %: | 22 |
| 4. Visible Light Out Reflectivity %: | 12 |
| 5. Visible Light In Reflectivity %: | 13 |
| 6. Solar Energy Reflectivity %: | 41 |
| 7. U-Value Winter Nighttime: | 0.23 |
| 8. U-Value Summer Daytime: | 0.21 |
| 9. Relative Heat Gain: | 62 |
| 10. Shading Coefficient: | 0.29 |
| 11. Solar Heat Gain Coefficient: | 0.26 |
| 12. Light-to-Solar Gain: | 2.34 |

2.06 GLAZING MATERIALS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

B. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, insulating glass seals and glazing channels.

1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; chemical curing; capable of water immersion without loss of properties; non-staining, cured Shore A hardness of 15 to 25.
 - a. Color: As selected.
 - b. Structural Silicone: Furnish high-modulus structural silicone glazing materials where sealant bonds glass to substrate.

- C. Glazing Compounds:
 - 1. Glazing Compound: Modified oil type, non-hardening, knife grade consistency; manufacturer's standard gray color.
- D. Glazing Splines and Gaskets: neoprene extruded shape to suit glazing channel retaining slot.
- E. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2%, designed for compression of 25% to effect an air barrier and vapor retarder seal.
- F. Setting Blocks: Neoprene or silicone, 80 to 90 Shore A durometer hardness, length of 0.1" for each square foot of glazing or minimum 4" x width of glazing rabbet space minus 1/16" x height to suit glazing method and pane weight and area.
- G. Spacer Shims: Neoprene or Silicone, 50 to 60 Shore A durometer hardness, minimum 3" long x one half the height of glazing stop x thickness to suit application
- H. Glazing Clips: Manufacturer's standard type.
- I. Fire-Resistant Glazing Materials: Materials used to obtain required fire-resistant rating.

2.07 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.02 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
- B. Glazing Sealants: Comply with ASTM C1193.
- C. Fire Rated Openings: Comply with NFPA 80.
- D. Heat treated float glass should be installed with the tin side facing inwards.
- E. Do not use unshimmed glazing tapes.
- F. Install setting blocks and edge spacing blocks.
- G. Do not install glass with edge or face damage.
- H. Be sure that installation does not block weepholes.
- I. Glazing Method: Install using glazing method appropriate for framing system and environment.
 - 1. Install exterior glazing using dry gasket glazing system.
 - 2. Install interior glazing using wet sealant glazing system.

3.03 SAFETY

- A. Provide all means necessary to ensure the safety of all trades and the public relating to the work of this Section.

3.04 CLEAN-UP

- A. Prior to final inspection, clean all glazing products installed under this Section. Leave manufacturer's labels in place throughout the final inspection period or until directed by the Architect to remove them.
 - 1. Immediately prior to the execution of the Certificate of Substantial Completion and occupancy by the Owner, clean all glazing in accordance with the product manufacturer's instructions.

3.05 PROTECTION OF INSTALLED CONSTRUCTION

- A. Section 01 70 00 – Execution and Closeout Requirements: Protecting installed construction.
 - 1. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

3.06 SCHEDULE

- A. See Drawings.

END OF SECTION

SECTION 09 22 00

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Section includes
 1. Metal stud wall framing.
 2. Metal channel ceiling framing.
 3. Gypsum board and joint treatment.
 4. Gypsum sheathing (non-structural).
 5. Moisture and mold resistant wallboard.
 6. Cement board underlayment.
 7. Textured Finish.
- B. Related Sections:
 1. Division 6 - Rough Carpentry
 2. Division 7 - Batt Insulation: Acoustic and Thermal Insulation

1.02 REFERENCES

- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2010 (Revised).
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; current edition.
- C. ASTM International:
 1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 2. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board.
 3. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 4. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
 5. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 6. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 7. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
 8. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.

9. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
 10. ASTM C1396 – Standard Specification for Gypsum Board.
 11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 12. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 13. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- D. Gypsum Association:
1. GA 214 - Recommended Levels of Gypsum Board Finish.
 2. GA 216 - Application and Finishing of Gypsum Board.
 3. GA 600 - Fire Resistance Design Manual Sound Control.
- E. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.
- F. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- G. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications and installation instructions for systems shown.
- B. When fire-rated assemblies are required submit:
1. Certificates: Submit manufacturer's certification of compliance with fire and sound requirements for each system shown. Include name of manufacturer and complete description of door frames, elevator door frames, electrical boxes, and other penetrations included in each tested assembly for each system shown.
 2. Proof shall include test results of the selected proprietary assembly), and the primary system components (such as gypsum panels) from an independent agency such as Underwriters Laboratories (UL).
 3. For shaft wall assemblies, submit Shop Drawings which show shaft wall dimensions relative to other work.
 4. Locate all openings in shaft wall with details indicating special construction for work of other Sections and conformance with requirements of fire rated construction.
- C. All components of an assembly shall be classified by the same agency. Only complete tested assemblies shall be accepted.

1.04 QUALITY ASSURANCE

- A. When building envelope is not completely closed prior to start of gypsum board installation, provide and install moisture- and mold resistant glass-mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 in all locations. Paper-faced gypsum board installed prior to closing of building envelope shall be removed
- B. Fire-Resistance Rating: Where systems with fire resistance ratings are indicated or required, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.
- C. Single Source Responsibility for shaft wall assemblies: Provide steel framing, gypsum boards, insulation, fasteners, joint treatments, and other materials in the assembly or assemblies from the single manufacturer which has utilized these materials in recognized fire containment and sound tests.
- D. Levels of Gypsum Board Finish: GA-214-90.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle materials to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements, General: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during, and after application of gypsum board.
- B. Cold Weather Protection: When ambient outdoor temperatures are below 55°F (13°C), maintain continuous, uniform, comfortable building working temperatures of not less than 55°F (13°C) for a minimum period of 48 hours prior to, during, and following application of gypsum board and joint treatment materials or bonding of adhesives.

- C. Ventilation: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid dry

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Celotex Building Products
- B. Certainteed
- C. Georgia Pacific
- D. National Gypsum Co
- E. United States Gypsum Co

2.02 METAL SUPPORT MATERIALS (NON-BEARING PARTITION OPTION)

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Review structural and Architectural Drawings. If not scheduled or noted on the Drawings, provide minimum 25 ga. and 20 ga. or having equivalent structural properties. In partitions less than full height, provide 14 ga.
 - 2. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 3. Runners: U shaped, sized to match studs.
 - 4. Ceiling Channels: C-shaped.
 - 5. Furring: Hat-shaped sections, minimum depth of 7/8".
- B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on Drawings.
- D. Fasteners: ASTM C1002
 - 1. Self-drilling or self-tapping screws.
 - 2. Power actuated.
 - 3. Drilled expansion bolts.
 - 4. Screws with sleeves.
- E. Hanger Wire: 8 ga.
- F. Tie Wire: 16 ga.
- G. Optional Furring System: Fire Front 650 System per Chicago Metallic Corporation.

- H. Lateral Bracing: As required by IBC to meet Seismic Requirements.

2.03 BOARD MATERIALS

- A. Interior Fire Rated Gypsum Board:
1. ASTM C 1396; fire resistive type, UL or WH rated.
 2. 5/8" thick, maximum available length.
 3. Ends square cut, tapered edges.
- B. Fire Rated Water-Resistant Gypsum Board:
1. ASTM C 1396, Type X.
 2. Gypsum core panel with enhanced fire-resistance and water resistance core.
 3. 5/8" thick, maximum available length.
 4. Ends square cut, tapered edges.
- C. Exterior Sheathing Board:
1. Refer to Structural Drawings.
- D. Moisture and Mold Resistant Wallboard: ASTM C1178 glass mat gypsum substrate for use as in moisture-prone areas and as tile backer, approved for use by the Tile Council of America (TCA) Handbook for Ceramic Tile Installation.
1. Product: Georgia-Pacific Corporation DensShield Fireguard Type X.
 2. Thickness: 5/8".
 3. Composition: Water-resistant treated core with glass mat moisture protectant coating and embedded glass mats, both sides. Face side surfaced with heat-cured copolymer water.
 4. Fire Resistance when tested in accordance with ASTM E119, UL Classified.
 5. Provide 2" wide, coated glass fiber tape for joints and corners.

2.04 CEMENT BOARD

- A. Underlayment:
1. Cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped.
 2. Complying with ANSI A118.9 and ASTM C 1325.
 3. Thickness: 1/4 in.
 4. Width: 4 ft.
 5. Length: 4 ft.
 6. Edges: Tapered.
 7. Compressive Strength: Not less than 2250 lbs. per sq. in. when tested in accordance with ASTM D 2394.
 8. Water Absorption: Not greater than 8% when tested for 24 hours in accordance with ASTM C 473.

- B. Fasteners:
 - 1. Nails: 1-1/2-in. long, hot dipped galvanized, and in accordance with FS FF-N-105B, Type 2, Style 20.
 - 2. Screws: Hi-Lo thread screws (No. 8) wafer head, corrosion-resistant, 1-1/4 in. or 1-5/8 in. long, and complying with ASTM C 1002.
- C. Joint Treatment: Tape: Alkali-resistant fiberglass mesh tape intended for use with cement board.

2.05 TRIM ACCESSORIES

- A. Provide trim shapes as required to cover and make neat edges.
- B. Paper Faced Metal Bead and Trim: ASTM C1047, electro-galvanized steel with paper face and flanges, USG Beadex specified for type and quality.
 - 1. Outside corner beads.
 - 2. Inside corners.
 - 3. L-type edge trims.
 - 4. J-shaped edge trim 5 3/4" radius corner beads.
- C. Metal Trim Shapes: ASTM C1047.
 - 1. Galvanized steel Expanded Flange Corner Bead, L-Trim, and J-Trim.
 - 2. Galvanized one-piece L-Trim, and J-Stop.
 - 3. Zinc Control Joint No. 093.

2.06 REVEAL MOLDINGS

- A. Reveal Moldings: Aluminum 6063 T5 alloy with chemical conversion coating.
- B. 1/2" F Reveal Moldings: Fry Reglet, DRMF-625-50, 5/8" deep by 1/2" wide.
- C. 3/4" F Reveal Moldings: Fry Reglet, DRMF-625-75, 5/8" deep by 3/4" wide.

2.07 JOINT TREATMENT MATERIALS

- A. General: ASTM C475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
- B. Joint Tape:
 - 1. Paper reinforcing tape for gypsum board.
 - 2. 2" wide 10x10 glass mesh tape for glass backer board.
- C. Interior Joint Compound: On interior work, provide chemical-hardening type for bedding and filling, and ready-mixed vinyl-type or vinyl-type powder-type for topping.
 - 1. Grade: A single multi-purpose grade for entire application.

- D. Water-Resistant Joint Compound: Special water-resistant type for treatment of joints, fastener heads and cut edges of water-resistant backing board.
 - 1. Product: Subject to compliance with requirements, provide Sheetrock Brand W/R Compound; United States Gypsum Company.

2.08 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
- B. Fasteners
 - 1. Screws conforming to ASTM C1002. Bugle or pan head, and lengths as required for securing materials in place.
 - a. Wood Framing and Backing: Type W.
 - b. Light Gauge Metal Framing: Type S.
 - c. 18 Gauge or Heavier Metal Framing: Type S-12.
 - 2. Pneumatic Fasteners:
 - a. Minimum 0.100" diameter.
 - b. Length to penetrate minimum 1/4" beyond steel stud framing.
 - c. Aericote 1000 corrosion-resistant coating.
- C. Wall Texture: Unaggregated texture coating designed for application over properly prepared interior surfaces.

2.09 GRID SUSPENSION SYSTEM FOR INTERIOR SUSPENDED GYPSUM BOARD CEILINGS

- A. ASTM C645 Direct Hung System Of Main Beams And Cross Furring Members That Interlock.
- B. Products By:
 - 1. Armstrong.
 - 2. Chicago Metallic.
 - 3. USG Interiors, Inc.

PART 3 EXECUTION

3.01 ERECTION TOLERANCES

- A. Maximum Variation From Indicated Position: 1/8" in 10 feet.
- B. Maximum Variation From Plumb: 1/8" in 10 feet.

3.02 INSTALLATION OF PARTITION FRAMING – METAL (NON-BEARING PARTITION OPTION)

- A. Align all partitions accurately according to the partition layout. Attach floor and ceiling runners 24' o.c. to concrete slabs with concrete stub nails or power driven anchors.
- B. Position studs plumb in ceiling and floor runners and securely attach with not less than one suitable screw with flat bearing surface on each side of stud ends. At Contractor's option, a crimping tool which is scissors shaped and manually operated can be used to rigidly attach metal studs to drywall ceiling and floor runners. Space studs no further apart than 16" o.c. Anchor all studs located adjacent to doors and window frames, partition intersections and corners to runner flanges with USG Metal Lock Fastener or by positive screw engagement with 3/8" Type S, pan head screws through each stud flange and runner flanges. Stud splicing not permissible.
- C. Fabricate corners using minimum of three studs.
- D. Brace stud framing system rigid.
- E. Locate studs no more than 2" from all door frame jambs, abutting partitions, partition corners and other construction. Provide two continuous studs each side of door frames. Securely anchor studs to the jamb and head anchor clips of each door or borrowed light frame by bolt or screw attachment. Over metal door and borrowed light frames install a cut-to-length section of runners with the flanges slit and web bent to allow flanges to overlap adjacent vertical studs and securely screw-attach to adjacent studs.
- F. Door Frames: Abut with metal stud reinforcing consisting of boxed double studs with gypsum panels screw-attached 8" o.c. to both studs. For standard doors, install boxed standard metal studs. For solid-core doors and doors 36" to 48" inclusive, install one standard and one 20 gauge stud with 20 gauge stud next to jamb anchor clip. For double doors, install two 20 gauge studs. Screw-attach stud reinforcing to jamb anchor clips.
- G. Spot-grout at the jamb anchor clip. Spot-grouting is required for heavy doors (over 50 lbs. with hardware). Apply joint compound just before inserting board into frame; do not terminate gypsum panel against trim return.

3.03 INSTALLATION OF PARTITION FRAMING - WOOD

- A. Install supplementary framing, blocking, and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, the "Gypsum Construction" handbook published by United States Gypsum Company.

- B. Install wood nailer at ceilings and where gypsum drywall system abuts other work, except as otherwise indicated.
- C. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural or substrate above the ceiling.
- D. Terminate partition and system at ceilings, except where indicated to be extended to structural support or substrate above.
- E. Space studs 16" o.c. unless otherwise indicated.
- F. Frame opening other than door openings to comply with details.

3.04 INSTALLATION OF WALL FURRING:

- A. Erect wall furring for direct attachment walls.
 - 1. Erect furring channels horizontally; space as noted on the Drawings, not more than 4" from floor and ceiling lines.
 - 2. Secure in place on alternate channel flanges at maximum 24" on center.

3.05 INSTALLATION OF CEILING SUPPORT SYSTEMS

- A. Space eight gauge hangers not over 4'-0" in the direction of the 1-1/2" main runner channels and within 6" of the ends of main runner runs, and of boundary walls, girders or similar interruption of ceiling continuity.
- B. Place main runners not over 4'-0" o.c. properly positioned, leveled, and saddle tie hangers along runner.
- C. Do not let main runners into nor bring in contact with abutting walls. Locate runner channels within 6" of the walls to support the ends of the furring channels.
- D. Space furring channels 16" o.c. and securely clip with furring channel clips or saddle tie with two strands of 16 gauge tie wire to main runners or main support members. Do not let into or bring in contact with abutting walls. Provide end splices by nesting channels or studs no less than 8" and securely wire tying.
- E. Install metal furring channel clips on alternate sides of the main runner channel. Wire-tie metal furring channel to 1-1/2" channel when clips cannot be altered and to main support members.
- F. At light troffers or any openings that interrupt the main runner or furring channels, install additional cross reinforcing.
- G. In ceilings, spacing of hangers and channels is designed to support only the dead load. Independently support heavy concentrated load.

3.06 INSTALLATION OF GYPSUM BOARD

- A. Gypsum Board Application and Finishing Standards: ASTM C840 and GA216.
- B. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate courses of board.
- C. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".
- D. Install wall/partition boards horizontally with as long as possible sheets to minimize joints with end joints staggered over studs.
- E. Install exposed gypsum board with face side out. Do not install imperfect, damaged, or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.
- F. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
- G. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.
- H. Cover both faces of stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are properly braced internally.
 - 1. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and be limited to 50% of full coverage.
- I. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

3.07 METHODS OF GYPSUM DRYWALL APPLICATION

- A. Single-Layer Application: Install gypsum wallboard.
 - 1. On ceilings, apply gypsum board prior to wall/partition board application to the greatest extent possible.
 - 2. On partitions/walls, apply gypsum board horizontally (perpendicular). Use maximum length sheets possible to minimize end joints.
- B. Single Layer Fastening Methods: Apply gypsum boards to supports as follows:
 - 1. Fasten with screws.

3.08 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by screwing or stapling in accordance with manufacturer's instructions and recommendations.
- B. Install metal corner beads at external corners of drywall work.
- C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound.
 - 1. Install Bullnose L bead around doors and windows.
 - 2. Install curved or radius outside corner bead.
 - 3. Install L-type trim where work is tightly abutted to other work.
- D. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

3.09 INSTALLATION OF MOISTURE AND MOLD RESISTANT WALLBOARD

- A. Wall And Ceiling Installations:
 - 1. On walls, install DensShield panels vertically or horizontally.
 - 2. On ceilings, install DensShield panels perpendicular to framing.
 - 3. Install as tile backer in accordance with manufacturer's recommendations and TCA Handbook for Ceramic Tile Installation, Method W245 and C311.
- B. Finishing:
 - 1. Substrate for tile – Apply glass mesh joint tape over joints. Embed tape in setting material indicated for specified tile finishes. Allow joints to dry prior to installing tile systems.
 - 2. Substrate for high-humidity finish systems (untiled) – Apply 6" wide reinforcing fabric over joints. Embed fabric in ground coat. Skim-coat tile backer surface with ground coat for smooth finish. Apply in accordance with finish coat manufacturer's instructions.

3.10 INSTALLATION OF DRYWALL FINISHING

- A. General: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects, and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by manufacturer.
- B. Apply joint tape at joints between gypsum boards, except where a trim accessory is indicated.

- C. Level 1 Finish:
1. Apply in plenum areas above ceilings, in attics, in areas where the assembly is concealed; however, in areas where fire-resistance rating is required for the gypsum board assembly, details of finish must be in accordance with reports of fire tests of assemblies that have met the fire-rating requirements.
 2. Apply the first embedding coat of joint compound to joint and to inside corners.
- D. Level 2 Finish:
1. Apply where water-resistant gypsum backing board is used as a substrate for tile; in garages, warehouse storage and similar areas where surface appearance is not a primary concern.
 2. Apply the first embedding coat and second fill coat of joint compound to inside corners and one coat of joint compound over all fasteners, metal bead and trim.
- E. Level 3 Finish:
1. Apply in appearance areas that are to receive heavy texture or medium texture (spray or hand applied) finishes before final painting, or where heavy grade wall coverings are to be applied as the final decoration. Do not use this level of finish in areas that require a smooth painted finish, or where medium weight wall coverings are to be applied as the final decoration.
 2. Apply the first embedding coat, second fill coat and third finish coat of joint compound to joints and inside corners. Apply 3 coats of joint compound over all fasteners, metal bead and trim.
- F. Level 4 Finish:
1. Apply where light texture and flat paint is to be used as the final finish decoration. Do not apply this level of finish where gloss, semi-gloss or enamel paint has been specified
 2. Apply the first embedding coat, second fill coat and third finish coat of joint compound to joints and inside corners. Apply 3 coats of joint compound over all fasteners, metal bead and trim sanding after each of three coats.
- G. Level 5 Finish:
1. Apply where gloss, semi-gloss, enamel or non-textured flat paint is to be used as the final finish decoration.
 2. Apply to provide a uniform surface.
 3. Apply the first embedding coat, second fill coat and third finish coat of joint compound to joints and inside corners. Apply 3 coats of joint compound over all fasteners, metal bead and trim sanding after each of three coats. Apply a thin skim coat over the entire surface.

3.11 APPLICATION OF TEXTURE FINISH

- A. Surface Preparation and Primer: Prepare and prime drywall and other surfaces in strict accordance with texture finish manufacturer's instructions. Apply primer to all surfaces to achieve texture finish.

- B. Finish Application: Mix and apply finish to drywall and other surface indicated to receive finish in strict accordance with manufacturer's instructions to produce a uniform texture without starved spots or other evidence of thin application, and free of application patterns.
- C. Texture shall be an orange peel finish.
- D. Remove any texture droppings or overspray from door frames, windows, and other adjoining work.

3.12 PROTECTION OF WORK

- A. Provide final protection and maintain conditions, in a manner suitable to installer, which ensures gypsum drywall work being without damage or deterioration at times of substantial completion.

3.13 SCHEDULE

- A. Fire-rated assemblies as noted on the Drawings.
- B. Cementitious backer board as noted on the Drawings.
- C. Moisture and mold resistant wallboard:
 - 1. Bathrooms.
 - 2. Kitchens.
 - 3. Showers.
 - 4. Laundry Rooms.
 - 5. Janitor Closets.
 - 6. Interior Areas Sheathed Prior to Closing of Building Envelope.
 - 7. Other areas as noted on the Drawings.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Tile, trim and accessories, setting materials, grouting materials and methods of installation for a complete and proper installation.
- B. Extent of Work is indicated on Drawings and schedules.
- C. Types of tile work in this section include the following:
 - 1. Floor Tile
 - 2. Wall Tile
 - 3. Mosaic Tile
 - 4. Tile Setting Materials
 - 5. Edge Protection Accessories
- D. Division 09: Gypsum Drywall Systems:
 - 1. Tile Substrate:
 - a. Mold and Moisture Resistant Wallboard
 - b. Cementitious Backer Board

1.02 REFERENCES

- A. ANSI A108 Series - American National Standard Specifications for Installation of Ceramic Tile.
- B. ANSI A108.1A Installation of Ceramic Tile in the Wet Set Method with Portland Cement Mortar.
- C. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
- D. ANSI A108.10 Installation of Grout in Tilework.
- E. ANSI A118.4 Specifications for Latex-Portland Cement Mortar.
- F. ANSI A118.6 Specifications for Ceramic Tile Grouts.
- G. ANSI A118.7 Polymer Modified Cement Grouts.
- H. ANSI A137.1 - Specifications for Ceramic Tile.

- I. ASTM (American Society for Testing and Materials)
- J. TCA “Handbook For Ceramic Tile Installation”; Tile Council of America, current edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C1028.
 - 1. Level Surfaces: Minimum of 0.6 (Wet).

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer’s technical information and installation instructions for materials required, except bulk materials.
- B. Product Data for Mortars, Grouts, and Adhesives:
 - 1. Submit manufacturer's product data demonstrating compliance with specified requirements.
 - 2. Submit manufacturer’s instructions for use.
 - 3. Submit manufacturer’s certification that materials are suitable for the intended use.
 - 4. Samples: Submit samples of each type and color of grouting material.
 - 5. Submit proof of warranty.
- C. Tile Samples:
 - 1. Submit manufacturer's samples inclusive of all standard colors, textures and patterns for each type of tile required, from which Architect will select color(s) and finish(es) of tile.
- D. Accessories Product Data and Samples:
 - 1. Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
 - 2. Verification Samples: For each finish product specified, two samples, minimum size 6 inches long, representing actual product, color, and finish
- E. Maintenance: Submit recommended maintenance including cleaning methods and solutions, stain removal methods, polishes and waxes.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years' experience.

- B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.
- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during tiling and for a minimum of 7 days after completion.

1.08 EXTRA MATERIALS STOCK

- A. Upon completion, furnish 2% minimum additional tile and trim shape of each type, color, pattern and size used. Furnish extra stock of installation mortar, grouts, adhesives and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile:
 - 1. Basis of Design: Atlas Concorde, USA
 - 2. Basis of Design: Interceramic, Corp
 - 3. Basis of Design: Crossville, Inc
- B. Setting Materials:
 - 1. Laticrete
 - 2. Custom Building Products
- C. Edge Protection Materials:
 - 1. Basis of Design: Schluter Systems, L.P
- D. The use of a Brand Name or Manufacturer within these specifications is for the purpose of describing the standard of quality, performance and characteristics desired and is not intended to limit or restrict competition. Refer to Section 01 60 00, Paragraph 1.08.

2.02 MATERIALS

A. Water Proofing Membrane for Showers:

1. Thin, load-bearing waterproofing designed specifically for ceramic tile installations.
2. Self-curing liquid rubber polymer and a reinforcing fabric.
3. IAPMO and ICC accepted for shower pans.
 - a. Meets ANSI A118.10 and ANSI A118.12
 - b. Non-hazardous, low VOC.
 - c. Anti-fracture treatment membrane.
 - d. Microban® antimicrobial product protection to inhibit growth of stain-causing mold and mildew.
 - e. ASTM C627 Rated "Extra Heavy" Service
4. Custom Building Products, RedGard®, Laticrete Hydroban or equal.

B. Tile, General:

1. Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated.
2. Provide tile in the locations and of the types, colors and patterns indicated on the Drawings and identified in the Schedule.
3. For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
4. For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.

C. Floor Tile Properties:

1. Moisture Absorption: Less than .5 percent
2. Thickness: 9mm or less for floor tile
3. Breaking Strength: >275 lbs per ASTM C648
4. Scratch hardness: MOHS 7.0 min for floor tile
5. Dynamic COF: exceed 0.60 on the ASTM C1028 test, wet and dry

D. Scheduled Tiles:

1. Tile 1 - Color Body Porcelain: "Haven" or "Redeem" by Atlas Concorde, wood look plank tile, matte finish
 - a. Floor Field Tile - nom 8" x 40"
 - b. Color to be selected by A/Er
2. Tile 2 - Color body Porcelain: "Haven" or "Redeem" by Atlas Concorde, wood look plank tile, matte finish
 - a. Wall Field Tile - nom 8" x 40"
 - b. Color to be selected by A/E
3. Tile 3 - Unglazed Through-Body Porcelain Floor Tile: "Intertech" unglazed mosaic tile by Interceramic, Corp
 - a. Shower floor tile, 12"x12" sheet of 2" x 2" mosaic tiles.
 - b. Color to selected by A/E

4. Tile 4 – Porcelain Stone: “Notorious” Honed finish by Crossville, Inc
 - a. Kitchen backsplash wall tiles 3”x15” and 12”x12” in pattern as shown on the drawings
 - b. Color to be selected by A/E

2.03 SETTING MATERIAL

- A. Thin-Set Portland Cement Mortar:
 1. Laticrete 4-XLT, multi-use, polymer fortified adhesive mortar for large format tile.
 2. Porcelain Tile Fortified Thin-Set Mortar, Custom Building Products or equal
- B. Grouting Materials:
 1. Laticrete SPECTRALOCK PRO Premium Grout, a proprietary high performance epoxy grout excellent color uniformity, durability, and stain protection, non-sag formula.
 2. Commercial quality A polymer-modified, cement based sanded grout that produces hard,dense joints that resist shrinking, cracking and wear. Custom Building Products Polyblend® Sanded Grout
 3. Colors: As selected by the A/E
- C. Sealant:
 1. Color-matched-to-grout sealant.
 2. Conform to the following properties under ASTM C920:
 - a. Type S, Grade NS, Class 25, use NT, for non-traffic areas.
 - b. Conforms to ASTM C794 Adhesion Properties.
 - c. Equipped with anti-microbial technology.
 - d. 25% extension & compression.

2.04 ACCESSORIES

- A. Edge Protection and Transition Profiles for Tiled Floors
 1. Schluter SCHIENE: for transition from tile to carpet and tile to resilient athletic flooring
 - a. L-shaped profile with 1/8 inch wide visible surface integrated trapezoid-perforated straight anchoring leg and grout joint spacer.
 - b. Stainless Steel Type 304 finish.
 - c. Height as required to coordinate with tile and setting system.
 2. Schluter RENO-U: for transition from tile to concrete
 - a. Profile with sloped exposed surface, 5/32 inch tall leading edge, integrated trapezoid-perforated straight anchoring leg and grout joint spacer.
 - b. Stainless Steel Type 304 finish.
 - c. Height as required to coordinate with tile and setting system.

- B. Finishing and Edge-Protection Profiles for Tiled Wall Outside Corners
 - 1. Schluter-JOLLY: Wall tile trim
 - a. L-shaped profile with 1/8 inch wide top section, integrated trapezoid-perforated straight anchoring leg and grout joint spacer.
 - b. Satin Nickel Anodized Aluminum finish.
 - c. Height as required to coordinate with tile and setting system.
 - 2. Schluter-RONDEC: Bullnose Trim
 - a. Profile with rounded visible surface with 1/4 inch radius, integrated trapezoid-perforated anchoring leg and grout joint spacer.
 - b. Finish: Satin Nickel Anodized Aluminum.
 - c. Height as required to coordinate with tile and setting system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
- C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding area from damage.
- B. Verify that floor and wall surfaces to be covered with tile, natural stone, trim units or thresholds are level and true to within maximum variations.
 - 1. Walls: 1/8" in 8'
 - 2. Floors: 1/8" in 10'
- C. Advise Contractor of surface or substrate conditions requiring correction before tilework commences. Beginning of work constitutes acceptance of substrate or surface conditions.
- D. Verify substrates to receive tile to be sound, solid, well bonded, stripped clean and free of form oil, dust, grease, sealers, curing compounds, loose plaster, paint, scale, wax, and all other contamination which may reduce or prevent adhesion.

- E. Seal substrate surface cracks with filler.

3.03 MIXING

- A. Comply with mixing requirements of referenced standards and manufacturers.
 - 1. Accurately proportion materials, water or additive.
 - 2. Use recommended mixing equipment, speeds, containers, mixing time and pot life to produce mortars and grouts of uniform quality with optimum performance characteristics.

3.04 INSTALLATION - GENERAL

- A. Install waterproofing membrane at shower receptors and walls.
- B. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.
- C. Install tile flooring so that it is stable, firm and slip resistant
- D. Setting - Thin Bed Method: Install latex portland cement mortar in compliance with current revisions of ANSI A108.02 (3.11), A108.1B and ANSI A108.5. Use the appropriate trowel notch size to ensure proper bedding of the tile, brick or stone selected. Work the latex portland cement mortar into good contact with the substrate and comb with notched side of trowel. Spread only as much latex portland cement mortar as can be covered while the mortar surface is still wet and tacky. When installing large format (>8" x 8") tile/stone, rib/button/lug back tiles, pavers or sheet mounted ceramics/mosaics, spread latex portland cement mortar onto the back of (i.e. 'back-butter') each piece/sheet in addition to trowelling latex portland cement mortar over the substrate. Beat each piece/sheet into the latex portland cement mortar with a beating block or rubber mallet to insure full bedding and flatness. Allow installation to set until firm. Clean excess latex portland cement mortar from tile or stone face and joints between pieces.
- E. Install edge protection profile accessories leaving no tile side edge exposed.
- F. Layout:
 - 1. Determine locations of all movement joints before starting tilework.
 - 2. Lay out all tilework in accordance with drawings.
 - 3. Locate tile cuts in both walls and floors so as to be least conspicuous.
 - 4. Lay out tile wainscots to next full tile beyond dimensions shown.
 - 5. Align all wall joints to give straight uniform grout lines, plumb and level.
 - 6. Align all floor joints to give straight uniform grout lines, parallel with walls.
- G. Sound tile after setting. Replace hollow sounding units
- H. Allow tile to set for a minimum of 48 hours prior to grouting.

- I. Grout/Pointing Joints: Verify grout joints are free of dirt, debris or tile spacers; follow manufacturer recommendations for minimum cure time prior to grouting. Sponge or wipe dust/dirt off tile faces and remove water standing in joints; Apply grout release to face of absorptive, abrasive, non-slip or rough textured ceramic tile, or trim units that are not hot paraffin coated to facilitate cleaning.
 - J. Workmanship: Use all products in strict accordance with recommendations and directions of manufacturers.
 - 1. Proportion all mixes in accordance with latest ANSI Standard Specifications.
 - 2. Smooth all exposed cut tile edges.
 - 3. Be sure cut tile edges are clean before installing.
 - 4. Fit tile carefully against trim, around pipes, electric boxes and other built-in fixtures so that escutcheons, plates and collars will completely overlap cut edges.
 - 5. Be sure all tilework is free of grout film upon completion.
 - K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- 3.05 CLEANING
- A. Clean tile and grout surfaces.
- 3.06 PROTECTION OF FINISHED WORK
- A. Do not permit traffic over finished floor surface for 72 hours after installation.
 - B. Cover floors with kraft paper and protect from dirt and residue from other trades.
 - C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways

END OF SECTION

SECTION 09 30 13

PORCELAIN SLAB COUNTERTOPS

PART 1 GENERAL

1.01 SCOPE

- A. Work of this Section includes preparation work, substrate review, products for and installation of porcelain slab countertops (Large Format Tile) as shown on the Drawings.
- B. Related Sections
 - 1. Section 06 40 00 - Architectural Woodwork
 - 2. Section 07 92 00 - Joint Sealers: Sealers between quartz surfacing and work of other Sections which are not specified in this Section.
 - 3. Section 09 22 00 - Gypsum Board Assemblies: Plywood substrate, blocking and backer board.
 - 4. Division 22 Division 22 Section "Plumbing Fixtures."

1.02 SUBMITTALS

- A. Product Data:
 - 1. Porcelain Slabs: Submit
 - a. Manufacturer's product data.
 - b. Fabrication information.
 - c. Installation instructions.
- B. Shop Drawings:
 - 1. Show field-verified dimensions, porcelain slab dimensions, locations and dimensions of cutouts, required locations of support and blocking members, edge profiles, seam locations and installation details and methods.
 - 2. Identify colors and finishes.
- C. Samples:
 - 1. Provide Samples for Color Approval: Submit two samples 4x4 inches of each color and finish selected.
 - 2. Submit sample of mitered joint demonstrating acrylic or epoxy bond.
- D. Maintenance Data:
 - 1. Submit manufacturer's care and maintenance data in project closeout documents.
- E. Fabricator Qualifications: Submit evidence of fabricator's qualifications.

1.03 REFERENCES

- A. ANSI A137.3: American National Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.
- B. ANSI A108.19: Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- B. Fabricator/Installer Qualifications:
 - 1. Work of this section shall be by trained fabricators, installers and applicators, having a minimum of five successful projects.
- C. Allowable Tolerances:
 - 1. Substrate must be within 1/8" variance in 10 feet.
 - 2. Location of openings: $\pm 1/8"$ (3 mm) from indicated location.
 - 3. Maximum 1/8" (3 mm) clearance between slab edge and wall.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Handling, and Unloading:
 - 1. Observe manufacturer's recommendations and handle in manner to prevent breakage or damage. Brace parts if necessary.
 - 2. Once the slabs have been fabricated, handle the finished countertop vertically, keeping any openings towards the top.
 - 3. If transported on trestles or stands, make sure that these are of the right size to completely protect the finished piece.
 - 4. Protect edges with foam rubber or polystyrene corner guards.
- B. Storage and Protection:
 - 1. If installation is delayed after delivery time, store slabs on racks in near-vertical position.
 - 2. Prevent warpage and breakage.
 - 3. Store inside away from direct exposure to sun.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: CROSSVILLE Porcelain Countertops by Crossville, Inc.
 - 1. Group: Notorius (Warm Neutrals) or Baltic (Cool Gray) as selected by the Owner

- B. Substitutions must have performance criteria equal to that of specified product, and must have aesthetic qualities of pattern and color approved by the A/E as acceptable.

2.02 PORCELAIN SLABS

- A. Slab dimensions after squaring off:

1. Width: 1620mm.
2. Length: 3240mm.
3. Thickness: 12mm.

- B. Slab Edges: Rectified

- C. Physical & Chemical Properties

Property	Test Method	Unpolished Value
Overall Dimensions	Laminam	$\geq 1620 \times 3240$ mm
Weight	Laminam	average value 30 kg/m ²
Surface Quality / % of tiles with no visible flaws	ISO 10545-2	> 95%
Flatness: 1620 side, 3240 side	Laminam	+/- 2 mm, +/- 2 mm
Thickness	Laminam	+/- 0.5 mm
Breaking Strength in N /camp. 200 x 300 MM	ISO 10545-4	> 4000 (sample dimensions 200 x 300 mm)
Water Absorption	ASTMC373	Average value 0.1% (< 0.3%)
Modulus of Rupture in N /MM ²	ISO 10545-4	average value 50 (sample dimensions 200 x 300 mm)
Mohs Scale Hardness	UNI EN 101	class: from 5 to 7
Resistance to Deep Abrasion	ISO10545-6	≤ 175 mm ³
Coefficient of Linear Thermal Expansion	ISO 10545-8	6.6 average value
Fire Reaction	EN 13501	A2 - s1,d0
Density	EN 14617-1 ASTM C97	2500 kg/m ³ (average value)
Bending Strength	EN 14617-2	50 MPa (average value)
Dry Heat Resistance	EN 12722, EN438-2 par.16	5 (no visible effect till 200°C)
Cold Liquid Resistance	EN 12720	no visible effect except ink (2)
Resistance to Fungi	ASTM G21	no fungal growth
Light Resistance	UNI EN 15187	5 no visible effect
Thermal Shock Resistance	EN 14617-6, ISO 10545-9	resistant
Resistance to Staining	ISO 10545-14, ASTM C1378	class: from 4 to 5 resistant

- D. Usage: Commercial medium duty, Interior.

- E. Color: To be selected by Owner from manufacturer's available color palette.

F. Countertop Edges: Mitered with a 2 to 3mm round/radius where indicated on the Drawings.

G. Fabrication

1. Fabricate countertops in accordance with manufacturer's written fabrication guide.

2.03 ACCESSORIES

A. Setting Materials as recommended by the Tile Manufacturer may include:

1. Silicone adhesive.
2. Thin set: LFT by Mapei, Prolite by Custom, or 254 Platinum by Laticrete.

B. Grouting Materials

1. Polymer added sanded and unsanded grout, epoxy grout, silicone, or polyurethane for filling the joints.

C. Cleaning Solution: As recommended by the tile manufacturer.

D. Tools and Equipment: blades, slab handling tools, trowels as recommended by the tile manufacturer.

E. Tile backer: Refer to Section 09 22 00.

PART 3 EXECUTION

3.01 SCHEDULING

A. Install at the end of the project after environmental conditions within the building are controlled.

3.02 EXAMINATION AND PREPARATION

A. Verify dimensions by field measurements prior to fabrication.

B. Base Cabinets: Cabinet units shall be securely fixed to adjoining units and back wall. Inspect finished surfaces for damage. Verify that substrates supporting surfaces are plumb, level, and flat to within 1/16 inch in ten feet and that necessary supports and blocking are in place.

C. Do not install until damaged materials have been repaired in an acceptable manner or replaced.

3.03 INSTALLATION

A. Install materials in accordance to manufacturer's recommendations. Lift and place to avoid breakage.

- B. Place porcelain panels in the prepared areas according to the patterns and layouts shown on the Drawings.
- C. Preliminary Installation and Adjustment:
 - 1. Position materials to verify that materials are correctly sized and prepared. Make necessary adjustments.
 - 2. If jobsite cutting, grinding, or polishing is required, use water-cooled tools. Protect jobsite and surfaces against dust and water. Perform work away from installation site if possible.
 - 3. Countertops: Allow gaps for expansion of not less than 1/16 inch per five feet when installed between walls or other fixed conditions.
- D. Fix in place and fill in accordance with manufacturers' instructions or recommendations.
- E. Allow a minimum distance of 2 mm between the sink or cooktop and the countertop surface, for thermal expansion. Seal edges with silicone, adhesive seal or an equivalent product.

3.04 PROTECTION

- A. Protect finish surface needs during remaining construction work, including final mechanical or electrical trimming, painting, and punch list work.

3.05 CLEANING

- A. Clean surfaces upon completion, following manufacturers' recommendations. Provide cleaning instructions for the Owner.

3.06 SCHEDULE

- A. Kitchen Countertops where indicated on the Drawings.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Acoustical ceiling panels.
 - 2. Exposed grid suspension system.
 - 3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.
- B. Related Sections
 - 1. Division 9 - Gypsum Drywall Assemblies
 - 2. Division 23 Sections - Mechanical Work
 - 3. Division 26 Sections – Electrical Work

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
 - 2. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - 3. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
 - 4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
 - 6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - 7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - 8. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material

9. ASTM E580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
11. ASTM E 1264 Classification for Acoustical Ceiling Products

1.04 SYSTEM DESCRIPTION

- A. Seismic Loads: Design and size components to withstand seismic loads in accordance with the International Building Code, Section 1621.2.5 for Seismic Design Category Category D

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
- C. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards, including but not limited to full scale seismic testing in accordance with ICC Evaluation Services AC156 Acceptance Criteria for Seismic Qualification Testing of Non-structural components.

1.06 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less
 - b. Smoke Developed: 50 or less
 2. Fire Resistance Ratings: As indicated by reference to design designations in UL Fire Resistance Directory, for types of assemblies in which acoustical ceilings function as a fire protective membrane and tested per ASTM E 119.
 - a. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

- C. Coordination of Work: Coordinate layout and installation of acoustic ceiling units and suspension system components with other work supported by or penetrating through ceiling, including light fixtures, HVAC equipment, sprinklers and gypsum board systems.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units to avoid chipping edges or damaging units.

1.08 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Acoustical Panels: Sagging and warping.
 - 2. Grid System: Rusting and manufacturer's defects.
- B. Warranty Period:
 - 1. Acoustical panels: Thirty (30) years from date of substantial completion.
 - 2. Grid: Ten (10) years from date of substantial completion.

1.09 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quantity of full-size units equal to 5.0 percent of amount installed.

1.10 PROJECT CONDITIONS

- A. Space Enclosure: Do not install interior acoustic ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Ceiling Panels:
 - 1. USG Ceiling Systems, Basis of Design
 - 2. Armstrong World Industries, Inc.
 - 3. A/E approved equal
- B. Suspension Systems:
 - 1. USG Ceiling Systems, Basis of Design
 - 2. Armstrong World Industries, Inc.
 - 3. Celotex Building Products
 - 4. A/E approved equal

2.02 CEILING TILES

- A. Acoustical ceiling tile (ACT) Basis of Design: USG Interiors, LLC, "Mars".
 - 1. Color: White
 - 2. Dimension 24 inches x 24 inches x 5/8 inches
 - 3. Grid Face: 15/16"
 - 4. Edge Detail: Square Lay-In
 - 5. Classification: Provide ceiling panels complying with ASTM E 1264 for type, form and pattern as follows:
 - a. Type: IV, mineral base with membrane faced overlay
 - b. Form: 1 & 2, Nodular and water felted
 - c. Pattern: E & G, smooth and light texture
 - 6. Color: Manufacturers standard Flat White 050.
 - 7. LR: Not less than 0.90.
 - 8. NRC: Not less than 0.75.
 - 9. CAC: Not less than 35.

2.03 METAL SUSPENSION SYSTEMS.

- A. Basis of Design: USG Donn Brand DX-15/16" Hanger Wire: Galvanized carbon steel; soft temper; pre-stretched; yield stress load at least three times the design load but not less than 12-gauge.
 - 1. Spacing and gauge per IBC, UL and Cisca design.
 - 2. Supplied and installed by ceilings subcontractor
- B. Components: Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with (Flange) type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished

galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.

1. Structural Classification: ASTM C 635 Heavy Duty D
2. Color: match the color of the selected ceiling tile, unless noted otherwise.

- C. Attachment Devices, Wire for Hangers and Ties, Edge Moldings and Trim shall be In accordance with the International Building Code, Section 1621.2.5 for Seismic Category D.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

- A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustic ceilings.
- B. Furnish hanger clips and similar devices to other trades for installation well in advance of time needed for coordination of other work.
- C. Measure each ceiling area and establish layout of acoustic units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans.

3.03 INSTALLATION

- A. Locate system on room axis according to reflected plan.
- B. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
- C. Install suspension system and panels in accordance with ASTM E580, the International Building Code, Section 1621.2.5 and with the authorities having jurisdiction.
- D. Refer to manufacturer's illustrated installation instructions.
1. Install the structural wall channel
 - a. For seismic installation, the structural wall channel must be installed with the 1" leg down.

- b. Using Drywall screws, attach the structural wall channel through the upper half of the body to each stud, drywall 16" or 24" OC max. Powder actuated fasteners or similar can be used for masonry or concrete walls.
- 2. Install the main tees
 - a. The system is installed with two adjacent walls fixed to the channel molding, and on opposing adjacent walls floating to provide +/- 3/4" movement between the tees and the wall molding.
 - b. Trim the main tees leaving a 3/4" gap on one wall, keeping the center of the main tee aligned with ceiling panel layout
 - c. Bend the US44CC to form a right angle.
 - d. Snap the US44CC into the wall channel with the two longer tabs down. Use a framing screw to attach the US44CC to the US44 Channel Molding in the upper pilot hole. For masonry walls, attached the US44CC clip to the US44 channel molding through the top leg into the pilot hole on the top of the clip.
 - e. Fixed side: Install the main tees by screw attaching the US44 channel clip to the web of the main tees with one framing screw through the pilot holes on the upper tab.
 - f. Floating side: Attach the main tees to the US44CC channel clips with one framing screw through at the center of the slot located at the top of the clip. Do not overtighten the screw.
 - g. For distances exceeding maximum unsupported spans, install hanger wires on main tees, or use the AdvanceSpan cross brace clip method to provide intermediate support.
- 3. Install the infill cross tees using the appropriate DX/DXL cross tees
 - a. Perimeter cross tees are installed either fixed or floating on the adjacent walls corresponding with the main tees. The cross tees are attached to the US44 structural channel molding using the US44CC channel clip.
 - b. Fixed side: attach the cross tee to the US44CC with a framing screw through the pilot hole into the bulb of the tee.
 - c. Floating side: cut the perimeter cross tees to length leaving a 3/4" gap between the cross tee and channel molding. Attach the cross tee to the US44CC with a framing screw in the center of the slot to the cross tee bulb
- 4. Framing intersections and corners
 - a. For seismic category three way and four way corridor intersection framing layouts.
 - b. For expansion joints at corners, bend the ASTMP splice plate to form a 90° angle. Attach the ASTMP to the longitudinal main tee using two screws. Install the face sleeve over the intersecting main tee and attach to the ASTMP through the center of the slot leaving the prescribed gap between the tees

3.04 ACOUSTIC UNITS

- A. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- B. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
- C. Cutting Acoustic Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Double cut and field paint exposed edges of tegular units.

3.05 ADJUST AND CLEAN

- A. Clean exposed surfaces of acoustic ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. Replace damaged and broken panels.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Resilient wall base

1.02 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of material required for Project.
- B. Samples: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with minimum five years successful experience completing flooring installation similar to that required.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store rolls in upright position.
- B. Store flooring materials in area of application; allow two days for material to reach same temperature as area and maintain for minimum 24 hours after completion of installation.

1.05 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain minimum 65 degree F air temperature at flooring installation area for minimum two days prior to, during, and for minimum 24 hours after installation of flooring.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 85 deg F

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Allstate Rubber
- B. Johnsonite Inc
- C. Roppe Manufacturing
- D. For consistency of colorway throughout facility, all products shall be supplied by a single manufacturer, unless otherwise approved by the A/E.

2.02 MATERIALS

- A. Traditional Rubber Wall Base
 - 1. Manufactured from a proprietary thermoplastic rubber formulation.
 - 2. Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.
 - 3. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.
 - 4. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class A, Smoke <450.
 - 5. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1 1/4" diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
 - 6. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
 - 7. Phthalate-free.
 - 8. Size: 4 inch height coved base unless noted otherwise on the drawings
 - 9. Length: coil 120'
 - 10. Gauge: 1/8 inch
 - 11. Color to be selected by A/E from manufacturer's full range of colors.
 - 12. Adaptors are to be 12 foot lengths per piece.

2.03 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation manufactured and warranted by a reputable manufacturer.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient wall base.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Preformed corners: Install preformed corners if available before installing straight pieces.
- G. Job-formed corners:
 - 1. Outside corners: Form by bending without producing discoloration (whitening) at bends.
 - 2. Inside corners: Butt one piece to corner then scribe next piece to fit.

3.04 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

SECTION 09 65 19

RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SUMMARY

- A. Provide resilient athletic flooring including preparation work, adhesive for installation and testing
- B. Related Sections
 - 1. Division 7: Dampproofing and Waterproofing.
 - 2. Division 09: Resilient Base

1.02 REFERENCES

- A. American Society for Testing & Materials (ASTM)
 - 1. ASTM D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
 - 2. ASTM D 2047: Standard Test Method for Static Coefficient of Friction of Floor Surfaces.
 - 3. ASTM D2240: Standard Test Method for Rubber Property (Durometer Hardness).
 - 4. ASTM D3389: Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader).
 - 5. ASTM E 648: Standard Test Method for Critical Radial Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - 6. ASTM E 662: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 7. ASTM E 1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - 8. ASTM E2180: Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials.
 - 9. ASTM F386: Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
 - 10. ASTM F410: Standard Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement.
 - 11. ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 12. ASTM F 970: Standard Test Method for Static Load Limit.
 - 13. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor Using Anhydrous Calcium Chloride.

1.03 SUBMITTALS

- A. Product data, including manufacturer's information for specified products
- B. Selection and verification samples for finishes, colors and textures.
- C. Shop drawings showing layout, profiles and product components.
- D. Installation and maintenance instructions as published by the manufacturer.
- E. Provide Manufacturer's current standard warranty as published by the Manufacturer.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Provide extra stock materials for use in facility operation and maintenance. Provide amount of approximately 2% of the total floor surface, of each type, color and dye lot.

1.05 QUALITY ASSURANCE

- A. The manufacturer must have experience in the manufacturing of prefabricated rubber surface(s).
- B. Installer must have performed installations of the same scale in the last three years and be recognized and approved by the commercial rubber-flooring manufacturer

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Materials must be delivered in manufacturer's original, unopened and undamaged containers with identification labels intact.
- B. Store material protected from exposure to harmful weather conditions, on a clean, dry, flat surface protected from all possible damage. Rolls are to be stored in the upright position at all times.
- C. Recommended environmental condition for storage is a minimum of 55o F (13o C).
- D. Material should not suffer excessive damage during handling (i.e. edge chipping, excessive warping etc)

1.07 SITE CONDITIONS

- A. Maintain a stable room and subfloor temperature for a minimum period of 48 hrs prior, during and 48 hrs after installation. Recommended temperature range: 65o F to 80 degrees F (18 degrees C to 27degrees C).
- B. Installation to be carried-out no sooner than the specified curing time of concrete subfloor (normal density concrete curing time is approximately 28 days for development of design strength).

- C. Concrete subfloors, on or below grade, must be installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, as per Manufacturer's instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010in).
- D. Concrete to have smooth, dense finish, and be highly compacted with a tolerance of 1/8" in a 10ft radius (3.2mm in 3.05m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
- E. Moisture and alkalinity tests must be performed on all concrete substrates, under in-service conditions. It is recommended to turn on the HVAC unit prior to performing moisture testing, in order to ensure stable testing conditions and accurate results. The concrete's surface pH should be between 7 and 10. Relative humidity of the concrete slab must not exceed 85%, in accordance with ASTM F2170 (in situ probes). Moisture vapor emissions from the concrete slab must not exceed the tolerance of the adhesive specified, in accordance with ASTM F1869 (anhydrous calcium chloride)

1.08 WARRANTY

- A. The commercial rubber flooring is warranted to be free from manufacturing defects for a period of one (1) year from the date of shipment from the manufacturer.
- B. For applications in ice arenas, the resilient athletic flooring is warranted against excessive wear under normal usage for a period of five (5) years from the date of shipment from the Manufacturer; all other applications under normal usage will be warranted against excessive wear for a period of ten (10) years from the date of shipment from the Manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 - 1. MONDO AMERICA INC., 2655 Francis Hughes, Laval, QC,
MONDO USA (Southwest Division), 1705 West NW Hwy., Suite 255,
Grapevine, TX Toll-Free: 1-888-966-6369
- B. Equivalent products by other manufacturers may be accepted when submitted under "Product Substitution Procedure" per Section 01 60 00 and approved by the A/E.

2.02 RESILIENT ATHLETIC FLOORING

- A. Resilient athletic flooring is based on MONDO IMPACT, prefabricated rubber athletic flooring, calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation
1. Manufactured in two layers vulcanized together. The shore hardness of the top layer will be greater than that of the bottom layer; shore hardness of layers to be recommended by the Manufacturer and the limits specified
 2. Thickness: 0.394" (10mm).
 3. Color: Shall be selected by A/E from manufacturer's standard color range.
 4. Finish: Sealskin.
 5. Format: 6'-1" x 29'-6" sheets
- B. Performance of the prefabricated rubber athletic flooring to conform to the following criteria:

Performance Criterion	Test Method	Requirement	Result
Elongation at Break	ASTM D412	-	>90%
Tensile Strength	ASTM D412	-	>560psi
Static Coefficient of Friction	ASTM D2047	≥0.50	>0.80
Hardness (Shore A)	ASTM D2240	-	80 ±5 (wear layer) 77 ±5 (backing)
Abrasion Resistance (H18 wheel, 1000g, 1000 cycles)	ASTM D3389	<1.0	0.15g
Critical Radiant Flux	ASTM E648	≥0.45	≥0.45 W/cm2 (Class 1)
Optical Density of Smoke	ASTM E662	<450	<450
Antimicrobial Activity	ASTM E2180	-	99.99% reduction
Thickness	ASTM F386	-	10mm (±0.2mm)
Thickness of Wear Layer	ASTM F410	-	>1.0mm
Resistance to Chemicals	ASTM F925	-	Compliant
Static Load Limit (tested at 250psi)	ASTM F970	-	<0.008in
Heat Stability	ASTM F1514	ΔE ≤8.0	Compliant
Light Stability	ASTM F1515	ΔE ≤8.0	Compliant
Indoor Air Quality	CA 01350	-	Compliant

2.03 ACCESSORIES

- A. Provide adhesive certified by the manufacturer, PU 105 Polyurethane Adhesive or EP 55 Epoxy Adhesive (refer to Instruction Manual of Adhesives provided by manufacturer).
- B. Patching or leveling compound to be supplied and/or recommended/approved by rubber athletic flooring Manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. The following must be ensured prior to installation of the primary product (ASTM F 710):
 - 1. Concrete sub-floors to be placed a minimum of twenty-eight (28) days prior to the installation of commercial and athletic rubber flooring.
 - 2. Concrete subfloors on or below grade shall be installed over a suitable moisture retardant membrane in accordance with ASTM E 1643 and E 1745.
 - 3. No concrete sealers or curing compounds shall be applied or mixed with the concrete subfloors
 - 4. Water vapor membrane complies with specification in ASTM E 1745.
 - 5. Moisture and alkalinity tests must be preformed. Moisture content must not exceed the capacity of the specified adhesive (verify using the anhydrous calcium chloride test as per ASTM F1869) and pH level should be in the range of 7 to 8.5.
 - 6. Smooth, dense finish, highly compacted with a tolerance of 1/8'' in a 10 ft radius (3.2 mm in 3.05m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.
- B. Subfloors must be clean, free of paint, thick dust, sealer, hardeners, grease, oil, solvents, old adhesive and any other foreign substances that may act as a bond barrier.
- C. Sealing of cracks, holes and, smoothing and leveling of rough, uneven surfaces, must be carried out using a good quality Portland cement based leveling compound (feathering compound), approved by the manufacturer.
- D. The beginning of installation stipulates the acceptance of surface and site conditions. Installation will not be carried out unless above conditions are satisfied. Report any discrepancies to the General Contractor for correction.

3.02 INSTALLATION

- A. Install rubber flooring in accordance with Manufacturer's current printed Installation Manual.

3.03 REPAIR

- A. Provide 10% extra stock material for repairs. Repair material must be from the same dye lot as material supplied for initial installation.

3.04 CLEANING

- A. Initial cleaning should only be performed 72 hours after the flooring has been completely installed.

- B. Maintain flooring according to Manufacturer's current maintenance instructions for specified product.

3.05 PROTECTION

- A. Protect floor during and after the installation, as per manufacturer's instructions, until project's acceptance by the owner or his agent.

END OF SECTION

SECTION 09 68 13

TILE CARPETING AND WALK-OFF

PART 1 GENERAL

1.01 DESCRIPTION

- A. Section includes:
 - 1. Modular tile walk-off mat
 - 2. Modular textile composite tile carpeting
 - 3. Installation
- B. Related Sections:
 - 1. Division 09: Resilient Tile Flooring: Resilient Base

1.02 REFERENCES

- A. Carpet and Rug Institute:
 - 1. CRI 104 - Standard for Installation of Commercial Carpet.
- B. Consumer Products Safety Commission:
 - 1. CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.
- C. National Fire Protection Association:
 - 1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

1.03 SUBMITTALS

- A. Product Data: As soon as practical after award of the contract, submit complete materials list of all items proposed to be furnished and installed under this section, including, but not limited to, the following:
 - 1. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
 - 2. Shop drawings showing location of joints, layout directions of tiles and location of edge moldings.
 - 3. Samples of patterns and colors for each product which are complimentary to one another.
 - 4. Manufacturer's recommended installation procedures.
 - 5. Manufacturer's recommended maintenance procedures.
 - 6. Manufacturer's written warranties.

- B. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 2. Carpet tile type, color, and dye lot.
 3. Type of subfloor.
 4. Type of installation.
 5. Pattern of installation.
 6. Pattern type, location, and direction.
 7. Installation method (monolithic, quarter turn, ashlar, brick random, interactive patterning).
 8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
- C. Samples: Provide full-size product samples for patterns/colorways chosen by A/E. The A/E shall select colors and patterns of carpet tiles for approval by the Owner and integration into the project.

1.04 QUALITY ASSURANCE

- A. Standards: Comply with standards specified herein as listed in “References” Section.
- B. Qualifications of Manufacturer: Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.
- C. Qualifications of Installers: Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely with the specified requirements and the methods needed for proper performance of the work of this section.

1.05 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.
- B. Installer: Company specializing in performing work of this section with a minimum of 5 years commercial carpet installation experience

1.06 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- B. Installation temperature: Maintain in accordance with manufacturer’s installation instructions.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Comply with carpet manufacturer's installation recommendations and the Carpet & Rug Institute Installation Standard 2011 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. HVAC system should be operational and running prior to carpet installation and remain running after carpet installation.
- D. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to allow bond between adhesive and concrete. Concrete slabs should have moisture and pH readings that are within the specified tolerance of the adhesive to be used.

1.08 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent face fiber loss, edge raveling, dimensional instability, excess static discharge, loss of tuft bind strength, delamination, and where face fiber is 100 percent solution dyed, inability to remove acid based stains, lack of colorfastness to atmospheric contaminants.
 - 3. Carpet must be manufactured and warranted by same manufacturer.
 - 4. Warranty Period: Lifetime Commercial Limited Warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 - 1. EF Contract: Modular walk off and modular tile carpeting.
 - 2. J + J Flooring – Latex multi-purpose floor adhesive
- B. Source Limitations:
 - 1. Single Source Responsibility: Provide products that have components manufactured by a single source. Fiber and backing, as well as final carpet product, should be manufactured and warranted by same company.

2. Commitment to sustainability: Carpet manufacturer must practice environmental responsibility through programs of source reduction, recycling, reuse, and conservation.

2.02 MODULAR WALK-OFF TILE BASIS OF DESIGN

- A. Construction: Textured Loop
 1. Standard Backing: Nexus® Modular
 2. Dye Method: Solution Dyed
 3. Fiber Type: Encore® SD Ultima® (with recycled content)
 4. Face Weight: 30 oz./sy
 5. Pile Density: 8000 oz./y³
 6. Pattern Repeat: N/A
 7. Gauge: 1/103.94 rows/cm
 8. Stitches: 10.00 stitches/in
 9. Total Thickness (nominal average): .135 inches
 10. Standard Size: 24" x 24" approx.
 11. Special Treatments: ProTex® Soil Release
 12. Standard Adhesive: Commercialon Premium Modular and LVT Adhesive
- B. Performance:
 1. Pill Test: Yes
 2. Flooring Radiant Panel: Class 1
 3. Smoke Density: Less than 450.0 flaming (ASTM E 662)
 4. Static: Less than 3.0 kv (AATCC-134)
 5. Lightfastness: Yes
 6. ADA Compliance: Compliant For Accessible Routes
- C. Service Warranties
 1. Encore SD Ultima Lifetime Fiber Warranty
 2. Nexus Modular Lifetime Warranty
 3. Commercialon Adhesive for Modular Carpet & LVT Lifetime Warranty
- D. Walk-Off Adhesive:
 1. Latex Multi-Purpose Floor Adhesive
 2. Product Type: Single Part Wet Adhesive
 3. Range Of TVOC: 0.5 mg/m³ or less
 4. Basis of Design: Commercialon Premium Carpet Adhesive

2.03 MODULAR COMPOSITE TEXTILE CARPETING

- A. Product: EF Contract Kinetix
 1. Construction Textile Composite
 2. Wear Layer: 100% Solution Dyed Polyester
 3. Standard Backing: Polyester Felt Cushion
 4. Dye Method: Solution Dyed
 5. Pattern Repeat: N/A

6. Total Weight (nominal average): 4.5 oz - 5.2 oz/ square foot
 7. Total Thickness (nominal average): .205 inches
 8. Dimensions: 24" x 24" modules
 9. Standard Adhesive: Kinetex PreFix , a peel and stick adhesive over companion primer floor
- B. Environmental Specifications & Tests
1. Recyclability: 100% Closed-loop Recyclable
 2. NSF 140: Platinum Certified
 3. Total Recycled Content: 55.8%
 4. Flooring Radiant Panel Class 1
 5. Smoke Density Less then 450 flaming (ASTM E 662)
 6. Static Test Less then 3 kv (AATCC-134)
 7. ADA Compliance Compliant For Accessible Routes
 8. Pill Test Yes
 9. Lightfastness Yes
- C. Service Warranties
1. Lifetime performance warranties for Product Performance
 2. Colorfastness (Light and Crocking)
 3. Stain Removal
 4. Static Propensity
 5. Edge Ravel, Delamination and Dimensional Stability

2.04 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Follow approved installation method(s) for each specific product.
- C. Kinetix Tiles:
1. PreFix™ Peel and Stick: Kinetex tiles are equipped with a pre-applied, pressure sensitive adhesive that is nonflammable, alkali and water-resistant, no odor and “zero VOC”.
 2. PreFix Primer Product Application
 - a. Read all installation instructions thoroughly.
 - b. Follow manufacturer’s mixing and application directions

PART 3 EXECUTION

3.01 INSPECTION

- A. The lighting to be used by the building occupants must be in service for proper inspection of color and joints.
- B. Installation of carpet tiles should be the last item on the construction schedule.

- C. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects prior to installation. See manufacturer's requirements for substrate conditions and ambient conditions.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing moisture and pH tests as recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 4. Lightweight concrete and gypcrete subfloors may require a primer such as Shaw 9050 or equivalent to reduce surface porosity.
 - 5. Where previous surface treatments are unknown, or where other concerns exist as to the ability of the adhesive to bond to the substrate, a 24 hour bond test is recommended.

3.03 PREPARATION

- A. General: Comply with Carpet & Rug Institute Installation Standard 2011, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Inspect modules prior to installation.
- C. Read all instructions prior to beginning installation.
- D. Use trowelable leveling and patching compounds that contain a cementitious base with a latex additive, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- E. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

- F. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.04 INSTALLATION

- A. All carpet tiles must be removed from the cartons and allowed to adjust to the job site temperature for 48 hours prior to installation.
- B. Install carpet in accordance with CRI 104.
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Dry fit (without adhesive) a row of tiles along the entire length of vertical and horizontal center lines. Go all the way to the walls. If necessary, offset either or both center lines to ensure perimeter tiles will be cut no less than half size, or 9.84 inches
- E. Tiles adjacent to fixtures, architectural elements and walls need to be cut. Follow manufacturer's guidelines: Always secure cut tiles with adhesive.
- F. Roll the entire installation with a 75 lb roller once installation is completed.

3.05 CLEANING AND PROTECTION'

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with Carpet & Rug Institute Installation Standard 2011, "Protecting Indoor Installations."
- C. When construction or move-in activities will continue where new carpet is installed, provide non-staining building material paper to protect carpet. Do not use plastic sheeting as it can trap moisture, and self-sticking plastic sheeting can transfer adhesive residue to carpet that will attract soil.
- D. When heavy objects are moved over carpet within 24 hours of installation, use plywood over carpet to prevent buckling and wrinkling
- E. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

3.06 SCHEDULE

- A. As indicated on the Drawings.

END OF SECTION

SECTION 09 77 00

FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Special wall surfaces, including fiberglass reinforced plastic panels.

1.02 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. ASTM International:
 - 1. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 - 2. ASTM D5420 Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
 - 3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide fiberglass reinforced plastic (FRP) panels which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.04 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.
- B. Product Data: Submit product data, including manufacturer's product sheet, for specified products.
- C. Shop Drawings: Submit Shop Drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

- D. Samples: Submit selection and verification samples for finishes, colors and textures. Submit 2 samples of each type of panel, trim and fastener.
- E. Quality Assurance Submittals: Submit the following:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
 - 3. Manufacturer's Instructions: Manufacturer's installation instructions. Submit manufacturer's *Installation Guide #6211*.
- F. Closeout Submittals: Submit the following:
 - 1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 01 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
 - 2. Warranty: Warranty documents specified herein.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.
 - 2. Manufacturer Qualifications: Manufacturer should be capable of providing field service representation during construction and should be capable of approving application method.

1.06 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Division 01 Product Requirements Sections.
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.
- D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer. Store panels indoors in a dry place at the project site.
- E. Handling: Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:

1. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
2. During installation, and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
3. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on Shop Drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Crane Composites, Inc.

1. Contact: Joliet Sales Office, PO Box 2429, Joilet, IL 60434; Telephone: (800) 435-0080, (815) 467-8600; Fax: (815) 467-8666; E-mail: salesjol@cranecomposites.com; Website: www.glasbord.com.
2. Proprietary Product/System(s) Listed : Kemlite FRP Panels.

B. Products by Alternate Manufacturers may be accepted by the A/E as equal, if approved as a substitute following the Substitution Procedures in Section 01 60 00 – Product Requirements.

2.02 MATERIALS

A. FRP Panels (Glasbord Panels):

1. Type:
 - a. Class A fire-rated wall panels: .09” thick, color to be selected by A/E.
2. Class A flamespread of less than 25, smoke developed less than 450 per ASTM E84 latest version.
3. Meets USDA/FSIS requirements.
4. Complies with ICBO Report Number 4583.
5. Color: to be selected by A/E from manufacturer’s standard color palette.
6. Size: to meet project conditions as shown on the Drawings.

B. Pre-Laminated FRP Gypsum Board Panels (Kempli Panels):

1. FRP Face: Same as listed above laminated to 5/8” Firecode X gypsum board substrate.
2. Color: color to be selected by A/E.
3. Size: to meet project conditions as shown on the Drawings.

- C. Accessories
 - 1. Moldings: Provide harmonizing PVC (polyvinyl chloride) moldings.
 - 2. Rivets: Provide in areas where there are large fluctuations in temperature and/or humidity, where the substrate is unusually uneven, and in all low temperature or cold storage applications.
 - 3. Division Bars, Corner Trim: Panel manufacturer's standard length extruded vinyl pieces; longest length possible to eliminate end joints.
 - 4. Fasteners: Noncorrosive drive rivets.
 - 5. Adhesive: Provide panel adhesive as recommended by panel manufacturer.

2.03 SOURCE QUALITY

- A. Source Quality: Obtain FRP panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

- A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
 - 1. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails are countersunk and joints and cracks are filled flush and smooth with the adjoining surface.
 - 2. Do not begin installation until backup surfaces are in satisfactory condition.

3.03 INSTALLATION

- A. Fiberglass Reinforced Panel (FRP) Installation:
 - 1. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
 - 2. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - 3. Predrill fastener holes in panels with 1/8" oversize.
 - 4. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
 - 5. Use products acceptable to panel manufacturer and install FRP system in accordance with panel manufacturer's printed instructions. Comply with panel manufacturer's *Installation Guide #6211*.

3.04 CLEANING

- A. Remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- B. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

3.05 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of painting and coating work is indicated on drawings and schedules, and as herein specified.
- B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated.
- C. Surfaces to be painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors or finishes available.
- D. Following categories of work are not included as part of field applied finish work:
 - 1. Prefinished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, prefinished partition systems, architectural casework, and finished mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.
 - 2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas.
 - 3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
- E. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting
- F. Related Sections: Section 09 97 10 – Industrial Coatings
- G. Following categories of work are included under other sections of these specifications:
 - 1. Shop Primers: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metalwork and similar items.
 - 2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.

- H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, or nomenclature plates.

1.02 REFERENCES

- A. SSPC: The Society for Protective Coatings
 1. SSPC-SP 1 - Solvent Cleaning
 2. SSPC-SP 2 - Hand Tool Cleaning
 3. SSPC-SP 3 - Power Tool Cleaning
 4. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete
- B. ASTM International
 1. ASTM F1869 - Moisture Test by use of Calcium Chloride
 2. ASTM D4258 - Standard Practice for Cleaning Concrete
 3. ASTM D4259 - Standard Practice for Abrading Concrete
 4. ASTM D4260 - Standard Practice for Etching Concrete
 5. ASTM D4263 - Plastic Sheet Method for Checking Moisture in Concrete

1.03 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each paint and coating product should include:
 1. Product characteristics
 2. Surface preparation instructions and recommendations
 3. Primer requirements and finish specification
 4. Storage and handling requirements and recommendations
 5. Application methods and recommended Wet and Dry Film Thickness
- B. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's color samples available.
- C. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information:
 1. Product name, and type (description)
 2. Application & use instructions
 3. Surface preparation
 4. VOC content
 5. Environmental issues
 6. Batch date
 7. Color number

- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.
- C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.05 QUALITY ASSURANCE

- A. Contractor shall have a minimum of 5 years of Commercial building experience and installers who are experienced with painting a variety of institutional and commercial projects and in the application of professional grade products
- B. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- C. Coordination of Work: Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.06 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

1.07 PRE-INSTALLATION MEETING

- A. Schedule pre-installation meeting with Owner and A/E one week minimum prior to commencing work of this section. (for Apparatus Bay floor coatings)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 - 1. Sherwin-Williams Company
 - 2. PROSOCO, Inc. • www.prosoco.com
- B. Products by the following manufacturer's may be substituted for scheduled products when equivalent in performance:
 - 1. Dunn Edwards Paint Company
 - 2. PPG Architectural Coatings, Inc

2.02 APPLICATION/SCOPE

A. Typical Surfaces to be coated:

1. Exterior Concrete
2. Exterior CMU
3. Exterior Metals
4. Interior Concrete
5. Interior Masonry: CMU
6. Interior Metals
7. Interior Gypsum Board

2.03 MATERIALS - GENERAL REQUIREMENTS

A. Paints and Coatings - General:

1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers:

1. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.04 ACCESSORIES

A. Coating Application Accessories:

1. Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

2.05 EXTRA MATERIALS

A. Supply 1 gallon of each color, and type; store where directed.

B. Label each container with Building Area Name, surface applied to, and date in addition to manufacturer's label showing type of paint and color identification formula and name.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of coatings until substrates have been properly prepared. Notify Architect or Specifier of unsatisfactory conditions before proceeding.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

- C. Proceed with work only after conditions have been corrected, and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

3.02 SURFACE PREPARATION

- A. Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.
- B. Fill all cracks, voids, bug holes and joints with appropriate filler or ArmorSeal Crack Filler, ArmorSeal Joint Sealant, or ArmorSeal Expresspatch.
- C. For concrete floor surfaces, follow the ASTM methods listed below:
 - 1. ASTM F1869 Moisture Test by use of Calcium Chloride
 - 2. ASTM D4258 Standard Practice for Cleaning Concrete.
 - 3. ASTM D4259 Standard Practice for Abrading Concrete.
 - 4. ASTM D4260 Standard Practice for Etching Concrete.
 - 5. ASTM D4263 Plastic Sheet Method for Checking Moisture in Concrete.
 - 6. SSPC-SP 13/Nace 6 Surface Preparation of Concrete
 - 7. ICRI # 03732 Surface Preparation of Concrete
- D. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50°F, unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50°F or higher to use low temperature products.

3.03 SURFACE PREPARATION METHODS

- A. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
- B. Concrete Unit Masonry: Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement, and hardeners. Concrete and mortar must be cured at least 30 days at 75°F, unless the manufactures products are designed for application prior to the 30-day period. The pH of the surface should be between 6 and 9, unless the products are designed to be used in high pH environments.
- C. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.
 - 1. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces.
 - 2. Minimum substrate cure is 28 days at 75°F.
 - 3. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining

systems. Remove all form release agents, curing compounds, salts, efflorescence, laitance, and other foreign matter by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. Refer to ASTM D4260. Rinse thoroughly to achieve a final pH between 8.0 and 10.0. Allow to dry thoroughly prior to coating.

- D. Drywall: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled nail heads and tape joints must be sanded smooth and all dust removed prior to painting.
- E. Galvanized Metal: Clean per SSPC-SP1 using detergent and water or a degreasing cleaner to remove greases and oils. Apply a test area, priming as required. Allow the coating to dry at least one week before testing. If adhesion is poor, Brush Blast per SSPC-SP7 is necessary to remove these treatments.
- F. Steel: Structural, Plate, etc.: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
 - 1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
 - 2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 - 3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
 - 4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 - 5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of

- mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
 7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
 8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
 9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.
 10. Water Blasting, NACE Standard RP-01-72: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

3.04 INSTALLATION

- A. Apply all coatings and materials with manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendation.
- B. Do not apply to wet or damp surfaces.
 1. Wait at least 28 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 28 days.
 2. Test new concrete for moisture content.
- C. Apply coatings using methods recommended by manufacturer.

- D. Uniformly apply coatings without runs, or sags, without brush marks, and with consistent sheen.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance. Tinted primer recommended.
- F. Apply coatings at spreading rate required to achieve the manufacturer's recommended dry film thickness.
- G. Inspection: The coated surface must be inspected and approved by the Architect or Engineer just prior to each coat.

3.05 CLEAN-UP

- A. During progress of work, remove from site discarded paint materials, rubbish, cans, and rags at end of each work day.
- B. Upon completion of painting work, clean window glass and other paint spattered surfaces.
 - 1. Remove spattered paint by proper methods of washing and scraping.
 - 2. Use care not to scratch or otherwise damage finished surfaces.

3.06 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

3.07 INTERIOR PAINTING AND COATING SCHEDULE

- A. Concrete Floors: Sealer
 - 1. 1 Coat S-W H&C® Wet Look Water Based Sealer Clear (200-300 sq/ft. per gallon)
- B. Metals: Aluminum, Galvanized and Ferrous Railings, Ladders, Doors and Frames and Miscellaneous; Semi-Glass Acrylic:
 - 1. Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series (5-10 mils wet, 2-4 mils dry)
 - 2. 1st Coat: S-W Pro Industrial Semi-Gloss Acrylic, B66-650 Series
 - 3. 2nd Coat: S-W Pro Industrial Semi-Gloss Acrylic, B66-650 Series (4.0 mils dry per coat)

- C. Wood: Wood Joists:
 - 1. 1st Coat: S-W Premium Wall & Wood Primer, (4 mils wet, 1.8 mils dry)
 - 2. 2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
 - 3. 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series (4 mils wet, 1.7 mils dry per coat)
- D. Gypsum Board – Walls and Ceilings, Egg-Shell Latex
 - 1. Primer: ProMar 200 Zero VOC Interior Latex Primer, 0 g/L VOC
 - 2. 1st coat: ProMar 200 Zero VOC Eg-Shel, 0 g/L VOC
 - 3. 2nd coat: ProMar 200 Zero VOC Eg-Shel, 0 g/L VOC
- E. Gypsum Board – Walls and Ceilings, Semi-Gloss Latex
 - 1. Primer: ProMar 200 Zero VOC Interior Latex Primer, 0 g/L VOC
 - 2. 1st coat: ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series
 - 3. 2nd coat: ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series

3.08 EXTERIOR PAINTING AND COATING SCHEDULE

- A. Metals: Railings, Semi Gloss Acrylic
 - 1. Primer: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310, <100 g/L VOC
 - 2. 1st coat: Pro Industrial Acrylic Semi-Gloss, B66-650 series, <50 g/L VOC
 - 3. 2nd coat: Pro Industrial Acrylic Semi-Gloss, B66-650 series, <50 g/L VOC;

END OF SECTION

SECTION 10 14 16

PLAQUES AND DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 QUALITY ASSURANCE

- A. Uniformity of Manufacturer: For each product type indicated, furnish products of single manufacturer.

1.03 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Manufacturer's Data: Submit manufacturer's descriptive literature and specifications, including color samples of material for selection.
- C. Shop Drawings:
 - 1. Submit scaled shop drawings showing fabrication method, finish, anchoring methods, layout, and installation method.
- D. Color charts for selection of by the A/E.

1.04 WARRANTY

- A. Lifetime Warranty: Manufacturer guarantees that should a product fade, break or contain any defect, manufacturer shall refinish or replace the defective material at no cost to the Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gemini Incorporated, 103 Mensing Way, Cannon Falls, Minnesota 55009; Tel: (800) 538-8377 (1-800-LETTERS); Fax: (800) 421-1256.
- B. A.R.K. Ramos Architectural Signage Systems, Oklahoma City, Oklahoma, Toll Free 1-800-725-7266, Fax 405-232-8516.
- C. Matthews International Corporation

2.02 METAL PLAQUES

- A. Cast Plaques: Actual design and lettering for the plaque to be determined by Owner.
 - 1. Plaque Material: Satin Aluminum.
 - 2. Plaque Size: 12" x 16" As shown on the Drawings.
 - 3. Border Style: Single Line Bevel Edge at 45 Degrees.
 - 4. Background Texture: Pebble.
 - 5. Background Color: To be selected by A/E from manufacturer's standard color range.
 - 6. Mounting: Stud mounting.
- B. Mounting: Stud mounting.

2.03 CAST METAL LETTERS AND LOGOS

- A. Text/Artwork as shown on the Drawings.
- B. Fabrication: Castings shall be free of pits, scale, sand holes and other defects.
- C. Metal:
 - 1. Metal: Aluminum
 - a. Natural satin.
- D. Font: As shown on the Drawings.
- E. Sizes: 6".
- F. Mounting: Flush mounting with studs set in adhesive Projected mounting with collars and studs set in adhesive.

2.04 ACCESSORIES

- A. Templates: Provide full size paper mounting templates showing hole placement and location of mounting holes.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Locate units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 - 1. Install level, plumb, and at the height indicated with sign surfaces free from distortion or other defects in appearance.
 - 2. Use mounting templates showing line lengths and hole locations to ensure correct spacing.
 - 3. Use silicone-base adhesive as recommended by the manufacturer for stud mountings with adhesive.

- B. Cleaning and Protection: After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.02 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until date of substantial completion.

END OF SECTION

SECTION 10 14 23

ROOM SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the following: HC300 ADA System room signs.

1.02 SUBMITTALS

- A. Manufacturer's Data: Submit manufacturer's descriptive literature and specifications, including color samples of material for selection, as applicable for approval.
- B. Submit shop drawings listing sign styles, lettering and locations, and overall dimensions of each sign.
- C. Submit full size sample sign of type, style and color specified including method of attachment.
- D. Manufacturers must submit 3 references showing comparable products for projects completed within the last 5 years.
- E. Submit manufacturer's standard warranty information.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: BEST Sign Systems Inc., 1202 N. Park Ave., Montrose, CO 81401 Telephone 1-800-235-BEST (2378); Fax 1-970-249-0223; email sales@bestsigns.com.

2.02 FABRICATION

- A. Raised Plastic Signs shall be Best's HC300 ADA System with a four-in-one construction style having the following characteristics:
- B. Tactile characters/symbols shall be raised 1/32" from sign plate face. Signs shall be of one-piece construction; added-on and/or engraved characters are unacceptable.
 - 1. Text shall be accompanied by Grade 2 Braille.
 - 2. 3/8" wide, 1/32" raised perimeter border with 1/8" inside radius typical.
 - 3. All letters, numbers and/or symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background. Characters and background shall have matte finish.

- C. Interior sign plaque material shall consist of melamine plastic laminate, approximately 1/8" thick, with core painted a contrasting color.
 - 1. Plastic laminate shall be impervious to most acids, alkalies, alcohol, solvents, abrasives and boiling water; and shall have a scratch resistant, non-static, fire-retardant, washable, non-glare surface.
 - 2. Mounting shall be with vinyl foam tape
 - 3. **Provide color coordinated backing plate when mounting on glass is indicated**
- D. Exterior sign plaque material shall be 1/8" thick fire, impact and corrosion resistant fiberglass laminate with non-glare UV inhibited painted surface, and 20+ year life expectancy for legibility, color retention and resistance to normal climatic elements. Intended for exterior use.
 - 1. Screw mount through pre-drilled holes in signs
- E. Lettering style shall be Standard Medium, upper case, or other sans serif or simple serif typeface.
- F. Sizes of letters and numbers shall be as follows:
 - 1. Room numbers shall be 5/8" high.
 - 2. Lettering for room usage and directional identification shall be 5/8" high.
 - 3. Lettering for restroom identification shall be 5/8" high, corresponding symbols shall be 3" high.
 - 4. Letters and numbers shall be centered on sign.
- G. Grade 2 Braille shall be placed directly below last line of letters or numbers, except for room number signs, where they shall be placed directly behind the last number.
- H. Radius corners: 1/2".
- I. Sign sizes:
 - 1. Restroom signs shall be 6" x 8".
 - 2. Room identification signs shall be 3" high by length to fit required wording; Signs may be 6" high where text will not fit within 3" high blank

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions. Install signs level, plumb, and at heights indicated.

3.02 SCHEDULE

- A. Shower Room Signs: Provide 2 with pictograms
 - 1. Male/Female Symbol with International Symbol of Accessibility
- B. Room signs: Provide 9:
 - 1. Conference
 - 2. Fitness Training
 - 3. Janitor
 - 4. Dorm E
 - 5. Dorm D
 - 6. Dorm C
 - 7. Dorm B
 - 8. Dorm A
 - 9. Laundry
 - 10. Mechanical

END OF SECTION

SECTION 10 26 00

WALL PROTECTION

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the following types of wall protection systems:
 - 1. Corner Guards

1.02 RELATED SECTIONS

- A. Blocking in walls for fasteners; refer to division 9 "Gypsum Board Assemblies"

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. Underwriters Laboratories (UL)

1.04 SUBMITTALS

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 "Submittal Procedures".
- B. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.
- C. Shop drawings showing locations, extent and installation details of crash rails. Show methods of attachment to adjoining construction.
- D. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of color, texture, pattern and end cap attachment and alignment.
 - 1. 12" long sample of each model specified including end cap and mounting hardware.
- E. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.
- F. Maintenance data for wall protection system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.05 QUALITY ASSURANCE

- A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

- B. Manufacturer's qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.
- C. Code compliance: Assemblies should conform to all applicable codes including IBC.
- D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM-E84 for Class 1 characteristics listed below:
 - 1. Flame spread: 25 or less
 - 2. Smoke developed: 450 or less
- E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.
- F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D-1308.
- G. Color match: Provide wall protection components that are color matched in accordance with the following:
 - 1. Delta Ecmc of no greater than 1.0 using CIELab color space. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present).
- H. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.
- C. Material must be stored flat.

1.07 PROJECT CONDITIONS

- A. Materials must be acclimated in an environment of 65°-75°F for at least 24 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. JL Industries
- B. Eagle Moldings
- C. Wallguard.com
- D. Alternate manufacturers when submitted in accordance with Substitution Procedures Section 01 60 00

2.02 MATERIALS

- A. Stainless steel: Type 304 alloy with #4 satin finish; minimum strength and durability properties as specified in ASTM A276.
- B. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.

2.03 CORNER GUARDS

- A. Stainless Steel Corner Guards Surface mounted guards.
 - 1. 90 degree corner guard with 3/16" radius and 2" wings
 - 2. Mounted with construction Adhesive

2.04 FABRICATION

- A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer's instructions.
- B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install the work of this section in strict accordance with the manufacturer's recommendations, using only approved mounting hardware, and locating all components firmly into position, level and plumb.
- B. Temperature at the time of installation must be between 65°-75°F and be maintained for at least 48 hours after the installation.
- C. Where splices occur in horizontal runs, splice aluminum retainer and cover at different locations along the run.

3.04 CLEANING

- A. General: Immediately upon completion of installation, clean covers and accessories in accordance with manufacturer's recommended cleaning method.
- B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Toilet, bath and washroom accessories.

1.02 REFERENCES

- A. ASTM International:

1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
7. ASTM C1036 - Standard Specification for Flat Glass.

1.03 SUBMITTALS

- A. Manufacturer's catalog cuts and data sheets, complete parts list, and installation requirements for each accessory item specified.
- B. Manufacturer's service and parts manual, maintenance data, operating instructions and keys required.

1.04 QUALITY ASSURANCE

- A. Grab bars and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building.
- B. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments

1.05 PRODUCT HANDLING

- A. Deliver materials and products in original containers with seals unbroken and labels intact until time of use. Label shall identify accessory, catalog number, and finish.
- B. Store delivered products in clean, safe, dry area.
- C. Protection: Use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.06 WARRANTY

- A. Mirrors: Furnish manufacturer's 15 year limited warranty against silver spoilage for first quality glass mirrors, which are triple-silvered and electro-copper, plated with baked enamel backing.

1.07 JOB CONDITIONS

- A. Coordinate as required with work of other trades to ensure proper backing.
- B. Sequencing and scheduling: Do not install accessories until after completion of finish painting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Bobrick Washroom Equipment, Inc.
- B. Products by these Alternate Manufacturers must meet function, dimensional criteria, and aesthetic. Provide product by single manufacturer.
 - 1. A&J Washroom Accessories
 - 2. American Specialties, Inc
 - 3. Bradley Corporation

2.02 MATERIALS

- A. Stainless Steel: ASTM A167 Type 304 (18-8); satin finish exposed surfaces unless otherwise specified.
 - 1. Provide corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories.

2. Units shall be neatly and rigidly assembled, uniformly finished, and free from burrs and rough edges.
- B. Design, quality, capacity, and function shall conform to manufacturer's descriptions corresponding to product numbers cited in schedule.
1. Doors shall be mounted to cabinet bodies by heavy duty stainless steel piano hinges.
 2. Recessed cabinets shall have one-piece face trim with no miters or welds and shall return 1/4" to wall.
 3. All doors provided with tumbler locks shall be keyed alike.
- C. Barrier Free Design:
1. Access to paper towels shall be located at 15 inches to 48 inches above finish floor. Hinged panels covering waste receptacle openings shall not require more than 5 pounds of force to open.
 2. Surface mounted accessories shall not be mounted above grab bars.
 3. Buttons and knobs shall be operable with one hand and without tight grasping, pinching, or twisting of the wrist.
 4. Operation of pull knobs shall not require more than 5 pounds of force.
 5. Operation of soap valves when unit has been filled completely, shall not require more than 5 pounds of force. Units located over lavatories or counters must be of design to allow push button mechanism to be located a maximum of 44 inches above the finish floor.
 6. Mirrors shall be of a design that allows the bottom edge of the reflective surface to be mounted no higher than 40 inches above the finish floor.
- D. Keys: Furnish 3 keys for each accessory to Owner

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that internal reinforcement for 300 pound point loading has been installed in areas of wall attached grab bars, hardware and fittings to transfer loading from those accessories to appropriate structural elements of the building.
- B. Verify substrates and blocking for attachment of other wall-mounted accessories are ready for installation of accessories.
- C. Examine areas to receive toilet accessories and verify that:
1. Surfaces are dry, clean, free from foreign matter, and otherwise proper for installation.
 2. Toilet compartments to receive accessories have been properly installed and correctly prepared.

- D. In the event of discrepancy, immediately notify the A/E and do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions. Install plumb, level, and rigidly anchored to substrates.
- B. Install accessories in accordance with applicable regulations for Barrier-Free Design.

3.03 ADJUSTING AND CLEANING

- A. Protect accessories from damage due to construction. Remove protective coverings when no longer required.
- B. Test accessories and adjust for proper operation.
- C. Clean exposed surfaces.

3.04 SCHEDULE

- A. See Drawings

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Fire Extinguishers
- B. Cabinets
- C. Accessories
- D. The extent of portable fire extinguishers, cabinets and brackets are shown on the Drawings.

1.02 REFERENCES

- A. NFPA10-Portable Fire Extinguishers
- B. ASTM E814-83 - Fire rated cabinets fabricated in accordance to measure, restore, perform.
- C. American National Standard ANSI A-117.1 2003
- D. Underwriters Laboratories Inc.:
 - 1. UL - Fire Protection Equipment Directory.

1.03 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements for portable fire extinguishers.
- B. Provide fire extinguishers, cabinets and accessories by a single manufacturer.
- C. Conform to ASTM E814-83 for fire resistive wall performance where necessary.
- D. Conform to ANSI A-117.1 on maximum cabinet projection of 4 inches.

1.04 SUBMITTALS

- A. Submit brochure and product data in compliance with Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. J.L. Industries, Inc., 4450 West 78th Street Circle, Bloomington, MN 55435, (952) 835-6850, Fax: (952) 835-2218
- B. Larsen's Manufacturing Company
- C. Badger Fire Protection
- D. Potter Roemer
- E. Manufacturers of equivalent products submitted and approved in accordance with Section 01 25 00 - Substitution Procedures.

2.02 FIRE EXTINGUISHERS

- A. 10 lb. capacity Multipurpose Dry Chemical Type, UL listing 4A-60B:C.

2.03 FIRE EXTINGUISHER CABINETS

- A. Where indicated on drawings, provide cabinets sized for extinguishers listed above.
 - 1. Door and trim to be fabricated from:
 - a. Clear anodized aluminum.
 - 2. Cabinet Style:
 - a. 3 inch Projected Rolled Edge Semi-Recessed
 - 3. Door Style:
 - a. Narrow Lite
 - 4. Glazing:
 - a. Clear acrylic
 - 5. Lettering:
 - a. Vertical
- B. Provide cabinets with fire-rated option, where shown in fire-rated walls.

2.04 ACCESSORIES

- A. Provide Extinguisher Brackets sized to support extinguisher type where brackets are indicated on the Drawings.
- B. Graphic Identification: provide vertical wall signage to be applied to wall surface above each extinguisher furnished

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim, and to comply with manufacturers instructions.
- B. Install items included in this section in locations and at mounting heights indicated:
 - 1. Install wall brackets, maximum 48 inches from finish floor to top of extinguisher handle
 - 2. Install cabinets plumb and level in wall openings, maximum 48 inches from finished floor to top of extinguisher handle
- C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.
- D. Position cabinet signage as required by authorities having jurisdiction

END OF SECTION 10 44 00

SECTION 11 21 73

COMMERCIAL WASHER/EXTRACTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Washer extractors.

1.02 RELATED SECTIONS

- A. Division 22: Plumbing
- B. Division 26: Electrical

1.03 REFERENCES

- A. UL Certification: Provide electric equipment and components that are evaluated by UL for fire, and electric shock according to applicable safety standards and that are UL certified for compliance and labeled for intended use.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
- C. Shop Drawings: Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.
- D. Operation and Maintenance Data: For laundry equipment to include in emergency, operation, and maintenance manuals. Include a schedule with the following:
 - 1. Designation indicated on Drawings.
 - 2. Manufacturer's name and model number.
 - 3. List of factory-authorized service agencies including their addresses and telephone numbers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store equipment on site protected from weather, direct sunlight and temperature extremes. Do not remove packaging prior to storage.
- B. Consult manufacturer if machines are to be stored for an extended period of time.

1.06 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

- A. Washer Extractor Parts Only: Manufacturer's standard form in which manufacturer agrees to repair or replace any part of the equipment assembly that fails within specified warranty period.
 - 1. Warranty Period: Three years
- B. Washer Extractor Parts Only, Mainframe, Cylinder Shaft Assembly, and Bearings Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace main frame, bearing, cylinder or cylinder shaft assembly that fails within specified warranty period.
 - 1. Warranty Period: Five years

PART 2 PRODUCTS

2.01 MANUFACTURERS/MODELS

- A. Acceptable Manufacturers/Models: As scheduled on the drawings
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. System Startup and Commissioning: Arrange for a local manufacturer's representative to inspect machines prior to startup and operation.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 11 30 00

RESIDENTIAL EQUIPMENT AND APPLIANCES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Kitchen equipment and appliances as scheduled on the drawings.
- B. Installation including connections to utilities.
- C. Related Work
 - 1. Division 06: Custom Casework
 - 2. Division 09: Tiling
 - 3. Division 22: Plumbing
 - 4. Division 23, Mechanical
 - 5. Division 26, Electrical

1.02 SUBMITTALS

- A. Submit manufacturer's installation instructions for each component.
- B. Submit operation and maintenance data.
 - 1. Include data on care of finished surfaces.
- C. Warranty: Include coverage of scheduled equipment, including disconnection of defective unit, and connection of replacement unit.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of DIVISION 1.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. The design is based on products of specific manufacturers as indicated in the Kitchen Equipment Schedule shown on the Drawings with essential coordination and attributes for those products, incorporated into the building design.
- B. Products of other manufacturers may be acceptable when approved by the A/E in accordance with DIVISION 1 of these specifications.

- C. Payment for incidental redesign and coordination services by the A/E and his consultants occasioned by acceptance of substitute products, shall be the sole responsibility of the Contractor at no additional cost to the Owner.

2.02 EQUIPMENT

- A. Refer to schedule shown on the Drawings.
- B. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.
- C. Provide suitable length of wire cord with plugs to match building receptacles.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify ventilation outlets, service connections, and supports are correct and in required location.
- B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Sequence installation to ensure electrical connections are achieved in an orderly and expeditious manner.
 - 1. Coordinate work with others.
- B. Use anchoring devices appropriate for equipment and expected usage.
 - 1. Install items in accordance with manufacturer's instructions.

3.03 ADJUSTING AND CLEANING

- A. Adjust equipment and apparatus to ensure proper working order and conditions.
 - 1. Remove and replace equipment creating noise or vibration.
- B. Remove masking or protective covering from finished surfaces.
- C. Wash and clean equipment.
 - 1. Polish glass, plastic, hardware and accessories, fixtures and fittings.

3.04 KITCHEN EQUIPMENT SCHEDULE

- A. As shown on Drawings.

END OF SECTION

SECTION 12 24 00

WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manually operated, roll-up fabric interior window shades including mounting and operating hardware.

1.02 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry.
- B. Section 07 92 00 – Elastomeric Sealants.
- C. Division 08: Aluminum Storefront and Entrances
- D. Section 09 22 00 – Gypsum Board Assemblies.
- E. Section 09 51 00 – Acoustical Ceilings.

1.03 REFERENCES

- A. NFPA 70 – National Electrical Code.
- B. NFPA 701-99 – Fire Tests for Flame-Resistant Textiles and Films.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 26 – Source Quality Control Reporting:
- B. Product Data: Manufacturer's data sheets on each product specified, including:
 - 1. Preparation instructions and recommendations.
 - 2. Installation and maintenance instructions.
 - 3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
 - 4. Storage and handling requirements and recommendations.
 - 5. Mounting details and installation methods.
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

- E. Selection Samples: For each finish product specified, a complete set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.
- G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
- H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years' experience in manufacturing products comparable to those specified in this section.
- B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.
- C. Mock-Up: Provide a mock-up of one of each type roller shade assembly specified for evaluation of mounting, appearance and accessories.
 - 1. Locate mock-up in window(s) designated by Architect.
 - 2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
- B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.
- C. Label containers and shades according to Window Shade Schedule.
- D. Store products in manufacturer's unopened packaging until ready for installation.

1.07 SEQUENCING

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.08 PROJECT CONDITIONS

- A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.09 WARRANTY

- A. Hardware and Shade Fabric: Manufacturer's standard twenty-five year limited warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425 ; Spiceland, IN 47385-0425; Toll Free Tel: 800-238-7999; Tel: 765-987-7999
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 MANUALLY OPERATED WINDOW SHADES

- A. Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Manual FlexShade XD as manufactured by Draper, Inc. including Single and DUAL Roller Shades (Dual includes 1 Solar and 1 Black-Out Shade on same bracket).
 - 1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
 - a. Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.
 - b. Bead chain loop: Stainless steel bead chain.
 - c. Bead Chain Hold Down: P-Clip.
 - 2. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.
 - a. Minimum Roller Tube Diameter: 1.56 inches (40 mm).
 - b. Fabric Connection to Roller Tube: Spline or Tape attachment, Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
 - c. Fabric Length: 6 inches (152 mm) greater than window height minimum.
 - d. Bottom Slat: 13/16 inch (20.6 mm) aluminum dowel, encased in bottom hem with heat sealed ends.
 - e. Orientation: Regular from back of roller.

3. Mounting:
 - a. Endcaps and headbox.
 4. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
 - a. Endcap covers: To match fascia or headbox color.
 5. Headbox Ceiling/Wall style: Aluminum fabrication with removable closure, endcaps, and back and top cover piece
- B. Spring Roller-Operated FlexShade as manufactured by Draper, Inc.
1. Operation: Spring roller operating mechanism with metal roller containing heavy duty spring with positive locking mechanism permitting shade to be stopped at each half turn of roller. Provide cord clasp and braided cotton cord attached to bottom shade slat. Spring sized by manufacturer to accommodate shade size. Provide roller idler assembly of molded nylon and zinc-plated steel pin.
 2. Mounting:
 - a. Mounting brackets.
 - b. Endcaps and fascia.
 3. Brackets: Plated stamped steel. Provide size compatible with roller size.
 4. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
 - a. Endcap Covers: To match fascia or headbox color.
 5. Fascia: L-shaped aluminum extrusion to conceal shade roller and hardware.
 - a. Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.
 - b. Shape: Square Fascia Panel.
 6. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Minimum roller diameter 1.5 inches. Fabric connected to the roller tube with LSE (low surface energy) double-sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.
 7. Shade Slat:
 - a. Closed pocket elliptical slate: 1 inch (25 mm) aluminum elliptical slat inside of a 1-5/8 inch (41 mm) pocket with heat sealed ends.

2.03 FABRIC

- A. Light-Filtering Fabrics:
1. E Screen with KOOLBLACK Technology 1 percent openness factor by Mermet:
 - a. PVC coated fiberglass yarn woven in 2 by 2 basketweave.
 - b. 0.021 inches thick.
 - c. Weight: 12.95 oz. per square yard.
 - d. GREENGUARD Gold certified as a low emitting fabric.
 - e. Manufactured to supply GREENGUARD Gold certificate.

- f. Fire Rating: NFPA 701, both small- and large-scale tests, California U.S. Title 19.
 - g. Microbial Resistance.
 - h. ASTM E2180 and ASTM G21: Pass.
 - i. Avg. 1 percent open.
 - 2. E Screen with KOOLBLACK Technology 3 percent openness factor by Mermet:
 - a. PVC coated fiberglass yarn woven in 2 by 2 basketweave.
 - b. 0.020 inches thick.
 - c. Weight: 11.3 oz. per square yard.
 - d. GREENGUARD Gold certified as a low emitting fabric.
 - e. Manufactured to supply GREENGUARD Gold certificate.
 - f. Fire Rating: NFPA 701, both small- and large-scale tests, California U.S. Title 19.
 - g. Microbial Resistance.
 - h. ASTM E2180 and ASTM G21: Pass.
 - i. Avg. 3 percent open.
 - 3. E Screen with KOOLBLACK Technology 5 percent openness factor by Mermet:
 - a. PVC coated fiberglass yarn woven in 2 by 2 basketweave.
 - b. 0.019 inches thick.
 - c. Weight: 10.6 oz. per square yard.
 - d. GREENGUARD Gold certified as a low emitting fabric.
 - e. Manufactured to supply GREENGUARD Gold certificate.
 - f. Fire Rating: NFPA 701, both small- and large-scale tests, California U.S. Title 19.
 - g. Microbial Resistance.
 - h. ASTM E2180 and ASTM G21: Pass.
 - i. Avg. 5 percent open.
- B. Room Darkening Fabrics:
- 1. SunBloc Series SB9100:
 - a. Close-woven fiberglass base textile with sun-resistant vinyl film bonded to each side.
 - b. Opaque with minimum tensile strength of 190 pounds for warp and 180 pounds for fill.
 - c. Fire Rating: NFPA 701 1006-Test 1.
 - d. Washable and stain resistant.
 - e. Weight: 12 oz./sq. yd.
 - f. White exterior in all colors.
 - g. 0.013 inches thick.
 - 2. Avila Twilight by Mermet:
 - a. 37.5 percent Polyester and 62.5 percent acrylic with foam backing.
 - b. Duraguard fabric protector and Sanitized Antimicrobial Protection.
 - c. Plain weave that is 100% PVC free.
 - d. Fire Classifications: NFPA 701-04 TM#1, California U.S. Title 19.

- e. Duraguard Stain Resistant, Sanitized Mold and Mildew Resistant, GREENGUARD, GREENGUARD Gold.
- f. Approximate Openness Factor: 0 percent.
- g. Average Fabric Thickness: 0.020 inches.
- h. Average Fabric Weight: 14.5 ounces per square yard Gold.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.
- C. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
 - 1. Endcaps.

3.04 TESTING AND DEMONSTRATION

- A. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.
 - 1. Chain and clutch.
- B. Demonstrate operation of shades to Owner's designated representatives.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 SCHEDULES

- A. Refer to Drawings for shade types and locations.

END OF SECTION

SECTION 21 13 00

FIRE SUPPRESSION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Design and install a centrally monitored Automatic Wet Fire Suppression System with fire pump, sprinkler heads, controls, fire department connection, inspector's test connection, drain connections, zone flow switches, tamper switches, valves, fittings, pipes and all other necessary accessories required for a complete and properly operating system for sleeping areas only.
 - 1. Conform to the applicable requirements of the building and backflow prevention codes of the State of New Mexico, Rio Arriba County, and applicable provisions of NFPA 13R STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS IN LOW RISE RESIDENTIAL OCCUPANCIES, NFPA 24 STANDARD FOR INSTALLATION OF PRIVATE SERVICE MAINS AND THEIR APPURTENANCES, and INTERNATIONAL FIRE CODE CHAPTER 9. Where these specifications exceed standards of above listed codes, these specifications shall be followed.
 - 2. Design shall be by a Fire Protection Engineer or as permitted by the Authority having jurisdiction.
 - 3. Design must bear the stamp of the registered professional who designs the system.
- B. Provide labor, materials, equipment, tools and services for the installation of the complete, properly working system meeting the requirements of the New Mexico
- C. Commercial Building Code and Regulatory Agency having Jurisdiction (AHJ).
 - 1. Acquire Permits.
 - 2. Acquire fire flow test data.
 - 3. Connect to the water main and extend pipe to the building.
 - 4. Provide and install required backflow protection with relief drain to the outdoors.
 - 5. Integration and coordination with Fire Alarm as applicable.
 - 6. System components shall be standard product of the latest design of the manufacturer.
- D. Provide Design, Shop Drawings, Project Record Drawings (as-built), equipment, fabrication, labor, transportation, and supervision necessary to install, flush, test, and place into service a complete hydraulically designed automatic wet-pipe sprinkler system. THE SCOPE IS TO SPRINKLER THE SLEEP AREAS ONLY AS APPROVED BY LOCAL FIRE MARSHAL.

1.02 QUALITY ASSURANCE

- A. Designer shall become fully aware of the building design and areas requiring fire protection. Failure to not be knowledgeable of the building will not be cause for additional charges.
- B. Fire protection systems specified herein shall be installed by contractor duly licensed and regularly engaged in the installation of automatic sprinkler equipment as listed by Underwriters Laboratories, Inc., or other nationally recognized testing laboratories.
- C. The Subcontractor is responsible for performing hydraulic calculations for the sprinkler system in accordance with NFPA 13R that account for all flow and pressure requirements to the location of the flow test hydrant that was used to determine the static and residual pressures. The Subcontractor is also responsible for determining the location and elevation of the static and residual test gauge relative to the riser reference point and providing this information on the sprinkler design plans in accordance with NFPA 13R.

1.03 COORDINATION

- A. Service Connection - Water Service: If not providing the fire line and its connection to water service main, coordinate provision of this line with General Contractor. Incoming fire service line shall include backflow prevention, post indicator valve and detection devices as required by applicable state, local building codes and NM Public Regulations Commission regulations. Note: Reduced Pressure Backflow preventor shall be located indoors.
- B. Integrate this system with Fire Alarm System, in order to establish exact requirements and location of items provided under this section which require connections to the fire alarm system.
 - 1. Furnish and install equipment necessary to accomplish the required water-flow alarm. Water-flow detection devices shall consist of approved water-flow indicators.
 - 2. Integrate water-flow indicators tamper switches and other required sprinkler system alarm functions into the building fire alarm system.
 - 3. Coordinate electrical connections from devices and components including water-flow indicators, tamper switches, etc., provided under this section with the building fire alarm system.
- C. Provide and Install a fire pump and control system to boost pressure as required to sprinkler requirements.

1.04 SUBMITTALS

- A. Refer to Sections 01 33 00 for general submittal requirements.
- B. Shop Drawings:
 - 1. Submit Shop Drawings of the complete fire protection system to the AHJ.

2. After approval by the AHJ submit to the A/E for coordination.
3. No construction work shall begin or equipment purchased without the written approval of the AHJ and the A/E of record.
4. Prepare Shop Drawings to comply with requirements of the Fire Protection Drawings Submittal Guidelines.
 - a. A base sheet with the title block and building floor plan will be supplied to the fire protection contractor upon request. The Drawing file will be a product of AutoCAD latest release.
5. Follow NFPA 13 Chapter 6 and IFC Chapter 9. Provide description of all equipment and materials to be furnished including performance, quality, dimensions and certifications of approving agencies.
6. Prepare complete Drawings of the system including plot plan showing location and arrangement of water supply connection, control valve, fire department connections, on-site fire main routing, fire hydrants and other equipment to be used; including head layouts coordinated with lighting, plumbing and air conditioning system.

C. Calculations:

1. Base hydraulic calculations on worst condition of available water pressure. Address summer pressure drop in water mains in time of high irrigation. In case of double water source (such as on site storage tank), use the lowest available pressure for calculating base.
2. Within hydraulic calculations, show minimum of 10% extra pressure for unexpected job site modifications of the system. This requirement is in addition to “worst available” water pressure as described in paragraph above.
3. Base hydraulic calculations on area/density method. Use room design method or pipe schedule sizing only if specifically approved by the AHJ.
4. The velocity shall not exceed 20 feet per second throughout the system.
5. Provide and Install Seismic protection for automatic sprinkler systems. Seismic category D if required by NPFA 13R.

1.05 WARRANTY

- A. Furnish five-year manufacturer warranty for products and one year for labor.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials and equipment used in the installation of the sprinkler system shall be new and listed by the UL Fire Protection Equipment Directory or the FM Approval Guide, latest edition. The standard products and the latest design of the manufacturer shall be used and installed per their listing, approval, or manufacturer recommendations. All products listed or approved by prior editions of the UL Directory or FM Approval Guide will not be acceptable if not listed or approved in the most recent edition of the Directory or Approval Guide.

- B. Where two (2) or more units of the same class of equipment are required, these units shall be products of the same manufacturer (e.g., couplings shall be from one manufacturer.) All materials shall be installed per their listing or approval and per the manufacturer's recommendations and specifications.

2.02 PIPING

- A. Incoming Fire line: PVC pressure pipe and fittings for water meeting AWWA C900.
- B. Underground inside of building at building entrance: Class 200 ductile iron with mechanical-restricted joints and thrust block. Interior of pipe and fittings shall be cement lined in accordance with AWWA C104 with exterior bituminous coating.
- C. Building Interior Piping System: Pipe for installation above ground shall conform to the requirements of NFPA 13R. Pipe shall be listed by UL and be FM approved, installed per its listing and approval, and meet the following requirements:
 - 1. Unless otherwise specified, the minimum steel pipe wall thickness shall be Schedule 10 for pipe sizes 2½ inches or larger. Pipe sizes smaller than 2½ inches shall be Schedule 40. Threaded or cut groove steel pipe shall be Schedule 40 for sizes less than 8 inches and a minimum of Schedule 30 in sizes 8 inches and larger for pressures up to 300 psi.
 - 2. Mechanical rolled groove pipe or welded pipe shall be a minimum of Schedule 10 for sizes 2½ inches up to 5 inches, 0.134-inch wall thickness for 6 inches, and 0.188-inch wall thickness for 8- and 10-inch pipe for pressures up to 300psi).
 - 3. Steel pipe installed for the water motor alarm line, piping from drain line valves and inspector's test valves, dry-pipe and pre-action sprinkler system piping, and where pipe is exposed to outdoor weather, etc., shall be internally and externally galvanized. Galvanized fittings are required where galvanized piping is used. Any piping leading to a pressure-operated water flow indication device shall also be galvanized. The starting point is on the alarm connection to the alarm check valve.
- D. Pipe Fittings: Pipe fittings for installation above ground shall conform to the requirements of NFPA 13R and shall be FM approved or UL listed.
 - 1. Mechanical groove couplings are required on all 4-inch and larger pipe.
 - 2. Plain-end pipe couplings shall not be used in any new installation.
 - 3. Galvanized pipe fittings shall be installed where galvanized piping is specified and shall be minimum Schedule 10 for pipe sizes 2½ inches or larger. Pipe sizes smaller than 2½ inches shall be Schedule 40 standard wall pipe thickness. Welded outlets shall be UL listed or FM approved, affixed with the UL or FM identification stamps, and pressure rated for 300-PSI maximum.
 - 4. Adjustable, two-piece drop nipples shall not be used. All drop nipples shall be one-piece, non-adjustable units with a minimum 1-inch diameter.

2.03 SPRINKLER HEADS

- A. Provide sprinklers in accordance with NFPA Standard 13R. Rooms with suspended ceilings shall be protected with chrome plated pendent sprinklers and two piece semi-recessed chrome-plated escutcheon plates.
- B. Areas without ceilings shall be protected with brass upright sprinkler heads. In the event that conditions prohibit upright heads, brass pendant heads may be installed provided they shall be equipped with guard cages.

2.04 PIPE HANGERS, SUPPORTS, AND SEISMIC BRACING

- A. Pipe hangers and hanger assemblies shall be UL listed or FM approved.
- B. C-clamps and beam clamps shall have lock nuts and retaining straps, or clips, and pipe rings shall be of the solid-band adjustable swivel type.
- C. Provide rod ceiling plates at finished ceilings for coach screw rods, expansion shields, and toggle hangers.
- D. All seismic bracing devices and flexible couplings shall be specifically UL listed or FM approved and installed per their listing or approval.
- E. When fastening hangers to purlins, bolt-through fastening methods shall be used. Beam clamps with restraining straps shall not be used in any circumstance.
- F. All seismic brace members shall be continuous. Under no circumstances shall members be spliced or off-set.
- G. Tension-only seismic bracing systems shall meet the following:
 - 1. The tension-only system shall be UL listed or FM approved for seismic service, and installed in accordance with listing limitations and installation instructions.
 - 2. A means to prevent vertical motion due to seismic forces shall be installed at the brace location.
 - 3. Two (2) tension-only braces shall be installed in opposing directions at each brace location.

2.05 FIRE PROTECTION VALVES

- A. Check valves in sprinkler system shall be UL listed or FM approved, have hand hole covers to provide adequate access to facilitate inspection and repair without the removal of the valve from the system, and shall be listed for installation in the vertical or horizontal position.
 - 1. All check valves shall have a working water pressure of 250 PSI.

- B. Alarm check valves (wet-pipe, dry-pipe, deluge, pre-action, etc.) shall be provided on all sprinkler risers and have the following:
1. The alarm check valve (ACV) shall be equipped with a removable hand hole cover assembly, and shall be listed for installation in the vertical or horizontal position.
 2. The ACV shall be equipped with gauge connections on the system side and supply side of the valve clapper.
 3. ACV trim piping and fittings shall be internally and externally galvanized.
 4. Ported alarm connections on the ACV shall be to a retard chamber to absorb variable pressure surges.
 5. Only "Flange x Flange" ACV devices shall be installed.
 6. Wet-pipe systems shall use a variable-pressure alarm check valve. Plain-type check valves are not allowed. The sprinkler alarm valve shall be equipped with an external bypass to eliminate false water flow alarms.
 7. Dry-pipe valves shall be a positive latching clapper, differential type dry valve, and air pressure to water pressure area differential shall be approximately 5 to 1.
 8. Deluge valves shall be externally re-settable by hydraulic means, and shall employ a positive vent on the priming line to ensure that the deluge valve will not prematurely reset.
- C. Backflow prevention devices shall be installed on all sprinkler systems.
1. A reduced pressure backflow prevention assembly (RPBFP) shall be installed to prevent cross-connection contamination between potable water systems and any fire sprinkler system, at the service connection for the fire sprinkler system. Ensure relief drain is piped to outdoors when located inside building.
- D. Post Indicator Valves shall be UL/FM adjustable indicator posts. MFG: Mueller Co. with supervisory switch.

2.06 SUPERVISORY DEVICES

- A. Supervisory devices shall be compatible with the site fire alarm system.

2.07 FIRE DEPARTMENT CONNECTIONS

- A. Fire department connections shall have a minimum of two (2) 2½-inch inlets with National Standard Hose (NSH) threads, internal double clapper check valve, brass plugs, and attached chains.
- B. Fire department connections shall be installed at each new alarm check valve, dry-pipe valve, deluge, and pre-action valve and standpipe, unless the sprinkler system is supplied by a fire department connection in the yard main, or as otherwise noted in NFPA 13R.
- C. The completed installations shall include a metal sign or escutcheon plate, with raised lettering, marked "FIRE DEPARTMENT CONNECTION STANDPIPE-AUTO. SPKR," "AUTOMATIC SPKR," or "STANDPIPE," as appropriate.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install a fire-protection water supply main complete with connection to existing water supply main. Trenching and backfill shall be as defined in 31 23 33 specifications. No installation will be permitted prior to approval of complete Shop Drawings.

3.02 CONSTRUCTION

- A. Take the following fire precautions during the construction of the building prior to the sprinkler system being in operation:
 - 1. Follow general good housekeeping procedures so that accumulations of debris and rubbish will not become a hazard.
 - 2. Supervise temporary heating equipment and open flame devices.
 - 3. Control smoking and permit only in specified areas.

3.03 COORDINATION WITH OTHER TRADES

- A. Carefully lay-out piping and sprinklers to avoid air conditioning equipment, ducts, lights and structure. Offset drops as required for coordination.

3.04 TESTS

- A. Upon completion and prior to the acceptance of the installation, test the system as required by NFPA Pamphlet No. I 3A, and furnish the Owner with a certificate.

3.05 STERILIZATION

- A. Flush and sterilize new lines with chlorine before acceptance for service.
 - 1. Use calcium hypochlorite powder, containing not less than 70% available chlorine for sterilization.
 - 2. Apply an amount of chlorine to provide a dosage of 40- 60 PPM for at least twenty-four hours.
 - a. At the conclusion of the twenty-four hour contact time, CL2 residual should be at least 20 PPM.
 - b. The chlorinating material shall be mixed with treated water in an acceptable container and injected directly into the system, the process being repeated until the system is filled.
 - c. Valves in the system shall be opened and closed three times during the procedure to insure that the sterilizing mixture is thoroughly and evenly distributed throughout the system.

3.06 FINAL FLUSHING

- A. After the application retention period, the heavily chlorinated water in the new system shall be flushed until the chlorine concentration is not higher than that of the source.

3.07 AS-BUILTS

- A. Furnish “As-Built” Drawings on reproducible mylar and CAD Drawings on a compact disk. The Drawing shall be produced utilizing AutoCAD “dwg” file format.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Hanger rods.
 - 3. Inserts.
 - 4. Flashing.
 - 5. Sleeves.
 - 6. Mechanical sleeve seals.
 - 7. Firestopping relating to HVAC Work.
 - 8. Firestopping accessories.
 - 9. Formed steel channel.
 - 10. Equipment bases and supports.

1.02 SYSTEM DESCRIPTION

- A. Firestopping Materials: To achieve fire ratings as noted on Architectural Drawings for adjacent construction, but not less than 1 hour fire rating.
- B. Firestop interruptions to fire rated assemblies, materials, and components.

1.03 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to FM or UL for fire resistance ratings and surface burning characteristics.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Hangers and Supports: Manufacturer's catalog data.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with three (3) years' experience.

- B. Installer: Company specializing in performing Work of this Section with three (3) years' experience.
- C. Perform Work according to AWS D1.1 for welding hanger and support attachments to building structure.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and for minimum three (3) days after installation of firestopping materials.
- C. Provide ventilation in areas to receive solvent-cured materials.

1.07 WARRANTY

- A. Furnish one-year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Plumbing Piping – Sanitary Sewer, Vent or Roof Drain:
 1. Conform to MSS SP-58; material and design of pipe supports, MSS SP-69: selection and application of pipe supports, and MSS SP-89: fabrication and installation of pipe supports.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 7. Vertical Support: Steel riser clamp.
 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
- B. Plumbing Piping – Domestic Water, Non Potable Water, Condensate:
 1. Conform to MSS SP-58; material and design of pipe supports, MSS SP-69: selection and application of pipe supports, and MSS SP-89: fabrication and installation of pipe supports.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.03 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
 1. Waterproofing: 5 lb./sq. ft sheet lead.
 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.05 SLEEVES

- A. Sleeves for Pipes Through Non-Fire-Rated Floors or Fire Rated Floors: 24 gage minimum thick galvanized steel. Sleeves can also be Schedule 40 galvanized steel pipe-ASTM A53-Type E grade A, or cast iron ASTM A74.
- B. Sleeves for Pipes Through Non-Fire Rated or Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 24 gage galvanized steel minimum. Sleeves can also be Schedule 40 galvanized steel pipe-ASTM A53-Type E grade A, or cast iron ASTM A74.
- C. Sealant: Acrylic.

2.06 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.07 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel, with holes 1-1/2 inches on center.

2.08 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Hilti Corp.
 - 3. 3M fire Protection Products.

2.09 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Mineral fiber matting.
 - 3. Sheet metal.
 - 4. Plywood or particle board.
 - 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

- D. General:
 - 1. Furnish UL-listed products.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
 - 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Obtain permission from Engineer before using powder-actuated anchors.
- D. Do not drill or cut structural members.

3.02 INSTALLATION

- A. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- B. Install according to MSS SP-89: Fabrication and installation of pipe supports; support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.

- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper-plated hangers and supports for copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00 – Painting and Coating. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 – Plumbing Insulation.
- N. Equipment Bases and Supports:
 - 1. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.
 - 2. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
 - 3. Construct supports of steel members, formed steel channels, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
 - 4. Provide rigid anchors for pipes after vibration isolation components are installed.
- O. Flashing:
 - 1. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
 - 2. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
 - 3. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
 - 4. Seal drains watertight to adjacent materials.
 - 5. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.
- P. Sleeves:
 - 1. Exterior watertight entries: Seal with mechanical sleeve seals.
 - 2. Set sleeves in position in forms. Provide reinforcing around sleeves.

3. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
 4. Extend sleeves through floors 1 inch finished floor level; caulk sleeves.
- Q. Pipe penetrations thru fire/smoke rated assemblies shall be fire caulked air tight to adjacent structure by means of a UL or FM approved fire proof caulking material conforming to the construction type, penetration type, annular space requirements and fire rating.
- R. Pipe penetrations thru non fire rated assemblies shall be fire caulked air tight by mean of approved caulking material. Provide joint sealers, joint filler and other related materials that are compatible under conditions of application. Provide color of exposed joint sealers to closely match finish color of adjacent surfaces.
- S. Firestopping:
1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.
 2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
 3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
 4. Fire-Rated Surface:
 - 1) Seal openings
 - 2) Install firestopping product in accordance with manufacturer's instructions.
- T. Install chrome-plated steel escutcheons at finished surfaces.

3.03 SCHEDULES

A. Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	HANGER ROD DIAMETER (inches)
*Cast Iron (All Sizes)	5	5/8
*Cast Iron (All Sizes) with 10-foot length of pipe	10	5/8
Copper Tube, 1-1/2 inches and smaller	6	3/8
Copper Tube, 2 inches and larger	10	3/8 up to 2" 1/2 2" through 3" 5/8 4" through 5"
PVC (All Sizes)	4	3/8 up to 4" 1/2 5" through 8" 5/8 10" through 12"
Steel, 1/2 inches and smaller	6	3/8
Steel, 3/4 inches through 1 inch	8	3/8

PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	HANGER ROD DIAMETER (inches)	
Steel, 1-1/4 inches and larger	10	1/2 5/8 3/4	2-1/2" to 3" 4" through 5" 6"
*Note for Cast Iron Pipe: Provide hanger within 18" of joint. Also provide hanger at each change of direction and each branch connection. Allow for expansion every 30 feet for plastic pipe, and support pipe at each horizontal branch connection.			

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Pipe markers.
 - 3. Ceiling tacks.
 - 4. Labels.

1.02 SUBMITTALS

- A. Product Data: Manufacturer's catalog literature for each product required.

1.03 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with three (3) years' experience.
- B. Installer: Company specializing in performing Work of this Section with three (3) years' experience.

PART 2 PRODUCTS

2.01 NAMEPLATES

- A. Product Description: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

2.02 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

- C. Plastic Tape Pipe Markers:
 - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Pipe Markers:
 - 1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.03 CEILING TACKS

- A. Description: Steel with 3/4-inch diameter color-coded head.
- B. Color code as follows:
 - 1. Plumbing valves: Green.

2.04 LABELS

- A. Description: Aluminum size 1.9 x 0.75 inches adhesive backed with printed identification and bar code.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces according to Section 09 90 00 – Painting and Coating.

3.02 INSTALLATION

- A. Apply painting according to Section 09 90 00 – Painting and Coating.
- B. Install identifying devices after completion of coverings and painting.
- C. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify water heaters, pumps, tanks, and water treatment devices with nameplates. Identify in-line pumps and other small devices with nameplates.
- G. Identify control panels and major control components outside panels with nameplates.

- H. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.
- J. Each outlet on the non-potable water line that is used for special purposes shall be posted with black uppercase lettering as follows: "CAUTION: NON-POTABLE WATER, DO NOT DRINK."

3.03 SCHEDULES

- A. Domestic Cold Water, Domestic Hot Water, Condensate Drain, Storm Drain, Sanitary Sewer, and Vent:

Pipe Size (inches)	Background Color	Lettering Color	Length Color Field (inches)	Letter Height (inches)
0.75 – 1.25	Green	White	8	0.5
1.5 – 2	Green	White	8	0.75
2.5 – 6	Green	White	12	1.25
8 – 10	Green	White	24	2.5
Over 10	Green	White	32	3.5

- B. Non-Potable Water:

Pipe Size (inches)	Background Color	Lettering Color	Length Color Field (inches)	Letter Height (inches)
0.75 – 1.25	Yellow	Black	8	0.5
1.5 – 2	Yellow	Black	8	0.75
2.5 – 6	Yellow	Black	12	1.25
8 – 10	Yellow	Black	24	2.5
Over 10	Yellow	Black	32	3.5
<u>Note:</u> Label Piping: "CAUTION: NON-POTABLE WATER, DO NOT DRINK."				

C. Natural Gas, Liquid Propane Gas:

Pipe Size (inches)	Background Color	Lettering Color	Length Color Field (inches)	Letter Height (inches)
0.75 – 1.25	Yellow	Black	8	0.5
1.5 – 2	Yellow	Black	8	0.75
2.5 – 6	Yellow	Black	12	1.25
8 – 10	Yellow	Black	24	2.5
Over 10	Yellow	Black	32	3.5

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets, and accessories.
2. Plumbing equipment insulation, jackets, and accessories.

1.02 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service, and location.

1.03 QUALITY ASSURANCE

- A. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- B. Factory-fabricated fitting covers manufactured in accordance with ASTM C450.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.06 WARRANTY

- A. Furnish one year manufacturer warranty for man-made fiber.

PART 2 PRODUCTS

2.01 PIPE INSULATION

- A. Type P-1: ASTM C547, molded glass fiber pipe insulation.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 850 degrees F.
 - 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.
 - 5. Valves and Fitting Covers: Pre-molded PVC covers with fiber glass insert.
Manufacturers: Proto Corp., Ceelco.

2.02 PIPE INSULATION JACKETS

- A. PVC Plastic Pipe Jacket:
 - 1. Product Description: ASTM D1785, One piece molded type fitting covers and sheet material, off-white color.
 - 2. Thickness: 0.020 inch for insulation outside diameter up to 18 inches and 0.030 inch for insulation outside diameters above 18 inches.
 - 3. Connections: Brush on welding adhesive.
 - 4. Standard PVC Fitting Covers: Factory-fabricated fitting cover system consisting of one-piece, pre-molded PVC covers with fiberglass inserts manufactured from 20-mils thick, high-impact, ultraviolet (UV)-resistant PVC.
- B. Aluminum Pipe Jacket:
 - 1. ASTM B209
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide, 0.010 inch thick stainless steel.

2.03 PROTECTION SADDLES AND SHIELDS

- A. Provide factory engineered galvanized steel hanger shields on horizontal insulated pipe complying with MSS SP-58 and MSS SP-59 standards for gauge and length of saddle.
- B. Saddles (Piping/tubing up to 2 inches):
 - 1. Use 180 degree saddle on systems utilizing teardrop type hangers.
 - 2. Use 360 degree saddle on systems utilizing trapeze hangers or clamps.

- C. Inserts and Shields (Piping/tubing over 2 inches):
 - 1. Use 360 degree calcium silicate insert with a 180 degree shield on systems utilizing clevis or teardrop type hangers.
 - 2. Use 360 degree calcium silicate with a 360 degree shield on systems utilizing trapeze hangers or clamps.
 - 3. The unit shall have an integral moisture barrier consisting of a tri-laminate All-Service Jacket equal and similar to the jacketing on the adjoining insulation.
 - 4. Insert: Calcium silicate, minimum density 9 pounds/cubic foot.

2.04 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.
- D. Adhesives: Compatible with insulation.

2.05 EQUIPMENT INSULATION

- A. TYPE E-1: ASTM C553; glass fiber, flexible or semi-rigid, noncombustible.
 - 1. Thermal Conductivity: 0.24 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 450 degrees F.
 - 3. Density: 1.5 pound per cubic foot.
- B. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory-applied reinforced aluminum foil jacket.
 - 1. Thermal Conductivity: 0.24 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 450 degrees F.
 - 3. Density: 3.0 pound per cubic foot.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.06 EQUIPMENT INSULATION JACKETS

- A. PVC Plastic Equipment Jacket:
 - 1. Product Description: ASTM D1785, sheet material, off-white color.
 - 2. Minimum Service Temperature: -40 degrees F.
 - 3. Maximum Service Temperature: 150 degrees F.
 - 4. Water Vapor Transmission: ASTM E96/E96M; 0.002 perm-inches.
 - 5. Thickness: 20 mil.
 - 6. Connections: Brush-on welding adhesive.

- B. Aluminum Equipment Jacket:
 - 1. ASTM B209
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

2.07 EQUIPMENT INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify piping and equipment has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION – PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
 - 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Glass Fiber Board Insulation:

1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Hot Piping Systems Less Than 140 Degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

F. Insulation Terminating Points:

1. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces less than 10 feet above finished floor: Finish with PVC jacket and fitting covers or aluminum jacket.

I. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

J. Prepare pipe insulation for finish painting. Refer to Section 09 90 00 – Painting and Coating.

3.03 INSTALLATION – EQUIPMENT

A. Factory-Insulated Equipment: Do not insulate.

- B. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor-retarder cement.
- D. Equipment Containing Fluids Below Ambient Temperature:
 - 1. Insulate entire equipment surfaces.
 - 2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
 - 3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 - 4. Finish insulation at supports, protrusions, and interruptions.
- E. Equipment Containing Fluids 140 Degrees F or Less:
 - 1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
 - 2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
 - 3. Finish insulation at supports, protrusions, and interruptions.
- F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket.
- G. Equipment Located Exterior to Building: Install vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.
- H. Cover insulation with aluminum jacket.
- I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.
- J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- K. Prepare equipment insulation for finish painting. Refer to Section 09 90 00 – Painting and Coating.

3.04 SCHEDULES

A. Water Supply Services Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS (inches)
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller	1.0
		1-1/2 inches and larger	1.0
Domestic Cold Water	P-1	1-1/4 inches and smaller	1.0
		1-1/2 inches and larger	1.0
Non-Potable Water	P-1	All sizes	1.0

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS (inches)
Storm Piping (Horizontal above ground within building)	P-1	All sizes	1.0
Storm Piping (Horizontal and vertical above ground within building when PVC pipe is used)	P-1	All sizes	1.0
Sanitary Sewer Piping (Horizontal and vertical above ground within building when PVC piping is used)	P-1	All sizes	1.0

C. Equipment Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	INSULATION THICKNESS (inches)
Roof Drain Bodies	E-2	1.0
Domestic Hot Water Storage Tanks (if not already factory insulated)	E-1 or E-2	1.0

END OF SECTION

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Domestic water, non-potable water and pressure drain piping, buried within building to a point 5 feet outside the building.
2. Domestic water, non-potable water and pressure drain piping, above grade within building.
3. Equipment Drains or Condensate Drains
4. Unions and flanges.
5. Gate Valves.
6. Ball Valves.
7. Check Valves.
8. Pipe hangers and supports.
9. Strainers.
10. Recessed valve box.
11. Underground pipe markers.
12. Bedding and cover materials.

1.02 SUBMITTALS

A. Product Data:

1. Piping: Materials, fittings, and accessories. Manufacturer's catalog information.
2. Valves: Manufacturers catalog information with valve data and ratings for each service.

1.03 QUALITY ASSURANCE

- A. For drinking water service, provide pipe, tube and fittings complying with NSF 61.
- B. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience and with service facilities within 500 miles of Project.
- C. Installer: Company specializing in performing Work of this Section with three years' experience.
- D. Plumbing for potable domestic water systems must be lead free per Public Law 99-339, Safe Drinking Water Act. Lead free is defined as no more than 0.2 percent lead in solder and solder flux, and no more than 8 percent lead in pipe and fittings.

1.04 WARRANTY

- A. Furnish one-year manufacturer warranty for items listed in Part 2 Products and as scheduled on Drawings.

PART 2 PRODUCTS

2.01 DOMESTIC WATER, NON-POTABLE WATER, AND PRESSURE DRAIN PIPING, BURIED WITHIN BUILDING TO A POINT 5 FEET OUTSIDE THE BUILDING

- A. Copper Tubing: ASTM B88, Type K annealed.
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.
 - 3. Protective pipe covering must be factory- or field-applied according to manufacturer's written instructions.
 - a. 2½ Inches and Larger: Products must be Polyken® No. 1027 primer and Polyken No. 930-35 tape coating, 35 mil, 21kV dielectric strength, as manufactured by Tyco adhesives, Corrosion Protection Group. Minimum one-inch overlap required.
 - b. 2 Inches and Smaller: Products must be 27 MIL plastic sleeve-protector. LSP® Products Group, Plasti-Sleeve or equivalent.

2.02 DOMESTIC WATER, NON-POTABLE AND PRESSURE DRAIN PIPING, ABOVE GRADE WITHIN BUILDING

- A. Copper Tubing: ASTM B88 Type L drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: Alloy Grade Sn95 tin-silver, lead-free solder.

2.03 EQUIPMENT DRAINS OR CONDENSATE DRAINS

- A. Copper Tubing: ASTM B88 Type L drawn.
 - 1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead-free solder.
- B. DWV copper pipe
 - 1. DWV wrought copper fittings in compliance with ANSI B16.29.
 - 2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead-free solder.

2.04 UNIONS, FLANGES AND REDUCERS

- A. Unions for Pipe 2 inches and Smaller:
 - 1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with soldered joints.
 3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
 4. Dielectric Connections: Use Brass fittings, valves or unions to join dissimilar metals.
 5. PVC Piping: PVC.
 6. CPVC Piping: CPVC.
- B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 2. Copper Piping: Class 150, slip-on bronze flanges.
 3. PVC Piping: PVC flanges.
 4. CPVC Piping: CPVC flanges.
 5. Gaskets: 1/16 inch thick preformed neoprene gaskets.
- C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.
- D. Reducers: Reduction in pipe sizes must be made with one piece reducing fittings. Forged bushings reducing at least two pipe sizes will not be acceptable only when there is no room for manufactured reducing couplings or swaged nipples. Cast bushings are not acceptable.

2.05 GATE VALVES

- A. 2 Inches and Smaller: Class 125, solder or threaded ends, bronze body, rising stem, screwed bonnet, and solid wedge. NIBCO S-111 or NIBCO T-111 or equivalent.
- B. 2½ Inches and Larger: Class 125, flanged ends, outside stem and yoke, iron body, bronze trim, rising stem, and solid wedge. NIBCO F-617-0 or equivalent.

2.06 BALL VALVES

- A. 2 Inches and Smaller: Bronze body, blow-out proof captive stem, double Teflon seats, full ported, stainless steel or chrome plated brass ball, two-piece, threaded or soldered ends. NIBCO T-585-70 or S-585-70, or a three-piece bronze body, full port, stainless steel trim, with a blowout-proof stem. NIBCO T or S-595-Y or equivalent.
- B. 2½ Inches to 3 Inches: Two or three-piece bronze body, blow-out proof captive stainless steel stem, double Teflon seals and seats, full ported, stainless steel or chrome plated brass ball and threaded ends. NIBCO T-585-70-66 or NIBCO T-585-Y.
- C. 4 Inches and Larger: Class 150, flanged ends, carbon steel body with 316 stainless steel trim, unibody design, full ported, blow-out proof captive stainless steel stem and ball, and seat. NIBCO F-510-CS-R-66-FS.

2.07 CHECK VALVES

- A. 2 Inches and Smaller: Class 125, threaded ends, bronze body, Y pattern, renewable seat and disk, Buna-N seat disc, and screw cap. Body and Cap conforming to ASTM B62. Valves shall comply with MSS SP-80. NIBCO T-413-W or equivalent.
- B. 2½ Inches and Larger: Class 125, iron body, silent check, flanged ends, globe style, spring actuated, renewable seats and disc, bronze trim or 316 stainless steel trim. Body Conforming to ASTM A126. Valves shall comply with MSS SP-125. NIBCO F-910-W or equivalent.
- C. Vertical Check: 2 Inches and Smaller: Class 125, threaded ends, bronze body, spring actuated, inline vertical lift type, TFE seat ring. NIBCO T-480-Y or equivalent.

2.08 PIPE HANGERS AND SUPPORTS

- A. See Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

2.09 STRAINERS

- A. 2 Inches and Smaller: Threaded ends, cast bronze body with screwed cap, and 20-mesh 304 stainless steel screen for water service. Watts series 777S.
- B. 2½ Inches and Larger: Flanged ends, cast iron body and bolted cap, 20-mesh stainless steel screen for water service. Watts series 77-DI-125.

2.10 RECESSED VALVE BOX

- A. Washing Machine: Plastic preformed rough-in box with brass valves with single-lever handle, socket for 2-inch waste, slip-in finishing cover.
- B. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle slip in finishing cover.

2.11 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.12 BEDDING AND COVER MATERIALS

- A. See specifications 31 23 33.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Prepare piping connections to equipment with flanges or unions.
- C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION

- A. Meters:
 - 1. Coordinate with local utility and conform to their requirements.
- B. Hangers and Supports:
 - 1. Install hangers and supports according to Section 22 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- C. Buried Piping Systems:
 - 1. Verify connection to existing piping system size, location, and inverts.
 - 2. Establish elevations of buried piping with not less than one (1) foot of cover.
 - 3. Establish minimum separation of sanitary sewer piping according to Uniform Plumbing Code.
 - 4. Excavate pipe trench according to Section 31 23 33.
 - 5. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
 - 6. Install pipe on prepared bedding.
 - 7. Route pipe in straight line.
 - 8. Install pipe to allow for expansion and contraction without stressing pipe or joints.
 - 9. Install shutoff valves at locations indicated on Drawings according to this Section.
 - 10. Install plastic ribbon tape continuous buried 6 inches below finish grade, above pipe line; coordinate with Section 31 23 33. Refer to Section 22 05 53.
 - 11. Pipe Cover and Backfilling: Section 31 23 33.
 - 12. Backfill trench according to Section 31 23 33.
 - 13. Maintain optimum moisture content of fill material to attain required compaction density.
 - 14. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 15. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 16. Do not use wheeled or tracked vehicles for tamping.

D. Aboveground Piping:

1. Install non-conducting dielectric connections wherever jointing dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
3. Group piping whenever practical at common elevations.
4. Slope piping and arrange systems to drain at low points.
5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
6. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.
7. Provide access where valves and fittings are not accessible.
8. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
9. Provide support for utility meters according to requirements of utility companies.
10. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
11. Install domestic water piping according to ASME B31.9.
12. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.
13. Install fire stopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
14. Install unions downstream of valves and at equipment or apparatus connections.
15. Install valves with stems upright or horizontal, not inverted.
16. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
17. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
18. Provide spring-loaded check valves on discharge of water pumps.
19. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
20. Pipe relief from valves, back-flow preventers and drains to nearest floor drain or as shown on drawings.
21. Test backflow preventers according to CSA B64.4 or CSA B64.4.1 OR as directed by facility maintenance.
22. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping as shown on drawings.
23. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures as shown on drawings. Fabricate same size as supply pipe and per manufacturer's requirements.

24. Piping installed in air plenums must be installed with piping materials that have a flame/smoke rating of 25/50 or less per ASTM E84 or piping must be wrapped with 3M Fire Barrier Plenum wrap to meet a flame/smoke rating of 25/50 or less per ASTM E84.
25. Where uncovered, exposed pipes pass through finished floors, finished walls, or finished ceilings, they shall be fitted with chromium plated spun brass escutcheon plates. Plates shall be large enough to completely close the hole around the pipe and shall be not less 1-1/2" or more than 2-1/2" larger than the diameter of the pipes. All plates shall be securely held in place.

E. Pumps:

1. Provide pumps to operate as specified on drawings.

F. Service Connections:

1. Provide new water service complete as illustrated on drawings.

3.04 FIELD QUALITY CONTROL

- A. Upon completion of the roughing-in and before setting fixtures, the entire water piping systems installed under this contract must be hydrostatically tested at a pressure of no less than 125 psig and must show no drop in pressure in a two-hour period. Where a portion of the water piping system is to be concealed before completion, this portion must be hydrostatically tested separately in the same manner as prescribed for the entire system.

3.05 CLEANING

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
- D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze according to AWWA C651.

- I. Requirements for demonstration of compliance with the Maximum Containment Level of the Safe Drinking Water Act:
 1. Total-chlorine-concentration of less than 1 milligram per liter (mg/L) (1 parts per million [ppm]).
 2. The absence of any coliform bacteria.
 3. Less than 200 non-coliform bacteria per 100 mL.

END OF SECTION

SECTION 22 13 00

FACILITY SANITARY SEWERAGE AND ROOF DRAIN PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sanitary sewer, vent, roof drain piping buried within building and to a point five (5) feet outside building.
2. Sanitary sewer, vent, and roof drain piping above grade within building.
3. Pipe hangers and supports.
4. Cleanouts.
5. Drains.
6. Traps and tailpieces.
7. Bedding and cover materials.

1.02 SUBMITTALS

A. Product Data:

1. Piping: Pipe materials, fittings, and accessories. Submit manufacturers catalog information.

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section with three (3) years' experience.

B. Installer: Company specializing in performing Work of this Section with three (3) years' experience.

1.04 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.05 WARRANTY

A. Furnish one-year manufacturer warranty for products listed in Part 2 and equipment listed on Drawing Schedules.

PART 2 PRODUCTS

2.01 SANITARY SEWER, VENT PIPING AND ROOF DRAIN PIPING, BURIED WITHIN BUILDING AND TO A POINT FIVE (5) FEET OUTSIDE BUILDING

A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
 3. Joints Manufactured by Tyler “LUBRI/FAST” or equivalent.
- 2.02 SANITARY SEWER, VENT, AND ROOF DRAIN PIPING, ABOVE GRADE WITHIN BUILDING
 - A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron, CISPI 301.
 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
 3. Couplings manufactured by Tyler “Wide Body”, Huskey Series 4000, Clamp-All, Mission, Iron Clad or equivalent.
- 2.03 PIPE HANGERS AND SUPPORTS
 - A. See Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
- 2.04 CLEANOUTS
 - A. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.
 - B. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.
 - C. Interior Finished Floor Areas: Fully adjustable, coated cast iron body with nickel bronze scoriated top. Zurn ZN-1400 (Normal Traffic) or ZN-1400-HD (Heavy Traffic) or equivalent.
 - D. Interior Finished Wall Areas: Coated cast iron body with Acrylonitrile-Butadiene-Styrene plug and smooth stainless steel access cover. Zurn Z-1441 or Z-1445 or equivalent.
 - E. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
- 2.05 DRAINS
 - A. Floor drains and floor sinks shall be Josam, Jay R. Smith, Wade, Watts, Zurn, or equivalent and compatible with the required piping systems.
- 2.06 TRAPS AND TAILPIECES
 - A. Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel, not less than 20 gage and without cleanout. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level and swivel joints below the discharge level, metal to metal or metal to plastic type as required for the application. Outlet shall be threaded or socket for solder joint

connection as required by the application. Tailpiece shall be copper-alloy to match P-trap. Furnish cast brass wall escutcheon at waste penetration through walls. P-traps, tailpieces, escutcheon, and all piping for above floor exposed installations, including installation within cabinets and casework shall be chrome plated. Underground P-traps shall be coated cast iron or plastic as required by the application.

- B. Traps and associated trim shall be furnished by the plumbing fixture manufacturer as specified on the Drawings, or shall be as manufactured by Dearborn, EBC, McGuire, T & S Brass, or equivalent.

2.07 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type as specified in Section 31 23 33.
- B. Cover: Fill Type as specified in Section 31 23 33.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Prepare piping connections to equipment with flanges or unions.
- C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION

- A. All sewer, vent and roof drain piping shall be properly graded and installed in strict accordance with all applicable codes and requirements.
- B. Make all changes in direction of drainage piping by use of 45 degree wyes, long turn tee wyes, long sweep quarter bends, sixth, eighth or sixteenth bends. Short turn sanitary tees permissible on horizontal to vertical where space conditions require.
- C. Flashing for piping through built up roofing with lead flashing, weight of not less than four pounds per square foot, extending at least 12" in all directions under roofing and up pipe. Cap flash pipe and turn down inside 1" approximately. Flashing shall be two-piece type, base and cap flashing.
- D. All floor drains and floor sinks shall be installed with grates square with building lines and with the top of grates installed level with adjacent finished floor.

- E. The Contractor shall extend drain lines from all equipment requiring drainage, relief valves, and drain pans to the nearest floor drain or floor sink, and shall terminate indirectly with a minimum clearance of one (1) inch or as otherwise required by applicable codes and standards. Relief valve drain lines shall be extended the outdoors as illustrated on Drawings.
- F. Hangers and Supports:
1. Inserts: See Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
 2. Pipe Hangers and Supports: See Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
- G. Buried Piping Systems:
1. Verify connection to existing piping system size, location, and inverts. Establish inverts to slope to drain at minimum slopes required by Uniform Plumbing Code.
 2. Establish elevations of buried piping with not less than one (1) foot of cover.
 3. Establish minimum separation of sanitary sewer piping according to Uniform Plumbing code.
 4. Excavate pipe trench according to Section 31 23 33.
 5. Install pipe to elevation as indicated on Drawings.
 6. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
 7. Install pipe on prepared bedding.
 8. Route pipe in straight line.
 9. Install pipe to allow for expansion and contraction without stressing pipe or joints.
 10. Install plastic ribbon tape continuous buried 6 inches below finish grade, above pipe line; coordinate with Section 31 23 33. Refer to Section 22 05 53 – Identification for Plumbing Piping and Equipment.
 11. Pipe Cover and Backfilling:
 - a. Backfill trench according to Section 31 23 33.
 - b. Maintain optimum moisture content of fill material to attain required compaction density.
 - c. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - d. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - e. Do not use wheeled or tracked vehicles for tamping.
- H. Aboveground Piping:
1. Establish inverts to slope to drain at minimum slopes required by Uniform Plumbing Code.

2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
3. Encase exterior cleanouts in concrete flush with grade.
4. Install floor cleanouts at elevation to accommodate finished floor.
5. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
6. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
7. Install piping to maintain headroom. Do not spread piping, conserve space.
8. Group piping whenever practical at common elevations.
9. Support cast iron drainage piping at every joint.
10. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
11. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 – Plumbing Insulation.
12. Install piping penetrating roofed areas to maintain integrity of roof assembly.
13. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
14. Install bell and spigot pipe with bell end upstream.
15. Sleeve pipes passing through partitions, walls and floors.
16. Install fire stopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
17. Support cast iron drainage piping at every joint.
18. Plastic Piping installed in air plenums must be installed with piping materials that have a flame/smoke rating of 25/50 or less per ASTM E84.

3.04 FIELD QUALITY CONTROL

- A. Test sanitary sewer, vent and roof drain piping system installed under this Contract by plugging all outlets and filling the lines with water to the level of the highest vent or roof drain stack above the roof. The system must hold this water for one (1) hour without showing a drop in level. Where only a segment of the system is to be tested, the test must be conducted in the same manner as prescribed for the entire system, except that a vertical stack supplying at least 10 foot head of water pressure must be installed above the highest horizontal line to be tested. The Contractor must install suitable fittings, such as plugged tees, if such fittings are required to isolate portions of the system for the test. The segment of the system being tested must hold this water pressure for one (1) hour without showing a drop in level. All joints must be inspected for visible leaks, and all leaks must be repaired before the placing of the system into service. All soil or waste piping located underground must be tested before backfilling.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fixtures and Equipment.
 - 2. Faucets.
 - 3. Plumbing Fixture Trim.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for plumbing fixtures, equipment, faucets, and trim as scheduled on Drawings.

1.03 QUALITY ASSURANCE

- A. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.04 WARRANTY

- A. Furnish one year manufacturer warranties for plumbing fixtures and accessories listed within this Specification and Drawings.

PART 2 PRODUCTS

2.01 FIXTURES AND EQUIPMENT

- A. Vitreous china and enameled cast iron fixtures by American Standard, Kohler, Crane, Eljer, or equivalent as listed and described in the Equipment Schedule on the Drawings. All vitreous china and enameled cast iron fixtures shall be white, unless otherwise indicated on the Drawings. The material used for plumbing fixtures shall be of non-absorptive, acid-resistant vitreous china, enameled cast iron or stainless steel, and free from all imperfections. Each water service main, branch main, riser and branch to a group of fixtures shall be valved or as otherwise shown on the Drawings. Stop valves shall be provided at each fixture. One-piece chrome plated escutcheons shall be installed on all water piping and trap connections at walls or base cabinets. All exposed connecting piping and material shall be chrome plated.
- B. Handicap accessible lavatories and counter-mounted sinks shall have exposed supply and waste services insulated with rigid, molded insulation kits as manufactured by T.C.I. "Skal-Gard," Brocar "Trap Wrap," True-Bro "Handi Lav-Guard," McGuire "Prowrap," or equivalent.

- C. Flush valves shall be low water consumption type, with flow rates as specified on Drawings. Valves shall be diaphragm type, with metal oscillating non-hold-open handle, screw driver back check angle stop assembly with cap, adjustable tailpiece, vacuum breaker flush connection, and spud couplings as required for wall and fixture rough-in. Exposed flush valves shall be fully chrome plated, with chrome plated supply pipe cover. Flush valves shall be Delany, Sloan Royal, Sloan Regal, Zurn, or equivalent.
- D. Closet seats shall be furnished for water closets as specified on the Equipment Schedule on the Drawings. Closet seats shall be white, unless otherwise required to match water closet. All closet seats shall be of smooth non-absorbent material and shall be properly sized for the water closet bowl type. All closet seats for fixtures for public use shall be open-front type without cover. Water closet seats provided for handicapped fixtures shall meet all handicapped requirements. Water closet seats shall be furnished by the plumbing fixture manufacturer as specified on the Equipment Schedule on the Drawings, or shall be as manufactured by Bemis, Beneke, Church, Olsonite, Sperzel, or equivalent.
- E. Stainless steel sinks shall be as specified on the Equipment Schedule on the Drawings and as manufactured by Kohler, American Standard, Elkay, Just, Moen, or equivalent.
- F. Electric water coolers (EWC) and drinking fountains shall be as specified on the Plumbing Fixture Schedule on the Drawings and as manufactured by Elkay, Haws, Halsey Taylor, Oasis, Westinghouse, Sunroc, or equivalent.
- G. Hose bibs and wall hydrants shall be as specified on the Equipment Schedule on the Drawings and as manufactured by Zurn, Jay R. Smith, Wade, Woodford, Acorn, Chicago, T&S Brass, Watts, or equivalent. Handles, if specified, shall be constructed of metal or brass and finished to match valve unit.
- H. Wall Cleanouts shall be dura-coated cast iron body, gas and water tight ABS tapered thread plug and round smooth stainless steel access cover with securing screw. Manufactured by Zurn or equivalent.
- I. Floor Cleanouts and Double Cleanouts (heavy duty) shall be Duco Cast Iron Cleanout with Round Adjustable Scoriated Nickel Bronze Top. Closure Plug Type. Pipe Outlet same size as pipe and connection liquid – air tight and compatible with pipe. Manufactured by JR Smith, Zurn or equivalent.

2.02 FAUCETS

- A. Plumbing fixture faucets shall be brass construction and fully chrome plated, unless special finish is specified on the Equipment Schedule on the Drawings. Faucets shall be furnished complete with all accessories required for the necessary application, including aerators, handles, spouts, and operating cartridges. Contractor shall coordinate exact faucet requirements with required fixture drilling and water and waste rough-in. Faucets for handicapped fixtures shall meet all handicapped and

ADA requirements, including a maximum of five (5) pounds of force to activate controls and adjustable metering faucet water flow duration of ten (10) seconds, minimum.

- B. Plumbing fixture faucets shall be furnished by the fixture manufacturer as specified in the Equipment Schedule on the Drawings and Paragraph 2.02 herein, or shall be as manufactured by Chicago, Delta, Moen, Royal Brass, Speakman, T&S Brass, or equivalent, and shall be commercial grade.

2.03 PLUMBING FIXTURE TRIM

- A. Plumbing fixture trim, including P-traps, supplies, and strainers, shall be furnished by the fixture manufacturer as specified in the Equipment Schedule on the Drawings and Paragraph 2.01 herein, or shall be as furnished by Brass Craft, McGuire, T&S Brass, EBC, or equivalent.
- B. Unless otherwise specified, traps shall be copper-alloy adjustable tube-type with slip joint inlet and swivel, not less than 17 gage and without cleanout. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level and swivel joints below the discharge level, metal-to-metal or metal-to-plastic type as required for the application. Outlet shall be threaded or socket for solder joint connection as required by the application. Tailpiece shall be copper-alloy to match P-trap. Furnish brass or copper wall escutcheon at waste penetration through walls. P-traps, tailpieces, escutcheon, and all piping for above floor exposed installations, including installation within cabinets and casework shall be chrome plated. Handicap-accessible lavatories shall be furnished with offset lavatory strainers.
- C. Fixture supplies, strainers, and trim shall be brass construction. Supplies shall be commercial grade, all brass angle stops, plastic stems and handles are not acceptable. Furnish supply with loose key unless otherwise specified. Supply pipe shall be 3/8" O.D., with smooth (non-corrugated) flexible copper riser and wall escutcheon. Supply assembly shall be completely chrome plated for all exposed installations, including installation within cabinets and casework. Strainers and other miscellaneous fixture trim shall be furnished as required for the proper installation and shall be chrome plated to match faucets, unless special finish is required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adjacent construction is ready to receive rough-in work of this Section.
- B. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.02 INSTALLATION

- A. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.

- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- C. The Contractor shall provide all necessary supports and connection materials and trim for plumbing fixtures as required to assure a complete properly installed and operating system. Installation shall be in accordance with manufacturer's recommendations and with International Building Code and Uniform Plumbing Code requirements. The Contractor shall caulk fixtures to the adjacent wall, floor and countertop construction with non-shrink, mildew-resistant caulking material.
- D. Furnish and install all "back-up" materials for fixtures and accessories, or as otherwise required by the Equipment Schedule, to properly support and provide a sturdy installation.
- E. Fixture carriers shall be provided for all wall-hung plumbing fixtures, including water closets, urinals, lavatories, sinks, etc., as manufactured by Josam, Jay R. Smith, Watts, Wade, Zurn, or equivalent. Carriers shall be bolted to the floor using all of the support bolts recommended by the manufacturer. Where the water closet nipple and studs extend beyond the maximum carrier recommended length, provide additional carrier support as recommended by manufacturer. Water closet carriers shall be horizontal or vertical, single or back-to-back units as required for the fixture installation and piping arrangement, and shall be adjustable.
- F. Single water closet carriers shall have factory-installed rear hold-down lugs and anchor foot to provide cantilever support.
- G. Wall-hung urinals shall be provided with floor-mounted fixture carrier complete with upper and lower fixture support plates as required to match fixture installation requirements.
- H. Wall-hung lavatories and sinks shall be provided with floor-mounted, concealed-arm type chair carriers, single or double (back-to-back) units as required for the fixture installation and arrangement.
- I. Contractor shall be responsible to provide the proper arrangement and selection of fixture carriers required for fully concealed installation in the available plumbing chase and/or wall construction.
- J. Exact location and rough-in requirements shall be carefully coordinated. Contractor shall refer to Drawings and Specifications, and shall check manufacturer's data, Shop Drawings, and rough-in drawing submitted and make all field measurements to the extent necessary to ensure his understanding of the work required to provide for complete rough-in installation.
- K. All fixtures shall be thoroughly cleaned before final acceptance of the Work.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipe hangers and supports.
 - 2. Hanger rods.
 - 3. Inserts.
 - 4. Flashing.
 - 5. Equipment curbs.
 - 6. Sleeves.
 - 7. Mechanical sleeve seals.
 - 8. Firestopping relating to HVAC Work.
 - 9. Firestopping accessories.
 - 10. Formed steel channel.
 - 11. Equipment bases and supports.

1.02 SYSTEM DESCRIPTION

- A. Firestopping Materials: To achieve fire ratings as noted on Architectural Drawings for adjacent construction, but not less than one (1) hour fire rating.
- B. Firestop interruptions for fire rated assemblies, materials, and components.

1.03 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to FM or UL for fire resistance ratings and surface burning characteristics.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Hangers and Supports: Manufacturers catalog data.

1.05 QUALITY ASSURANCE

- A. Perform Work according to AWS D1.1 for welding hanger and support attachments to building structure.
- B. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.

- C. Installer: Company specializing in performing Work of this Section with minimum 3 years' experience.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- B. Maintain this minimum temperature before, during, and for minimum three days after installation of firestopping materials.
- C. Provide ventilation in areas to receive solvent cured materials.

1.07 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.08 WARRANTY

- A. Furnish five (5) one-year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Refrigerant Piping:
 - 1. Conform to MSS SP-58; material and design of pipe supports, MSS SP-69: selection and application of pipe supports, and MSS SP-89: Fabrication and installation of pipe supports.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 7. Vertical Support: Steel riser clamp.
 - 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 9. Copper Pipe Support: Copper-plated carbon-steel ring.

2.02 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.03 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
 - 1. Waterproofing: 5 lb./sq. ft sheet lead.
 - 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire-resistant elements.

2.05 EQUIPMENT CURBS

- A. Manufacturers: To match equipment.

2.06 SLEEVES

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel. Sleeves can also be schedule 40 galvanized steel pipe-ASTM A53-Type E grade A, or cast iron ASTM A74.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel. Sleeves can also be Schedule 40 galvanized steel pipe-ASTM A53-Type E grade A, or cast iron ASTM A74.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel.
- E. Sealant: Acrylic.

2.07 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.08 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.09 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Hilti Corp.
 - 3. 3M Fire Protection Products.

2.10 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Mineral fiber matting.
 - 3. Sheet metal.
 - 4. Plywood or particle board.
 - 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
 - 1. Furnish UL listed products.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
 - 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive sleeves.
- B. Verify openings are ready to receive firestopping.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Obtain permission from Engineer before using powder-actuated anchors.
- D. Do not drill or cut structural members.

3.03 INSTALLATION

- A. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- B. Pipe Hangers and Supports:
 - 1. Install according to MSS SP-89: fabrication and installation of pipe supports.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers with minimum 1/2 inch space between finished covering and adjacent Work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment.
 - 6. Support vertical piping at every floor.
 - 7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
 - 8. Support riser piping independently of connected horizontal piping.
 - 9. Provide copper plated hangers and supports for copper piping.
 - 10. Design hangers for pipe movement without disengagement of supported pipe.
 - 11. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00 – Painting and Coating. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 12. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00 – Plumbing Insulation.
 - 13. Refer to manufacturer's recommendations for grooved end piping systems.
- C. Equipment Bases and Supports:
 - 1. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment.

2. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
 3. Construct supports of formed steel channel and steel pipe and fittings. Brace and fasten with flanges bolted to structure.
 4. Provide rigid anchors for pipes after vibration isolation components are installed.
- D. Flashing:
1. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
 2. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.
 3. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.
 4. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.
- E. Sleeves:
1. Exterior watertight entries: Seal with mechanical sleeve seals.
 2. Set sleeves in position in forms. Provide reinforcing around sleeves.
 3. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
 4. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
 5. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent Work with stuffing or firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
 6. Install chrome plated steel escutcheons at finished surfaces.
- F. Pipe penetrations thru fire/smoke rated assemblies shall be fire caulked air tight to adjacent structure by means of a UL or FM approved fire proof caulking material conforming to the construction type, penetration type, annular space requirements and fire rating.
- G. Pipe penetrations thru non fire rated assemblies shall be fire caulked air tight by mean of approved caulking material. Provide joint sealers, joint filler and other related materials that are compatible under conditions of application. Provide color of exposed joint sealers to closely match finish color of adjacent surfaces.
- H. Firestopping:
1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.
 2. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

3. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
 4. Fire-Rated Surface:
 - a. Seal openings
 - b. Install firestopping product in accordance with manufacturer's instructions.
- I. Install chrome-plated steel escutcheons at finished surface.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Ceiling tacks.

1.02 SUBMITTALS

- A. Product Data: Manufacturer's catalog literature for each product required.

1.03 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.
- C. Installer: Company specializing in performing Work of this Section with three years' experience.

1.04 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 NAMEPLATES

- A. Product Description: Metal nameplate with operational data engraved or stamped permanently fastened to equipment.

2.02 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Fire dampers/smoke dampers: Red.
 - 3. Plumbing valves: Green.
 - 4. Heating/cooling valves: Blue.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with **nameplates**. Identify in-line pumps and other small devices with tags.
- D. Identify control panels and major control components outside panels with plastic nameplates.
- E. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot spacing.
- F. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Testing, adjusting, and balancing of air systems.

1.02 SUBMITTALS

- A. Test Reports: Submit prior to final acceptance of Project and for inclusion in operating and maintenance manuals. Assemble in soft cover, letter size, with table of contents page and tabs, and cover identification. Include reduced-scale Drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.03 QUALITY ASSURANCE

- A. TAB Agency: Perform Work in accordance with the latest edition of AABC or NEBB procedural standards for TAB of environmental systems. All quality assurance provisions, recommendations, and suggested practices contained in these TAB standards are considered mandatory.

PART 2 PRODUCTS

2.01 INSTRUMENTS

- A. The TAB Agency shall furnish instruments required for testing, adjusting, and balancing.
- B. Instruments used for measurements shall meet AABC or NEBB-specified accuracy and calibration histories, and shall be available for spot-checking by Owner's representative.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before starting work, verify systems are complete and operable.
- B. Report defects, deficiencies, or abnormal conditions in mechanical systems preventing system balance.
- C. Beginning of work means acceptance of existing conditions.

D. Subcontractor Responsibilities:

1. Provide window in project schedule for completion of TAB services prior to final inspection of project.
2. Have mechanical, controls, structural and related electrical systems complete and operable before notifying that project is ready for TAB Agency services.
3. Complete operational readiness prior to commencement of TAB services.
Verify the following:
 - a. Doors, windows and ceilings are installed. Pipe penetrations and other holes or openings are sealed.
 - b. Systems are started and operating in safe and normal condition.
 - c. Temperature control systems are installed complete and operating. Testing and programming of all system components and the overall system has been completed.
 - d. Airflow control systems are installed complete and operating. Testing and programming of all system components and the overall system has been completed.
 - e. Proper thermal overload protection is in place for electrical equipment.
 - f. Construction filters have been replaced and the final filters are clean and in-place.
 - g. Duct systems are clean of debris.
 - h. Fans are rotating correctly, and fan belts, if equipped, are aligned and tight.
 - i. Fire, smoke, and manual volume dampers are in place and open and the location of volume dampers are accessible and appropriate for effective balancing.
 - j. Air coil fins are cleaned and combed.
 - k. Access doors are closed and duct end caps are in place.
 - l. Air outlets and inlets are installed and connected.
 - m. Fume hoods and other local exhaust ventilation inlets are installed and connected.
 - n. Duct and piping supports are installed.
 - o. Duct systems are leak and pressure tested as required.
 - p. Hydronic systems are leak tested per specifications.
 - q. Hydronic systems are flushed, filled and vented.
 - r. Refrigerant systems are leak-tested per specifications.
 - s. Pumps are rotating correctly.
 - t. Start-up screens from pump suction diffusers are removed.
 - u. Proper strainer baskets are clean and in place.
 - v. Service and balance valves are open.
 - w. Pressure gauges, temperature gauges, test fittings, etc., are installed.
4. Put HVAC systems and equipment into full operation and continue operation during times of testing and balancing.
5. Do not operate equipment until properly lubricated and brought into manufacturer's specified operating conditions.
6. Provide labor and materials to make any change in sheaves, belts, and dampers, required for correct balance as requested by the TAB Agency.

7. Provide labor, i.e., remove and reinstall ceiling tiles, etc., to access concealed equipment as requested by TAB Agency.
8. After TAB Agency is notified and TAB work started, should system(s) be found to not be in readiness or a dispute occurs as to readiness of system(s), the Owner may require a joint inspection be made by representatives of Owner, the TAB Agency and the Subcontractor.
9. Should inspection reveal TAB services notification to have been premature, costs of work previously accomplished by TAB Agency shall be paid for by the Subcontractor.
10. Such items as are not ready for TAB services shall be completed and placed in operational readiness by Subcontractor, and TAB services shall again be scheduled.

3.02 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust to within plus or minus 5 percent of design.

3.03 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to deliver design outside, supply, return, and exhaust air quantities within previously stated tolerances.
- B. Make air flow rate measurements in ducts by traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extent those adjustments do not create objectionable air motion or sound levels. Change volume using dampers mounted in ducts.
- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes to accomplish system air flow. Vary branch air quantities by damper regulation.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Allow for pressure drop equivalent to 50 percent loading of filters.
- G. Adjust automatic outside air, return air, and exhaust air dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust air dampers to check leakage.

- I. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- J. Adjust air quantities for multi-zone units with mixing dampers set first for cooling, then heating, then modulating.
- K. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

3.04 FIELD QUALITY CONTROL

- A. Verify recorded data represents actually measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices. Set and lock memory stops.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. HVAC ductwork insulation, jackets, and accessories.

1.02 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics, and list of materials and thickness for each service.

1.03 QUALITY ASSURANCE

- A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84 and UL 723.
- B. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.06 WARRANTY

- A. Furnish one (1) year manufacturer warranty for man-made fiber.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Knauf Fiber Glass.

- B. Owens/Corning Fiberglass.
- C. Armstrong.
- D. Johns Manville.

2.02 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
 - 1. Thermal Conductivity: 0.30 at 75 degrees F.
 - 2. Maximum Operating Temperature: 250 degrees F.
 - 3. Density: 0.75 pound per cubic foot.
- B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied metalized polypropylene scrim kraft facing meeting ASTM C1136, Type II.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Density: 3.0 pound per cubic foot.
- C. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
 - 1. Thermal Conductivity: 0.24 at 75 degrees F
 - 2. Density: 1.5 pound per cubic foot Maximum Operating Temperature: 250 degrees F.
 - 3. Maximum Air Velocity: 6,000 feet per minute.
- D. TYPE D-5: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Density: 3.0 pound per cubic foot.
 - 3. Maximum Operating Temperature: 250 degrees F
 - 4. Maximum Air Velocity: 4,000 feet per minute
- E. TYPE D-8: Inorganic blanket encapsulated with scrim reinforced foil meeting UL 1978.
 - 1. Thermal Conductivity: 0.42 at 500 degrees F.
 - 2. Weight: 1.4 pound per square foot.
 - 3. Surface Burning Characteristics: Maximum 0/0 flame spread/smoke developed index when tested in accordance with ASTM E84.

2.03 DUCTWORK INSULATION JACKETS

- A. Aluminum Duct Jacket:
 - 1. ASTM B209.
 - 2. Thickness: 0.016 inch thick sheet.
 - 3. Finish: Embossed.
 - 4. Joining: Longitudinal slip joints and 2 inch laps.
 - 5. Fittings: 0.016 inch thick die shaped fitting covers with factory-attached protective liner.
 - 6. Metal Jacket Bands: 3/8 inch wide; 0.010 thick stainless steel.

2.04 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape:
 - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, welded with integral head.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12-inch centers.
- F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION – DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor retarder jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces below 10 feet above finished floor: Finish with aluminum jacket.

- E. External Glass Fiber Duct Insulation:
1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
 2. Secure insulation without vapor retarder with staples, tape, or wires.
 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. Duct and Plenum Liner:
1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
- G. Kitchen Exhaust Ductwork:
1. Cover duct by wrapping with insulation using overlap method.
 2. Overlap seams of each method by 3 inches.
 3. Attach insulation using steel banding or by welded pins and clips.
 4. Install insulation without sag on underside of ductwork. Use additional fasteners to prevent sagging.
 5. Install insulation according to external duct insulation paragraph above.
 6. Provide external insulation with vapor retarder jacket. Cover with with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
 7. Finish with aluminum duct jacket.
 8. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.
- H. Ducts Exterior to Building:
1. Install insulation according to external duct insulation paragraph above.
 2. Provide external insulation with vapor retarder jacket. Cover with with caulked aluminum jacket with seams located on bottom side of horizontal duct section.
 3. Finish with aluminum duct jacket.
 4. Calk seams at flanges and joints. Located major longitudinal seams on bottom side of horizontal duct sections.
- I. Prepare duct insulation for finish painting. Refer to Section 09 90 00 – Painting and Coating.

3.03 SCHEDULES

A. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches (mm)
Supply Ducts located in unconditioned space	D-1	2
Return Ducts located in unconditioned space	D-4 or D-5	1
Supply Ducts located in conditioned space.	As indicated on Drawings	1
Return Ducts located in conditioned space	As indicated on Drawings	1
Exhaust Ducts	As indicated on Drawings	1
Kitchen Listed Grease Exhaust Duct (2 layers of 1-1/2 inch each)	D-8	3.0
Outside Air, Supply Air, Return Air, (exterior to building located outdoors)	D-2 or D5	3.0
Transfer Air Ducts (internally insulated)	D-4 or D-5	1.0

END OF SECTION

SECTION 23 11 23

FACILITY LP-GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Polyethylene piping below grade.
 2. Anodeless Riser.
 3. Transition Fitting.
 4. LP gas piping above grade.
 5. Regulator Vent Piping.
 6. Unions and flanges.
 7. Ball Valves.
 8. Plug Valves.
 9. Pipe hangers and supports.
 10. LP gas pressure regulators.
 11. Appliance Connectors.
 12. Underground pipe markers.
 13. Bedding and cover materials.

1.02 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.
- C. Provide pipe hangers and supports according to MSS SP 58.
- D. Use plug valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.03 SUBMITTALS

- A. Product Data:
1. Piping: Data on pipe materials.

1.04 QUALITY ASSURANCE

- A. Perform gas Work according to NFPA 54.

- B. Perform Work according to local gas company requirements.
- C. Perform Work according to ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- D. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.
- E. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.
- F. Installer: Company specializing in performing Work of this Section with three years' experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Furnish temporary protective coating on cast iron and steel valves.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.07 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.08 COORDINATION

- A. Coordinate trenching of buried piping systems.

1.09 WARRANTY

- A. Furnish one-year manufacturer warranty for valves excluding packing.

PART 2 PRODUCTS

2.01 LP GAS POLYETHYLENE PIPING, BELOW GRADE

- A. Manufacturer: Performance Pipe (Driscopipe 8100 or Yellowstripe 8300), no substitution.
- B. Pipe: Polyethylene, high-density, ASTM D2513, PPI-PE4710, SDR11 iron pipe size, ASTM D3350 cell classification number 445574C. Provide and install SDR-9 polyethylene pipe when performing horizontal directional drilling or other pipe pulling operation.
- C. Fittings: Polyethylene, high-density, butt heat fusion type, ASTM D2513, PE4710, SDR 11, ASTM D3350 cell classification number 445574C.

2.02 ANODELESS RISER

- A. Manufacturer: R.W. Lyall and Company, Inc.
- B. Prebent, for use with Performance Pipe (Driscopipe 8100 or Yellowstripe 8300) polyethylene piping, ASTM D 2513, PPI-PE 4710 (PE 3408), SDR11, iron pipe size NPT steel end by PE butt fusion, size to match piping system. Steel pipe shall be standard wall, black steel, API 5L EW, Grade A or ASTM A53, Type E, Grade A for 1 1/2 inch and less, Grade B for 2 inch and larger. The mechanical joint shall be provided with a tamper proof, gas tight connection and seal per ASTM D2513, Category 1.

2.03 TRANSITION FITTING

- A. Manufacturer: R.W. Lyall and Company, Inc.
- B. Preformed steel pipe to PE pipe, for use with Performance Pipe (Driscopipe 8100 or Yellowstripe 8300) polyethylene piping, ASTM D 2513, PPI-PE 4710 (PE 3408), SDR11, iron pipe size beveled steel end for welding by PE butt fusion, size to match piping system. Steel pipe shall be standard wall, black steel, API 5L EW, Grade A or ASTM A53, Type E, Grade A for 1 1/2 inch and less, Grade B for 2 inch and larger. The mechanical joint shall be provided with a tamper proof, gas tight connection and seal per ASTM D2513, Category 1.

2.04 LP GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black or Schedule 40 galvanized steel, seamless Type S, or welded Type E, ASTM A53/A53M.
 - 1. Fittings: 2 Inches and Smaller: Class 150, banded malleable iron, screwed, ASME B16.3. Galvanized fittings shall be hot dipped in accordance ASTM A153.
 - 2. Fittings: 2½ Inches and Larger: Class 150, Schedule 40 wrought steel butt-weld fittings, ASME B16.9.
 - 3. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

2.05 REGULATOR VENT PIPING, ABOVE GRADE

- A. Indoors: Same as natural gas piping, above grade.

2.06 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
 - 1. Ferrous Piping: Class 150, malleable iron, threaded.
- B. Flanges for Pipe 2-1/2 inches and Larger:
 - 1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 - 2. Flanges for steel piping system shall be forged steel, weld neck, or slip on, 1/16-inch raised face Class 150 flanges conforming to ANSI B16.5.

3. Flange connections for valves and equipment shall match the rating and drilling of the valves and equipment furnished.
4. Where specifically required by the application, black cast iron Class 125 standard threaded plain face companion flanges may be utilized for flanged connections in threaded piping systems.
5. Gaskets shall be 1/16 inch thick full face non asbestos material suitable for the temperatures and pressure application.
6. Flange bolting shall be carbon steel machine bolts or studs and hex nuts, ASTM A307, Grade B.

2.07 BALL VALVES

- A. Outdoor systems operating above 0.5 psig: 100% full port, hot-forged brass body, double Viton o-rings, PTFE seats, integral lockout device, valve certified to 175 psig. Jomar model no. 175LWN.
- B. Appliance equipment applications, systems operating at less than 0.5 psig: Forged-brass body, fluorocarbon O-rings, PTFE seats, valve certified to 0.5 psig. Nibco GB Series.

2.08 PLUG VALVES

- A. Outdoor Systems, 2 inches and smaller: Cast iron body, threaded ends, flat-head lock-wing, nonlubricated full-port brass plug, 100 psig natural or propane gas rating, rated for use in ambient temperatures between -20°F and 150°F, A.Y. McDonald 10687B. If an insulating union is required, the same requirements would be applied, A.Y. McDonald 6266 series.
- B. Outdoor Systems, 2½ inches and greater: Cast iron or ductile iron body, ANSI 125 flanged, seals rated for gas, non-lubricated eccentric-type one-piece plug, natural or propane gas rating, Milliken Millicentric Series 600.
- C. Indoor systems, appliance shutoff valve: Brass body and plug, lock-wing head, threaded ends, 25 psig rating, A.Y. McDonald Series 10621.
- D. Indoor Systems, 2½ inches and greater: Cast iron or ductile iron body, ANSI 125 flanged, seals rated for gas, nonlubricated eccentric-type one-piece plug, natural or propane gas rating, Milliken Millicentric Series 600.

2.09 PIPE HANGERS AND SUPPORTS

- A. Conform to MSS SP 58.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.
- F. Vertical Support: Steel riser clamp.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- H. Sheet Lead: ASTM B749, 2.5 lb/sq ft thick.
- I. Piping supports for roof mounted piping designed to absorb thermal expansion and contraction of natural gas piping installed on built up and single ply membrane roofs shall be provided. Wood blocks are not acceptable. Three inch and smaller gas piping shall be mounted on a roller bearing support, Miro Industries Model 3-R, or equivalent, pipe supports on centers required by Code with a total weight not to exceed 38 pounds per pipe stand. Provide spacers as required. Larger piping, and all piping requiring roller bearing action for pipe expansion, shall be mounted on Miro Industries adjustable height pipe stand with stainless steel rods, polycarbonate saddle and base. Support model shall match the specific pipe size. Maximum load weight shall not exceed the manufacturers published data, or equivalent, on centers required by Code.

2.10 LP GAS REGULATOR

- A. EXISTING LP GAS TANK: LP gas regulator shall be furnished and installed by LP gas supplier. Coordinate with gas supplier and conform to their requirements. Set for the required gas leaving pressure shown on the Drawings.
- B. LP regulators at building are sized as indicated on Drawings.

2.11 APPLIANCE CONNECTORS, SYSTEMS OPERATING AT LESS THAN 0.5 PSIG

- A. Stainless steel or coated stainless steel, corrugated, ANSI Z21.24, Connectors for Gas Appliances, certified for indoor and outdoor use. Brasscraft model no. SSC or CSSC.

2.12 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Brightly colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.13 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type as specified in Section 31 23 33.
- B. Cover: Fill Type as specified in Section 31 23 33. Soil Backfill from Above Pipe to Finish Grade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- B. Pipe Hangers and Supports:
 - 1. Install pipe hangers and supports according to Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- C. Buried Piping Systems:
 - 1. Install LP gas piping according to NFPA 54.
 - 2. Verify connection to existing piping system as indicated on Drawings.
 - 3. Establish elevations of buried piping with not less than 2 ft of cover.
 - 4. Establish minimum separation of piping according to NFPA 54 code.
 - 5. Remove scale and dirt on inside of piping before assembly.
 - 6. Excavate pipe trench according to Section 31 23 33. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.
 - 7. Install pipe on prepared bedding.
 - 8. Route pipe in straight line.
 - 9. Install pipe to allow for expansion and contraction without stressing pipe or joints.
 - 10. Pipe Cover and Backfilling:
 - a. Backfill trench according to Section 31 23 33.
 - b. Maintain optimum moisture content of fill material to attain required compaction density.
 - c. After pressure test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 24 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - d. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

e. Do not use wheeled or tracked vehicles for tamping.

D. Aboveground Piping Systems:

1. Install LP gas piping according to NFPA 54.
2. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
3. Route piping in orderly manner and maintain gradient.
4. Where required, bend pipe with pipe bending tools according to procedures intended for that purpose.
5. Install piping to conserve building space and not interfere with use of space.
6. Size and install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.
7. Group piping whenever practical at common elevations.
8. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
9. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
10. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.
11. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
12. Provide support for utility meters according to requirements of utility company.
13. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood. Protect vent against entry of insects and foreign material.
 - a. Minimum Vent Size: Connection size at regulator vent connection.
 - b. Run individual vent line from each relief device, independent of breather vents.
14. Breather vents may be manifolded together with piping sized for combined appliance vent requirements.
15. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Section 09 90 00 – Painting and Coating.
16. Install identification on piping systems including underground piping. Refer to Section 23 05 53 – Identification for HVAC Piping and Equipment.
17. Install valves with stems upright or horizontal, not inverted.
18. Protect piping systems from entry of foreign materials by temporary covers, completing Sections of Work, and isolating parts of completed system.
19. Install medium pressure gas pressure regulator with tee fitting between regulator and upstream shutoff valve. Cap or plug one opening of tee fitting.
20. Install medium pressure gas pressure regulator with tee fitting not less than ten pipe diameters downstream of regulator. Cap or plug one opening of tee fitting.
21. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.
22. Provide new gas service complete with gas meter and regulators as indicated on Drawings.

3.03 FIELD QUALITY CONTROL

- A. Where gas appliance will be damaged by test pressure, disconnect appliance and cap piping during pressure test. Reconnect appliance after pressure test and leak test connection.
- B. Where gas appliance is designed for operating pressures equal to or greater than piping test pressure, provide gas valve to isolate appliance or equipment from gas test pressure.
- C. Fuel gas piping shall be tested using compressed air or dry nitrogen at 25 psig test pressure and shall show no drop in pressure in a 2-hour period. Immediately after fuel gas is turned on into a new system, the piping shall be tested for leakage; gas leaks shall be located by a non-corrosive leak detector fluid.
- D. Where new branch piping is extended from existing system, pressure-test new branch piping only. Leak-test joint between new and existing piping with noncorrosive leak detection fluid or other approved method.
- E. When pressure tests do not meet specified requirements, remove defective Work, replace and retest.
- F. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.
 - 1. Where leakage is detected, shut off gas supply until necessary repairs are complete.
- G. Do not place appliances in service until leak testing and repairs are complete.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Duct Materials.
2. Glass fiber ducts.
3. Flexible ducts.
4. Insulated flexible ducts.
5. Single wall spiral round ducts.
6. Transverse duct connection system.
7. Casings.
8. Ductwork fabrication.
9. Kitchen hood exhaust ductwork fabrication.
10. Duct cleaning.

1.02 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts according to ASHRAE table of equivalent rectangular and round ducts.

1.03 SUBMITTALS

- A. Product Data: Duct materials.

1.04 QUALITY ASSURANCE

- A. Perform Work according to SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A standards.
- C. Manufacturer: Company specializing in manufacturing products specified in this Section with three years' experience.
- D. Installer: Company specializing in performing Work of this Section with three years' experience.
- E. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code".

- F. Fiberboard duct is not acceptable duct material except when used for fabricating return air sound traps.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

1.06 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.07 WARRANTY

- A. Furnish one-year manufacturer warranty for products.

PART 2 PRODUCTS

2.01 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating (0.90 oz/sf) in conformance with ASTM A90/A90M. Sheets shall be free of pits, blisters, slivers, and un-galvanized spots.
- B. Fasteners: Use galvanized rivets, bolts, and sheet metal screws throughout, except on stainless ductwork, use SS fasteners.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded. Use galvanized steel, 1/4 inch minimum diameter fasteners for ductwork 36 inch or less in length; use 3/8 inch minimum diameter for lengths longer than 36 in.
- D. Hanger Straps: ASTM A653 galvanized steel having G90 zinc coating in conformance with ASTM A90.
- E. Structural Steel Members: ASTM A36 steel. Use aluminum, 6061-T6 or galvanized steel members for aluminum ducts.
- F. Supports: Angle iron, channels, rods and related supporting materials shall be galvanized or red oxide coated.

2.02 DUCTS

- A. Glass Fiber Ducts: (Use this material ONLY for fabricating return air sound traps. Use black mat interior finish.)
 - 1. Manufacturer: CertainTeed, Tough Gard with Enhanced Surface or equivalent.

2. Product Description: Rigid resin-bonded fiberglass board faced on exterior side with foil-scrim-kraft (FSK) vapor retarder, and air stream surface faced with a tightly bonded non-woven black mat facing or impregnated with a polymer coating. Service temperature 250 degrees F maximum, air velocity 5000 fpm maximum, and internal static pressure plus or minus 2 inches water maximum. The air stream surface shall contain EPA registered antimicrobial agent to reduce the potential of microbial growth. Flame spread/smoke developed 25/50 maximum meeting NFPA 90A requirements, thickness 1 inch.
- B. Flexible Ducts (Insulated, Low Pressure):
1. Manufacturer: Flexmaster, Type 5 or equal.
 2. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A. Flexible duct shall have a flame resistant rating of 25 or less and a smoke developed rating of 50 or less.
 3. Pressure Rating: 6 inches w.g. positive, 4 inches w.g. negative through 16 inches diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
 4. Rated Velocity: 4000 fpm.
 5. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.
 6. Insulation: Fiberglass, K-factor (thermal conductivity) of approximately 0.24 BTU•in/hr•ft²•F at mean temperature of 75 degrees F.
- C. Flexible Ducts (Insulated, High Pressure):
1. Manufacturer: Flexmaster, Type 3 or equal.
 2. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A. Flexible duct shall have a flame resistant rating of 25 or less and a smoke developed rating of 50 or less.
 3. Pressure Rating: 12 inches w.g. positive, 5 inches w.g. negative through 16 inch diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
 4. Rated Velocity: 5500 fpm.
 5. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.
 6. Insulation: Fiberglass, K-factor (thermal conductivity) of approximately 0.24 BTU•in/hr•ft²•F at mean temperature of 75 degrees F.
- D. Flexible Ducts (Non-Insulated, Low to High Pressure):
1. Manufacturer: Flexmaster, Type NI-35 or equal.
 2. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A. Flexible duct shall have a flame resistant rating of 25 or less and a smoke developed rating of 50 or less.

3. Pressure Rating: 12 inches w.g. positive, 5 inches w.g. negative through 16 inches diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
4. Rated Velocity: 6500 fpm.
5. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.

E. Single Wall Spiral Supply Round Ducts:

1. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.
2. Construct duct with following minimum gages:

Diameter	Gage
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

3. Construct fittings with following minimum gages:

Diameter	Gage
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.03 TRANSVERSE DUCT CONNECTION SYSTEM

- A. Product Description: SMACNA "E" rated SMACNA "F" rated or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.04 CASINGS

- A. Fabricate casings according to SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.
- B. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.
- C. Fabricate acoustic casings with reinforcing turned inward. Furnish 16 gage back facing and 22 gage perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb per cu ft minimum glass fiber media, on inverted channels of 16 gage.

2.05 DUCTWORK FABRICATION

A. General:

1. Fabricate and support rectangular ducts according to SMACNA HVAC Duct Construction Standards - Metal and Flexible. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
2. Fabricate and support round ducts with longitudinal seams according to SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards). Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
3. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
4. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45-degrees convergence downstream.
5. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
6. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.
7. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
 - a. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
 - 1) Do not provide sealing products not bearing UL approval markings.

B. Glass Fiber Duct Fabrication:

1. Fabricate according to SMACNA Fibrous Glass Duct Construction Standards.
2. Pressure sensitive tape, UL approved.
3. Machine-fabricate glass fiber ducts and fittings. Make only minor on-Site manual adjustments.
4. Staple duct joints and tape with 3 inch wide 2 mil thick or 2 inch wide 3 mil-thick aluminum.
5. Do not use glass fiber ducts within 12 inches of electric or fuel-fired heaters.

C. Kitchen Hood Exhaust Ductwork Fabrication:

1. Fabricate according to SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
2. Exposed Kitchen Hood Exhaust Ducts: Construct of stainless steel ASTM ASTM A240/A240M OR ASTM 666, type 316 using continuous external welded joints.
3. Concealed Kitchen Hood Exhaust Ducts: Construct of 16 gage carbon steel or 18 gage stainless steel ASTM ASTM A240/A240M OR ASTM 666, Type 316 using continuous external welded joints.

4. Grease Duct: Provide factory-built commercial grease ducts labeled and listed according to UL 1978.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION

- A. Install and seal ducts according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Install glass fiber ducts according to SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.
- C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.
- E. Install duct hangers and supports according to Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
- F. Use double nuts and lock washers on threaded rod supports.
- G. Connect flexible ducts to metal ducts with draw bands.
- H. Install kitchen range hoods according to NFPA 96.
- I. Install residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out.
- J. Kitchen Hood Exhaust Ducts: Use stainless steel for ductwork exposed to view and stainless steel or carbon steel where ducts are concealed.
- K. For outdoor ductwork, protect ductwork, ductwork supports, linings and coverings from weather.
- L. Exhaust Outlet Locations:
 1. Minimum Distance from Property Lines: 3 feet.
 2. Minimum Distance from Building Openings: 3 feet.
 3. Minimum Distance from Outside Air Intakes: 10 feet.
- M. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

- N. Install balancing dampers with indicating type locking quadrant where noted on Drawing. Inspect and ensure that the construction of balancing dampers, including the hand quadrant, is of good quality prior to installation.
- O. Install flexible connections with minimum 1 inch slack immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- P. Where indicated, weld or braze duct joints and seams in accordance with AWS D9.1.
- Q. Repair damaged galvanized ductwork surfaces (welds, scratches, etc.) by applying minimum 2 coats of a zinc base paint.
- R. Paint exposed ductwork in occupied areas to match surroundings. Refer to Section 09 90 00 – Painting and Coating.
- S. Provide UL/FM approved through-penetration firestop system when penetrating fire-rated barriers (i.e., walls, floors, etc.).
- T. Secure duct liner with mechanical fasteners and adhesive per SMACNA duct liner standards and/or manufacturer's installation specifications. Coat all raw exposed edges per manufacturer's instructions.
- U. Insulate ductwork in accordance with Section 22 07 13 – Plumbing and HVAC Insulation.
- V. Provide duct drops to diffuser same size as diffuser neck size.
- W. Seal duct seams and joints in accordance to the duct pressure classification as described in SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- X. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
 - 1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
 - 2. Do not provide sealing products not bearing UL approval markings.
- Y. Do not use pressure-sensitive sealant on ducts with a pressure class of 1 inch w.g. or greater.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

- B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

3.04 CONCEALED GREASE DUCT TESTING

- A. Prior to concealing, wrapping, or insulating grease ductwork, or placing grease duct in service, perform leakage test.
- B. Test complete extent of duct installed, including joint at which duct connects to exhaust hood.

3.05 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean duct systems in accordance with National Air Duct Cleaners Association (NADCA) specifications.
 - 1. The cleaning agency shall be a certified member of NADCA, or shall be certified by a nationally recognized program and organization.

3.06 SCHEDULES

- A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply (Heating Systems)	Galvanized Steel
Supply (Cooling Systems)	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Kitchen Hood Exhaust	Stainless Steel
Dishwasher Exhaust	Stainless Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Intake and Exhaust	Galvanized Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Supply ductwork	1 inch w.g.
Return air ductwork	1 inch w.g.
Restroom exhaust and general exhaust air ductwork	2 inch w.g.
Return and Relief	1 inch w.g.
General Exhaust	2 inch w.g.
Dishwasher Exhaust	2 inch w.g.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Back-draft dampers.
 - 2. Volume control dampers.
 - 3. Flexible duct connections.

1.02 SUBMITTALS

- A. Product Data: Items listed on Drawing Equipment Schedules.

1.03 QUALITY ASSURANCE

- A. Test, rate, and label dampers according to latest UL requirements.
- B. Damper pressure drop ratings based on tests and procedures performed according to AMCA 500.
- C. Manufacturer: Company specializing in manufacturing products specified in this Section with three (3) years' experience.

1.04 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.05 WARRANTY

- A. Furnish one-year manufacturer warranty for duct accessories.

PART 2 PRODUCTS

2.01 DAMPERS

- A. Back-Draft Dampers:
 - 1. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, Galvanized 16 gage thick steel or extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment device to permit setting for varying differential static pressure.

- B. Volume Control Dampers:
1. Fabricate according to SMACNA HVAC Duct Construction Standards - Metal and Flexible.
 2. Splitter Dampers:
 - a. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
 - b. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 - c. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
 - d. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch to 12 x 48 inch.
 3. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
 4. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches w.g.
 5. Quadrants:
 - a. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 - b. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 - c. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.02 FLEXIBLE CONNECTIONS (EXPOSED TO SUN AND WEATHER)

- A. Manufacturer: Ventfabrics, Ventlon or equal.
- B. Heavy glass fiber (coated with duPont's Hypalon), fire retardant, UL Standard 214, and complies with NFPA-90A.
1. Pressure Rating: 10 inches w.g., negative and positive.
 2. Temperature Rating: Minus 10 degrees F to plus 275 degrees F.
 3. Weight: 26 oz/sq yd plus or minus 2 ounces.

2.03 FLEXIBLE CONNECTIONS (INDOOR)

- A. Manufacturer: Ventfabrics, Ventglass or equal.
- B. Heavy glass fiber (coated with duPont's neoprene), fire retardant, UL Standard 214, and complies with NFPA-90A.
1. Pressure Rating: 10 inches w.g. negative and positive.
 2. Temperature Rating: Minus 20 degrees F to plus 200 degrees F.
 3. Weight: 30 oz/sq yd plus or minus 3 ounces.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install according to NFPA 90A, follow SMACNA HVAC Duct Construction Standards - Metal and Flexible and in accordance with manufacture's installation instructions. Conform to Section 23 31 00 – HVAC Ducts and Casings, for duct construction and pressure class.
- B. Install duct accessories of materials suited to duct materials:
 - 1. Use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts.
 - 2. Stainless-steel accessories in stainless-steel ducts.
 - 3. Aluminum accessories in aluminum ducts.
- C. Install back-draft dampers or control dampers on exhaust fans or exhaust ducts as close as possible to exhaust fan and where indicated on Drawings.
- D. Install temporary duct test holes where required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- E. Install permanent duct test holes where required for testing and balancing purposes.

END OF SECTION

SECTION 26 00 10

GENERAL CONDITIONS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Labor, equipment, tools, materials, supplies, and operations necessary to install a complete electrical system, including that which may be reasonably implied on the Drawings or in the Specifications as being incidental to the work of Division 26.
- B. Labor, equipment, tools, materials, supplies, and operations required to make a completely electrically operable system of the equipment furnished under other Divisions of this Specification.

1.02 MISCELLANEOUS MATERIALS

- A. The Drawings are not intended to and do not show all equipment such as junction boxes, outlet boxes, conduit, fittings, mounting and miscellaneous hardware, and similar. Even though such items may not be specifically mentioned in the Specifications nor shown on the Drawings, nor noted on Shop Drawings, if they are necessary to make a complete installation, include them in the work required under this Division.

1.03 QUALITY ASSURANCE

- A. Use only thoroughly trained and experienced personnel who are completely familiar with the requirements of this work and with the recommendations of the manufacturer of the specified items to fabricate, install, and test the work of this Division.
- B. Where the Specifications or Drawings call for equipment or methods to be of better quality or higher standards than required by referenced Codes or Standards, the Specifications and Drawings shall prevail.

1.04 SUBSTITUTIONS

- A. When requesting substitution of material for products specified in this Division, comply with Section 01 25 00 – Substitution Procedures. Include as part of the request detailed descriptions and drawings showing all resultant changes to the electrical work.
- B. The design of certain equipment may be related to factors not immediately obvious. Changes in design of equipment may require technical justification, or require changes be made in other equipment to match the proposed changes, or require the equipment be supplied as specified, or any combination of the above, at no additional cost to the Owner.

1.05 LOCATION OF ELECTRIC EQUIPMENT

- A. The Drawings or other Specification sections define the approximate location of services, cabinets, panelboards, switches, lights, receptacles, and other equipment. Determine the most suitable location by actual measurement during construction. Maintain clearance required by NEC Article 110. Propose final location and obtain approval of the Engineer in advance of installation.
- B. Coordinate location and configuration of electrical work with the work of other trades to avoid interference, to assure convenient access for operation and maintenance of equipment, for optimum luminaire placement, and for neat appearance.

1.06 SIZE AND RATING OF MATERIALS

- A. The size and rating of the conductors, conduits, overcurrent protection devices, disconnect devices, motor starters, and other related equipment used to provide and control electric supply to the various power consuming equipment furnished under this contract have been determined based on the requirements of the specified equipment. If the requirements of the power consuming equipment actually furnished causes a need to change the rating of any of these materials:
 - 1. Consult with the Engineer to determine the changes necessary to provide and control electric supply to the equipment furnished, and
 - 2. Install the agreed upon materials at no increase in the Contract amount or time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 26 00 20

CODES, PERMITS, AND FINES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 COMPLIANCE

- A. This Section applies to Division 26 and to Division 40 Section 40 90 00 – Plant Control System, and to Sections referenced therein.
- B. Perform electrical work and provide material and equipment in compliance with the State of New Mexico Electrical Code (NMEC but also referred to as NEC in these specifications for convenience) and other national, state, and local codes, regulations, laws, and ordinances. The Engineer will resolve conflicts between the above and the Specifications or the Drawings.
- C. Without relieving the Contractor from the obligation to comply with all provisions of the NMEC and other codes and standards, attention is directed to the following portion of the NMEC, 2017, 14 NMAC 10.4.11 B. (1) “Section 110.2 Approval.” Only with written permission of the Engineer and of the Authority Having Jurisdiction (AHJ), provide certification of non-labeled equipment or material from a nationally recognized testing laboratory that has been approved by the electrical bureau.

1.02 PERMITS

- A. Obtain electrical permits. This applies whether or not the AHJ requires a permit for the structural/process portion of a project.

1.03 INSPECTIONS AND CERTIFICATES

- A. Arrange and pay for electrical inspections.
- B. Correct deficiencies noted as a result of inspections then arrange for additional inspections.
- C. Furnish properly executed certificates of final electrical inspection and approval from the AHJ at the conclusion of the work and before final acceptance of the work by the Owner.
- D. It is recognized that inspection by the AHJ is intended to determine whether the work is in compliance with applicable codes, not to determine whether the work is in compliance with the Contract Documents.

1.04 PAYMENTS TO THE AHJ

- A. Include in the Bid the cost of permits and initial inspections.
- B. No change in the Contract Amount will be allowed for other costs associated with this Section, such as but not limited to the cost for certification of non-labeled equipment, additional inspections, and fines/penalties levied by the AHJ. Exception: If a Change Order results in charges from the AHJ for an additional permit and/or additional inspections, then itemized, documented costs will be included in the Change Order amount.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 26 00 40

PROJECT RECORD DOCUMENTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 GENERAL

- A. Except as may be stated below, this Section applies to Division 26 and to Section 40 80 00 – Instrumentation and Controls, and to Sections referenced therein. It contains minimum requirements; also comply with Section 01 78 39 – Project Record Documents.

1.02 LEGIBILITY

- A. Materials that are not sufficiently legible to the Engineer may be returned without being reviewed.
- B. Materials of marginal legibility may be accepted for preliminary review but rejected for use as final Record Documents.
- C. Minimum text height on project-specific submittal drawings such as schematics, connection diagrams, loop diagrams, and similar: 1/8 inch.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONTRACT DRAWINGS

- A. Maintain a complete set of Contract Drawings in “Record” condition. Mark, initial, and date changes, modifications, or corrections as they occur.
- B. Show by dimensions and by correct scale the location and burial depth of underground conduits, duct banks, conduit stubouts, and direct buried cables. Show location and depth at each end and at every bend.
- C. Show all differences between electrical and instrumentation design and the actual construction of electrical and instrumentation systems.
- D. Have the Drawings available for inspection by the Engineer during standard work hours at the project site.
- E. Furnish the “Record” Contract Drawings to the Engineer after completing the work and tests.

3.02 SHOP DRAWINGS/SUBMITTALS

- A. Maintain a complete set of Shop Drawings in “Record” condition. Mark, initial and date changes, modifications, or corrections as they occur.
- B. Where required in the equipment sections, return field marked Shop Drawings to the respective manufacturer who shall transfer “Record” markings to the original tracings, stamp the originals “Record” and place the date adjacent to the stamp. Contractor submit.
- C. Where a connection diagram is required as part of the submittals for a Section of these Specifications, whether in Division 26 or Division 40 or not, the Record documents for that section shall include copies of the connection diagrams that show all field interconnection information. Where a wire goes to a field device, such as a STOP pushbutton, the interconnection information may simply say “STOP pushbutton, field.” Where a wire goes to an equipment where it is terminated on a terminal board, show the wire destination by equipment name or abbreviation, then terminal board number, then terminal point number, AFD1-B 6 for example.
- D. Furnish other “Record” Shop Drawings to the Engineer.
- E. Furnish “Record” submittals to the Engineer where specified in individual sections.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE WIRE AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low voltage wire and cable.

1.02 SYSTEM DESCRIPTION

- A. Furnish wire and cable for all systems except:
 - 1. Where supplied as part of an equipment or system.
 - 2. Where specifically stated otherwise in other parts of the Specifications or on the Drawings.
- B. Install, connect, mark, and test all wire and cable.

1.03 SUBMITTALS

- A. Paragraph 2.01: Not required.
- B. Paragraphs 2.02 through 2.07: Manufacturer's standard literature.

PART 2 PRODUCTS

2.01 600V POWER AND GENERAL PURPOSE WIRE

- A. Meet NEC 310, UL 83, and the ANSI C8 Series.
- B. Conductor: Copper.
- C. NEC Type: THWN/THHN
- D. Minimum wire size unless specifically noted otherwise on the Drawings:
 - 1. 480V: #10 AWG.
 - 2. 120/208/240V: #12 AWG.
 - 3. Control: #14 AWG, stranded.
 - 4. Grounding/bonding conductors: #12, except #14 for control runs.

2.02 600 POWER AND GENERAL PURPOSE WIRE (ALUMINUM)

- A. Meet UL Standard 1581 for stranded AA-800 series aluminum alloy conductors.
- B. Conductor: Aluminum.
- C. NEC Type: XHHW-2.

- D. Wire Size: #6 to 1000 kcmil.

2.03 SHIELDED CABLE (TWSH)

- A. 90 degree C. operation.
- B. Single Pair: Stranded bare or tinned copper, #16 AWG with 600V insulation, meet NEC 336.
- C. Insulation: Extruded PE, PVC, or PVC/Nylon.
- D. Conductor Identification: Colored pairs.
- E. Pair Construction: Twisted pair, lay 1-1/2 inches to 2-1/2 inches.
- F. Core Tape: Polyester with 25 percent overlap.
- G. Shield: Polyester supported aluminum tape with tinned #18 AWG copper drain wire.
- H. Jacket: Ultraviolet stabilized, flame retardant extruded black PVC with non-hygroscopic rip cord.

2.04 TRAY CABLE (TC)

- A. Meet NEC 336, 501, 725, 727, and 760. UL listed as Type TC. UL listed as suitable for direct burial in sizes #14 AWG and larger.
- B. Flame, moisture, and sunlight resistant. Meet UL 1581 Vertical Tray Flame Test at 70,000 BTU.
- C. Ratings:
 - 1. 600V.
 - 2. 90 degrees C. dry locations; 75 degrees C. wet locations.
- D. Construction:
 - 1. Conductor: Stranded soft annealed copper.
 - 2. Insulation: Polyvinyl chloride with 5 mil nylon jacket.
 - 3. Jacket: Polyvinyl chloride.
- E. Conductor Identification:
 - 1. #8 AWG and larger: ICEA Method 4.
 - 2. #10 AWG and smaller: ICEA Table K 2, Methods 1 and 4.
 - 3. As shown on Drawings or Schedules.

2.05 DEVICENET™ CABLE

- A. DeviceNet Thick Cable:
 - 1. UL Labeled 600V rated power limited tray cable (PLTC).
 - 2. Power pair, signal pair, drain wire, braided shield, jacket.

3. Specifically designed for DeviceNet data communications networks.
 4. Meet the standards of ODVA™ (www.odva.org) for trunk cable.
- B. DeviceNet Thin Cable:
1. UL Labeled 300V rated CL2/AWM cable.
 2. Power pair, signal pair, drain wire, braided shield, jacket.
 3. Specifically designed for DeviceNet data communications networks.
 4. Meet the standards of ODVA (www.odva.org) for drop cable.
- C. Northwire, Inc. (www.northwire.com/devicenet) DataCELL® FIELD DeviceNet Cable or Engineer reviewed equivalent.

2.06 ETHERNET CABLE

- A. Labeled as c(UL)US compliant.
- B. Verified to Category 6 ANSI/TIA/EIA-568-B.2.
- C. Four pair 24 gage with blue jacket.
- D. Use ANSI/TIA/EIA compliant connectors and installation.

2.07 PROFIBUS CABLE

- A. NEC PLTC. UL listed.
- B. For Profibus DP signals.
- C. 300V 75 degree C.
- D. Construction:
 1. 2 – 22 AWG (7x30 AWG) stranded copper with FRFPE insulation, twisted.
 2. 100% coverage foil insulation.
 3. 65% coverage tinned copper braided shield.
 4. Purple PVC jacket.
- E. Belden Profibus DP Hi-Flex, 3079E, or equivalent.

2.08 OTHER WIRE AND CABLES

- A. As supplied under other Sections or as required on the Drawings or Schedules.

PART 3 EXECUTION

3.01 COLOR CODING

- A. 600V Power and General Purpose Wire:
 - 1. Neutral and ground as required by NEC. Where two neutrals are run in a conduit, make one white and one grey. For three: one white, one grey, and one white that is field marked with a band of grey tape at each end.
 - 2. 480V Phases: Brown, orange, yellow (A,B,C, respectively).
 - 3. 120/240V: Black and blue.
 - 4. 120/208V: Black, blue, violet (A,B,C, respectively).
 - 5. Motor Control Leads:
 - a. THWN/THHN: Red to field devices with white (grey) neutral.
 - b. Tray Cable: Inherent to cable.
 - 6. THWN/THHN: #14 to #10 AWG: Colored insulation.
 - 7. THWN/THHN: Larger than #0: Tape may be used.
- B. TWSH and TC: Inherent to cable construction.
- C. Color shall be the same from end to end of a run. Do not change conductor color at splices or terminal boards.

3.02 MARKING

- A. Mark all field conductors unless directed otherwise on the Drawings or Schedules.
- B. Text:
 - 1. Power and Control Circuits associated with MCC:
 - a. Mark power feeders to motors with the motor control center number, cubicle number and terminal strip number, such as, 28 2A-T1 for MCC 28, cubicle 2A, phase A.
 - b. Mark control conductors with motor tag number followed by MCC cubicle terminal point number; such as, M3941-X2. Use pump or equipment number in the absence of a tag number.
 - 2. All lighting circuits and power circuits not associated with a motor control center (MCC): Panel designation and circuit number, such as, LP1-12, or PPA-23,25,27.
 - 3. Lighting and power circuits from a panelboard furnished as an integral part of a MCC: Panel designation and circuit number, such as, LP1-12, or PPA-23,25,27.
 - 4. Control Circuits not associated with MCC: Terminal board number or wire number shown on schematics and/or submittals.
 - 5. Instrumentation (all ends of complete run of all milliamp signal cables): Tag number, i.e., LS01, on pair, then "+" on positive conductor. Use black for positive polarity and white for negative.
 - 6. Mark otherwise as specifically shown on the Drawings or Schedules.

- C. Method:
1. Hot marked (embossed, not just surface printed) heat shrink tubing of the proper diameter; Raychem, or
 2. Typed or computer printed, wrap-on, cloth adhesive labels held in place with a length of clear heat shrinkable tubing, or
 3. Typed or computer printed, wrap-on labels held in place with a wrapped and heat bonded cover, 3M ScotchCode, or
 4. Engineer reviewed equivalent.
 5. Direct hot marking of wire or labeling methods, which depend solely on adhesive for attachment, are not acceptable.
- D. Location: Install wire markers at every connection point to terminal boards, control stations, indicators, starters, instruments, and similar equipment, and at all splices.

3.03 TAGGING

- A. Tag conductors and cables unless directed otherwise on the Drawings or Schedules.
- B. Text:
1. Power and Control Circuits associated with MCC: MCC number and cubicle designation, such as MCC28-2BL.
 2. All lighting circuits and power circuits not associated with a motor control center (MCC): Panel designation and circuit number, such as, LP1-12, or PPA-23,25,27.
 3. Lighting and power circuits from a panelboard furnished as an integral part of a MCC: Panel designation and circuit number, such as, LP1-12, or PPA-23, 25, 27.
 4. Control Circuits not associated with MCC: Name of equipment being controlled.
 5. Instrumentation: Tag number.
 6. Mark otherwise as specifically shown on the Drawings or Schedules.
- C. Method:
1. Loosely group conductors of same service. Use tie wraps to keep grouped.
 2. Install marking tag as specified in Section 26 05 53.
- D. Location: In pull boxes, handholes, manholes, and other enclosures where accessible but neither terminated nor spliced. It is not necessary to tag conductors in 4 by 4 or smaller boxes, or in conduit bodies.
- E. Mark the cover of 4x4 or smaller boxes with a permanent black felt tip marker to indicate wiring content as required in paragraph 3.03.B above.

3.04 INSTALLATION

- A. Install all wiring in conduit, except where specifically allowed otherwise on the Drawings.

- B. Bending Radii: Not less than permitted by ICEA or as recommended by cable manufacturer, whichever is greater.
- C. Cable in cable trays, open wireway, and trenches:
 - 1. Except for individual THWN grounding conductors, use TC or PLTC only.
 - 2. Maintain separation between AC and DC cables.
- D. Splicing:
 - 1. Power Circuits:
 - a. Splicing of THWN/THHN and XHHW-2 conductors is permissible in boxes, enclosures, handholes, manholes or similar accessible and protected locations.
 - b. Splicing in conduit bodies is not permitted.
 - 2. Control circuits and instrument wiring:
 - a. No splicing allowed.
 - b. If intermediate connections are required, provide enclosure and terminal block(s) where allowed by Engineer. Mark conductors as required above in this Section. Mark terminal boards as required in Section 26 27 27.
 - 3. Direct buried splices allowed only as shown on the Drawings or Schedules.
- E. Shields of TWSH:
 - 1. Ground instrumentation cable shields at the PLC Cabinet.
 - 2. Cut shield at field end 1/2" shorter than cable pair(s). Install heat shrink tubing over shield to prevent contact with ground.

3.05 UNUSED CONDUCTORS OF TC, PLTC

- A. When a cable has conductors which are not shown to be terminated then fold them back and tape in place. Do not cut short.

3.06 GROUNDING CONDUCTORS

- A. Grounding Electrodes/Grounding Electrode Conductors: Bare copper.
- B. Equipment Grounding Conductors: Insulated as required in 2.01, or as part of a cable. Bare copper where shown thus on the Drawings.

3.07 SCHEDULE

- A. Wire and cable required under this Section for this project:
 - 1. PARA 2.01 600V Power and General Purpose Wire
 - 2. PARA 2.02 600 Power and General Purpose Wire (Aluminum)
 - 3. PARA 2.06 Ethernet Cable

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Furnish, install, connect, and test a complete grounding system for all non-current carrying conductive components and grounded circuit conductors of the wiring system, building structural steel, metallic piping, motor controls and panels, transformer neutrals and cases, motor frames, and other electrical systems and components.
- B. Where grounding systems are not shown on the Drawings, as a minimum, ground in accordance with the NEC.
- C. Where grounding systems are shown on the Drawings and are more stringent than required by the NEC, the Drawings take precedence.

1.02 SUBMITTALS

- A. Literature for electrolytic ground rods.

PART 2 PRODUCTS

2.01 GROUND RODS

- A. High carbon steel rod with minimum 0.01 inch thick electroplated copper coating.
- B. Minimum 5/8" diameter and minimum 10' long; provide larger if so scheduled or shown on the Drawings.
- C. Nehring Electrical Works Company NCC series (NCCS series for sectional rods) or Engineer approved equivalent.

2.02 ELECTROLYTIC GROUND RODS

- A. Manufacturer:
 - 1. Minimum 10 years experience manufacturing electrolytic ground rods.
 - 2. ISO 9002 certified.
- B. Ground Rod:
 - 1. UL listed.
 - 2. 100% self activating/sealed and maintenance free without addition of chemical or water solutions.

3. Operate by hygroscopically extracting moisture from the air to activate the electrolytic process improving performance.
4. 100% copper 2" nominal diameter hollow copper tube with a minimum wall thickness of 0.083 inches.
5. Permanently capped on the top and bottom with air breather holes in the top of the tube and holes in the bottom of the tube for electrolyte drainage into the surrounding soil.
6. Factory filled with non-hazardous Calsolyte to enhance grounding performance.
7. Ten feet long unless shown otherwise by schedule or Drawings.
8. Provide a stranded 4/0 AWG Cu ground wire that is bonded to the side of rod by means of heavy-duty exothermic welding process.
9. 25 year manufacturer's warranty.
10. Lyncole XIT or Engineer approved substitution.

C. Backfill Material:

1. Provide manufacturer recommended quantity but minimum 50 pounds per rod.
2. Natural volcanic, non-corrosive form of clay grout backfill material free of polymer sealants, which absorbs approximately 14 gallons of water per 50 pound bag for optimal 30% solids density and which has a pH value of 8-10 with maximum resistivity of 3 ohm-m at 30% solids density.
3. Lynconite II or Engineer approved substitution.

2.03 GROUND ACCESS BOX

A. Composite Box:

1. For non-traffic applications only.
2. Provide snap-lock flush cover with "breather" holes.
3. Nominal twelve inch diameter by ten inches high.
4. Lyncole model XB-12F or Engineer approved substitution.
5. Use only where specifically called for on Drawings.

B. Precast Concrete Access Box, Medium Traffic:

1. Slots for conduit entrances.
2. Minimum size ten inch diameter by twelve inches high.
3. Round cast iron grate flush cover with "breather" slots.
4. Lyncole Model XB-12C or Engineer approved substitution.
5. Unless shown otherwise on the Drawings, use in dirt areas, in sidewalks, and in asphalt dust aprons.

C. Precast Concrete Access Box, Heavy Traffic:

1. Minimum twelve inch diameter by ten inches high.
2. Cast iron frame with lifting sockets.
3. Triangular cast iron cover with breather holes.
4. Lyncole model XB-22 or Engineer approved equal.
5. Unless shown otherwise on the Drawings, use in driveways, parking lots, access aprons, alleys (paved or otherwise), private streets, and public streets.

2.04 GROUND CONDUCTORS AND TAPS

- A. Stranded soft-drawn bare copper.
- B. Conductor Size: NEC Article 250, unless shown larger on Drawings.

2.05 CONNECTIONS

- A. Use heavy duty exothermic welding process (HDEWP) or NEC/UL approved/listed compression connectors for all copper to copper grounding connections and for copper to ground rod connections.
- B. Use NEC/UL approved/listed compression connectors from copper conductor to structural reinforcing rod. Burndy Hyground Hygrid YGL-C or Figure 6 Hytap YGHP-C, or equal.
- C. Connection to power equipment (switchboard, MCC, panelboard, AFD, and similar): Install compression lugs on wire and bolt lugs to equipment ground bus.

PART 3 EXECUTION

3.01 CONDUIT AND RACEWAY SYSTEMS

- A. Conduit Systems at Panels and Boxes: Double locknuts with sealing-type locknut on outside. Use bonding jumpers for conduits installed in concentric or eccentric knockouts and between conduits installed at non-metallic boxes.
- B. Conduit Systems: Install a green insulated grounding conductor in all conduits for the length of the conduit. Size conductor in accordance with the NEC, as a minimum, unless otherwise specified on the Drawings. Use grounding bushing and connectors.
- C. Install a #4/0 (minimum) bare copper grounding conductor under all underground primary power duct banks. No grounding conductor is required in primary conduits.
- D. Install bare copper grounding conductors within or under other duct banks as shown on the Drawings.

3.02 SOLID GROUND RODS

- A. Install in firm soil outside of excavated areas.
- B. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
- C. Unless either excluded or shown otherwise on the Drawings, install access box at each rod. If box will have concrete cast adjacent to it, install one-half inch expansion material around box before pouring concrete. Set box flush with concrete surface.

- D. Depth:
 - 1. Where access box is installed, drive rod so top is 4 inches below finished grade.
 - 2. Where access box is not installed, drive rod so top is 24 inches below finished grade.

3.03 ELECTROLYTIC GROUND RODS

- A. Install according to manufacturer's instructions.
- B. Use for lightning protection grounds, whether specifically differentiated on the Drawings or not.
- C. Use for other grounds where shown on the Drawings.
- D. Install precast concrete access box at each rod. If box will have concrete cast adjacent to it, install ½ inch expansion material around box before pouring concrete. Set box flush with concrete surface.

3.04 STRUCTURE GROUNDING ELECTRODE SYSTEM

- A. Where shown on the Drawings, install bare copper grounding conductor in the concrete of the footing. Braze copper conductor to the tail of a reinforcing rod at minimum 4 places. Bond copper conductor to equipment where shown. Bond copper conductor to building structural steel columns, metallic piping, and similar, whether shown or not.

3.05 MARKING OF GROUND ACCESS BOXES

- A. If called for on the Drawings, mark each ground access box.
- B. Where an access box is surrounded by concrete, stamp the legend "GND" into the concrete adjacent to the box, minimum one inch high letters.
- C. Where an access box is surrounded by asphalt, pour a twenty inch by six inch by twelve inch deep concrete marker in a nearby non-traffic area with the legend "GND BOX ?? FT" and an arrow pointing to the box, minimum one-inch high characters.
- D. Where an access box is surrounded by dirt, pour a six inch by six inch by twelve inch deep concrete marker adjacent to it. Stamp the legend "GND" into the concrete, minimum one inch high letters.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strut Systems.
- B. Supports.
- C. Anchors.

1.02 SUBMITTALS

- A. Not required.

PART 2 PRODUCTS

2.01 CORROSION RESISTANT METAL STRUT SYSTEM

- A. Channel:
 - 1. Designed with edges turned in, forming lips which allow special spring loaded nuts to be inserted anywhere along the channel.
 - 2. Material: 6063-T6 aluminum, or 304 stainless steel.
- B. Spring Loaded Nut and Spring:
 - 1. Nut made of 304 stainless steel and designed to provide positive locking in place when tightened.
 - 2. Spring made of zinc chromate plated steel or stainless steel.
- C. Braces, Brackets, and Structural Shapes Used in the Assembly of Metal Strut: 6063-T6 aluminum, 5052-H32 aluminum, or 304 stainless steel.
- D. Threaded Rod, Bolts, and Nuts: 304 stainless steel.
- E. All materials by the same manufacturer and designed as a system.
- F. Dimensions and Style:
 - 1. Single strut: 1-5/8" by 1-5/8" – 12 gage, solid.
 - 2. Back-to-back strut: 1-5/8" x 3-1/4" – 12 gage, solid.
 - 3. As specifically noted otherwise on Drawings.
- G. Unistrut, B-Line, Superstrut, or Engineer reviewed equivalent.

2.02 FIBERGLASS STRUT SYSTEM

- A. Strut and Hanger Rod Construction: Linear glass strands, continuous mat laminates, and corrosion-resistant polyester resins simultaneously pultruded to form a uniform rigid thermoset shape.
- B. Fiberglass: Self-extinguishing with UL 94 V-O classification.
- C. Hanger Rod Washers: Stamped from pultruded flat stock.
- D. Hanger Rod Square Nuts: Made from pultruded flat stock.
- E. Hanger Rod Nex Nuts and Strut Nuts: Injection molded.
- F. Hanger Rod Beam Clamps and Pipe Straps: Steel, with 15 mil PVC coating and SS bolts.
- G. Deflection Versus Loading and Recommended Loading: Equal to or better than that of Rob Roy Industries Rob-Glass Fiberglass Strut Support System.
- H. Single Strut: 1.715 by 1.76 by 0.15 wall by length.
- I. Back-to-Back Strut: 1.715 by 3.52 by 0.15 wall by length.

2.03 METAL STRUT SYSTEM

- A. Same as 2.01 except galvanized or painted steel.
- B. Hardware: Zinc or cadmium plated.

2.04 ANCHORS

- A. Comply with the requirements of Division 5, specifically with Section 05 50 01 – Anchor Bolts and Chemical Anchors. Lead shields with lag bolts: not acceptable. Concrete tapping screws: not acceptable.
- B. Anchors placed in poured concrete: Stainless steel expansion bolts, such as Hilti, Wejit, or equal, or chemical anchors.
- C. Anchors Placed in Concrete Masonry Units:
 - 1. Chemical anchors.
 - 2. Toggle bolts may be used in hollow portions of concrete masonry units in Non-Process Indoor Areas.

PART 3 EXECUTION

3.01 ANCHORS

- A. Comply with the installation requirements of Section 05 50 01 – Anchor Bolts and Chemical Anchors.

3.02 SUPPORT OF ALUMINUM CONDUIT AND BOXES

- A. Support with stainless steel bolts, washers, and nuts and aluminum clamps, plates, angles, and/or strut.

3.03 SUPPORT OF OTHER CONDUIT AND BOXES

- A. Support with stainless steel bolts, threaded rod, washers, and nuts and stainless steel clamps, plates, angles and/or stainless steel strut.
- B. As allowed in Paragraph 3.05.

3.04 FLEXIBLE STRAP

- A. Flexible steel and/or copper perforated straps (such as plumber's tape) are not acceptable for support of any electrical item.

3.05 USAGE OF STRUT

- A. Do not install fiberglass strut where exposed to sunlight.
- B. Do not cast fiberglass or aluminum strut in concrete.
- C. Follow manufacturer's recommendation as to maximum loading.
- D. Do not exceed deflection stated in manufacturer's literature.
- E. Unless specifically allowed otherwise on Drawings, use painted Metal Strut Systems (Paragraph 2.03), only in Non-Process Indoor Areas.
- F. Unless specifically allowed otherwise on Drawings, use galvanized Metal Strut Systems (Paragraph 2.03), only in Non-Process Indoor Areas, and in indoor spaces in which liquid sewage or sludge is not handled, such as a blower room.

END OF SECTION

SECTION 26 05 33.10

ELECTRICAL CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Conduit and accessories.

1.02 SUBMITTALS

- A. Manufacturer's standard literature for conduits and fittings.
- B. Additional Submittals Required for PVC RMC:
 - 1. Copy of ETL or UL Report to show compliance with the requirements of Paragraph 2.02 A.2.
 - 2. Furnish documentation certifying that each installer, who will install PVC RMC on this project, has been trained by the manufacturer in the proper methods and tools for installing PVC RMC.
 - 3. Furnish a certification from the conduit manufacturer that a representative of the manufacturer has inspected the completed installation, found the installation to conform to the Manufacturer's recommendations, and certifies the Manufacturer's Warranty is in effect. Include the ending date of the warranty on the face of the warranty.
- C. Additional Submittals Required for RTRC:
 - 1. Furnish documentation certifying that each installer, who will install RTRC on this project, has been trained by the manufacturer in the proper methods and tools for installing RTRC.
 - 2. Where installed in Class 1 Division 2 locations, if in the Schedule, or were required on the Drawings, furnish a certification from the conduit manufacturer that a representative of the manufacturer has inspected the completed installation, found the installation to conform to the Manufacturer's recommendations, and certifies the Manufacturer's Warranty is in effect. Include the ending date of the warranty on the face of the warranty.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT (RMC)

- A. Steel RMC:
 - 1. Meet NEC 344 and ANSI C80.1.
 - 2. Listed and labeled under UL6 or CSA recognized.
 - 3. Electro-galvanized on outside, inside, and on threads.

- B. Aluminum RMC:
 - 1. Meet NEC 346, UL 6, and ANSI C80.5.
 - 2. Listed and labeled under UL6 or CSA recognized.

2.02 POLYVINYL CHLORIDE COATED RIGID METAL CONDUIT (PVC RMC)

- A. Standards:
 - 1. Comply with NEC 344, UL 6, and ANSI C80.1.
 - 2. ETL Verified to meet Intertek ETL SEMKO High Temperature Water PVC Coating Adhesion Test Procedure, or successfully tested by UL for PVC adhesion after 240 hours at 100 degrees C in an air-circulating oven and 600 hours of salt spray (fog) exposure in accordance with ASTM B 117-94.
 - 3. Each length of conduit shall bear the ETL Verification Mark “ETL Verified to PVC-001” and a UL6 label.
- B. Steel Conduit: Threaded, then hot-dip galvanized inside, outside, and on the threads, then coated inside, outside, and on the threads.
- C. External PVC Coating:
 - 1. 0.035 to 0.045 inch thick polyvinyl chloride on the full length of the exterior of the conduit except on the threads.
 - 2. Comply with NEMA RN 1 - Type A.
 - 3. Minimum strength of bond between galvanized steel and PVC coating: 3500 PSI.
- D. External Urethane Coating:
 - 1. Minimum 2 mil thickness of clear two-part urethane.
 - 2. Apply on threads, overlapping the PVC coating and the inner coating.
- E. Internal Urethane Coating:
 - 1. Minimum 2 mil thickness of colored two-part urethane.
 - 2. Finished coating: Sufficiently flexible so it does not peel or crack when bends are made in the conduit.
 - 3. Apply on the full length of the interior of the conduit.
- F. Boxes and Fittings:
 - 1. Listed and labeled under UL514B.
 - 2. Same materials as the conduit.
 - 3. Coated on the exterior, interior, and threads the same as the conduit.
- G. Boxes, Fitting, and Sealing Fittings for Hazardous Locations:
 - 1. Listed under UL886.
 - 2. Same materials as the conduit.
 - 3. Coated on the exterior, interior, and threads the same as the conduit.
 - 4. Provide gas seals which are designed and manufactured so the total allowable fill in the gas seal is not less than the total allowable fill in the conduit.
- H. PVC and Urethane Coating Repair Materials: By the conduit manufacturer.

- I. Provide manufacturer's warranty that the conduit and fittings are free from defects in material and workmanship. Length of warranty: Five years from the date of shipment from the manufacturer's plant or three years from the date the installation is certified, whichever occurs last.
- J. Perma-Cote, Robroy, Ocal, or Engineer reviewed equivalent.

2.03 RIGID NONMETALLIC CONDUIT (RNC)

- A. Might be referred to as RNMC on the Drawings.
- B. Meet NEC 352 and NEMA TC2.
- C. Listed/labeled under UL 651 for use with conductors operating at 90 degrees C.
- D. Ultraviolet resistant.
- E. Schedule 40 Polyvinyl Chloride Except Schedule 80:
 - 1. Where called for in the schedule.
 - 2. Where installed exposed, or
 - 3. Where called for on Drawings.
- F. Glue all Joints Except:
 - 1. Provide bell and spigot expansion joint with O rings where required for expansion/contraction, and
 - 2. Provide glue to thread fittings for transition to threaded conduit systems.
- G. Fittings and Cement: By conduit manufacturer.
- H. Carlon Plus 40 (Plus 80), or Engineer reviewed equivalent.

2.04 FIBERGLASS – REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

- A. Meet NEC 355 and NEMA TC14.
- B. Listed/labeled under UL 2420 (below grade) and UL 2515 (above grade).
- C. Manufacturing Process:
 - 1. Manufactured using a single circuit filament winding process.
 - 2. Winding mandrels shall be straight and true as to produce non-tapered conduits.
 - 3. Epoxy based resin system with no fillers, using an anhydride curing agent.
 - 4. Fiberglass shall consist of continuous E-glass Grade "A" roving.
 - 5. Curing using two step oven heated process.
 - 6. Interior conduit body walls shall be smooth and all fibers embedded in the epoxy.
- D. Mechanical Characteristics:
 - 1. Tensile strength: 11,000 psi (ASTM D2105)

2. Compression strength: 12,000 psi (ASTM D695)
3. Impact resistance: ASTM D2444

Minimum Impact Resistance @ 0°C		
Size (inches)	Standard Wall Ft-lbs	Heavy Wall Ft-lbs
0.75	20	150
1	25	400
1.5	35	500
2	40	550
2.5	55	600
3	70	700
3.5	80	850
4	120	1,000
5	160	1,200
6	200	1,300

E. Minimum Wall Thickness:

Size (inches)	Standard Wall – Wall Thickness (inch)	Heavy Wall – Wall Thickness (inch)
0.75	.070	.25
1	.070	.25
1.5	.070	.25
2	.070	.25
2.5	.070	.25
3	.070	.25
3.5	.070	.25
4	.096	.25
5	.096	.25
6	.096	.25

- F. Couple by means of bell and spigot with triple seal gasket or with glued couplers. Glued couplers required when there is no interference joint (e.g. after a field cut).
- G. Elbows: Factory formed.
- H. Factory assemble couplers onto conduit where adapting to different conduit types.
- I. Two-Part Epoxy: Provided by manufacturer of conduit.
- J. Champion Fiberglass or Engineer reviewed equivalent.

2.05 ELECTRICAL METALLIC TUBING (EMT)

- A. Meet NEC 358. Listed/labeled under UL 797.

- B. Connectors and Couplings:
 - 1. Steel, not die-cast.
 - 2. Rain-tight compression type, T&B TC11xA or equivalent.
 - 3. Neither set screw nor indenter type will be acceptable.
- 2.06 FLEXIBLE METAL CONDUIT (FMC)
 - A. Meet NEC 348. Listed/labeled under UL 1.
 - B. Steel.
 - C. Use a single piece for each run. Do not use couplings.
 - D. Connectors: Steel squeeze type, Appleton Catalog Numbers 7480 through 7490, or Engineer reviewed equivalent.
- 2.07 LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LFMC)
 - A. Meet NEC 350.
 - B. Listed/labeled under UL 360 for use in ambient temperatures from –30 degrees C to +80 degrees C, wet.
 - C. Galvanized steel with UV resistant PVC jacket.
 - D. Use a single piece for each run. Do not use couplings.
 - E. Connectors: Appleton ASTM series or Engineer reviewed equivalent.
- 2.08 LIQUID-TIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)
 - A. Conform to NEC 356.
 - B. Listed/labeled under UL 1660 for use in ambient temperatures up to +80 degrees C, dry; +60 degrees C, wet.
 - C. Sunlight resistant.
 - D. Use a single piece for each run. Do not use couplers.
 - E. Connectors: Appleton ASTM series or Engineer reviewed equivalent.
- 2.09 OTHER CONDUITS
 - A. Meet requirements of appropriate NEC article and applicable UL standard.
 - B. Use only after specific written approval of the Engineer.

2.10 FLEXIBLE EXPLOSION-PROOF COUPLING (XPFC)

- A. Listed/labeled under UL 886.
- B. Braided steel or copper alloy with inner insulating sleeve.
- C. Fittings: Threaded.
- D. Crouse-Hinds Series EC, or Engineer reviewed equivalent.

2.11 CABLE CONNECTOR

- A. Aluminum liquid tight, strain relief type, T & B 29XXSST series.
- B. Where installed through enclosure wall, also use sealing ring with SS retainer, T & B 5262 series.

2.12 CONDUIT GAS SEALS

- A. Approved for use in Class I and Class II areas as defined in NEC Article 500.
- B. Listed/labeled under UL 886.
- C. Malleable iron construction with NPT threads.
- D. Where used with PVC RMC or RTRC conduit, provide seals with the same coating systems as the conduit and other fittings.
- E. Designed so the cross-sectional area is larger than or equal to the cross-sectional area of the conduit.

PART 3 EXECUTION

3.01 CONDUITS REQUIRED

- A. Many conduits and associated conductors are not shown or are only partially shown on plan views in the Drawings. Install as if fully shown.
- B. In addition to conduits that are shown on plan views in the Drawings:
 - 1. Install conduits which are shown in the conduit schedules. Schedules are appended to this Section or are included in the Drawings.
 - 2. An entry in a conduit schedule requires conduits and conductors end-to-end, complete. For example, there is only one entry for a given motor feeder, even though there is actually one conduit and set of conductors from the starter to the local disconnect switch and another from the disconnect switch to the motor.
 - 3. Install as implied for circuiting, such as where a panelboard circuit number is shown adjacent to a wiring device, and from switches to associated luminaires.
 - 4. Install as called for in panelboard schedules.
 - 5. Install as called for in tables shown as part of schematic diagrams.

6. Install as required for control of process equipment. Pay special attention where recommendations of the manufacturer of the process equipment supplied differ from that shown in the design.
7. Install as required for a complete system.
8. Install as called for on the One-Line Diagram.

3.02 INSTALLATION

- A. Conduit Bends:
 1. Factory made or made with a conduit bending machine recommended by the conduit manufacturer.
 2. If EMT is specifically allowed in the matrix of conduit usage then bends in EMT may be made with a hand bender which fully supports the side walls.
- B. Wrench tighten all threaded joints, couplings, fittings, and connectors.
- C. Run conduits concealed in finished areas and where indicated on the Drawings. In many places, such as at motors and surface-mounted wiring devices in pump rooms and electrical rooms, the end of a run may be an exposed vertical riser even though the symbol used for the conduit denotes concealed.
- D. Run exposed conduit either parallel with or perpendicular to structural members of the building or structure except where allowed otherwise by the Engineer.
- E. The only conduit that may be above a roof is conduit that serves equipment on that roof. Locate roof penetrations so no horizontal runs of conduit are required on the roof.
- F. Conduit installed above lay-in ceilings will be considered to be concealed, and need not comply with parallel/perpendicular requirements for exposed conduit. Route to avoid interference with piping, duct work, and luminaries. Locate conduit well above the lay-in ceiling. Support independently of ceiling suspension wires.
- G. Do not install conduit on slabs, decks, sidewalks or floors where it may create a trip hazard. The Engineer or Owner judges what conditions are "trip hazards". Conduits may be installed on slabs only with written permission from the Engineer or Owner.
- H. Drainage: Avoid pockets in conduit runs. Provide suitable drainage fittings in low spots in exposed conduit. Weep holes not permitted.
- I. Field Cuts and Threads:
 1. Cut ends of conduit square. Ream to remove burrs and sharp edges.
 2. Non-factory threads: Same effective length, thread dimensions, and taper as factory cut threads.
 3. Carefully remove burrs from threads.
 4. For steel RMC, paint conduit threads with vinyl repair compound, same as used for PVC RMC.

- J. Supports:
1. Comply with NEC and Section 26 05 29 – Hangers and Supports.
 2. In horizontal conduits runs install one-hole conduit straps with the anchor below the conduit.
- K. Conduit Ends:
1. Where conduits terminate in hand holes, manholes, trenches, floor cavities, or similar, or through concrete into open-bottom enclosures plug spaces between conductors/cables and conduit with duct seal.
 2. Protect conduit ends during construction to prevent entrance of foreign material.
 3. Install insulated throat grounding bushing on conduit ends and install bonds as specified in Section 26 05 26 – Grounding and Bonding, and as required by the NEC.
 4. Where conduits enter an enclosure from underground, whether through concrete or from earth (such as in a transformer), set end of conduit at two to three inches above the surrounding or nearby concrete.
- L. Clean and swab inside by mechanical means to remove foreign materials and moisture before wires or cables are installed, also for spare conduits.
- M. Spare Conduits:
1. Blow a pull string through the conduit.
 2. If end is buried or exposed to weather, glue pull string to inside of cap with silicone seal, let set, leave adequate slack, then install cap.
 3. Where not exposed to weather, seal conduit end with duct seal.
- N. Use anti-seize compound on threads of aluminum RMC.
- O. Conduit and Boxes Installed on Guard Rails:
1. Allowed only where shown on the Drawings or where specifically proposed in writing by the Contractor and approved by the Engineer.
 2. If allowed for conduits, mount on the outside of the rail (opposite from the walking surface).
 3. If allowed for enclosures, install strut on the outside of the rail then extend upward to support enclosures.
 4. Where guard rail is removable, provided with a gap and chains, or has a gate, run conduit on the side of the bridge, below the level of the walking surface.
- P. Where shown on Drawings, provide sleeves for conduit penetrations. Where the penetration is through the wall of a process structure which contains water, provide mechanical “link-seals” between the inside of the sleeve and the outside of the conduit. Seal other penetrations with 40-year rated silicone seal.
- Q. Requirements where conduits enter/exit a structure/building below grade:
1. Do not run conduits in/through footings.
 2. Bury conduits larger than 2 inch trade size minimum 12 inches below the bottom of the footing.

3. Fewer than 5 conduits of 2 inch trade size or less in a loose grouping may penetrate the stem wall.
 4. More than 5 conduits of any size in a grouping:
 - a. Bury minimum 12 inches below the bottom of the footing or
 - b. Submit structural details of blockouts and reinforcing through the stem wall for review by the Engineer. After conduits are installed through a blockout, fill the remaining space with non-exothermic, non-shrink grout.
- R. Expansion Joints: Where conduit spans building expansion joints or in long duct runs, use expansion fittings and bonding jumpers.

3.03 INSTALLATION OF PVC RMC

- A. Comply with installation requirements of Paragraph 3.02. In addition, comply with the requirements of Paragraph 3.03.
- B. Obtain training and certification of installers of PVC RMC from the manufacturer and use only installers who are trained and certified and whose records are on file with the Engineer, all specifically for this project.
- C. Use special bending tools, vise jaws, pliers, wrenches, drivers, and other tools designed for working with PVC RMC to eliminate damage to the PVC coating.
- D. Repair external coating where damaged. Apply coating repair liquid in multiple coats so the thickness of the coating at the entire damaged area is minimum 80 mils.
- E. Paint all metal surfaces exposed by field cutting and/or threading with colored two-part urethane and allow to dry before installing conduit.
- F. Paint male threads with coating repair liquid immediately prior to installation of a fitting or coupling.
- G. During installation, seal PVC to PVC at the joints with coating repair liquid.
- H. The requirements of the above five paragraphs are minimum requirements, even if more stringent than the recommendations of the manufacturer. If portions of the recommendations of the manufacturer are more stringent than the above, follow those as well. Bring objections of the conduit manufacturer (if any) to the Engineer for resolution.
- I. Furnish the services of an authorized representative of the conduit manufacturer to inspect the finished installation.
 1. If the representative cites installation problems then rectify the problems.
 2. When the representative finds the installation to be at least in accordance with the manufacturer's recommendation, then obtain from the representative and furnish to the Owner a certification from the conduit manufacturer that the installation conforms to the manufacturer's recommendations and that the Manufacturer's Warranty is in effect.

3. If during the warranty period any material or the installation of any material is defective, replace or repair such material as mutually agreed between the Owner and the Contractor. Replacement or repair operations shall not adversely affect the warranty.

3.04 INSTALLATION OF RTRC

- A. Comply with installation requirements of Paragraph 3.02. In addition, comply with the requirements of Paragraph 3.04.
- B. Obtain training and certification of installers of RTRC from the manufacturer and use only installers who are trained and certified and whose records are on file with the Engineer, all specifically for this project.
- C. Use special tools designed for working with RTRC.
- D. Where installed in a Class I Division 2 location, for below grade elbow elbows, and where penetrating a concrete slab, only Heavy Wall RTRC shall be used. All other locations Standard Wall is acceptable, except if noted otherwise in the Schedule or on the Drawings.
- E. Where installed in Class 1 Division 2 locations, if in the Schedule, or were required on the Drawings, furnish the services of an authorized representative of the conduit manufacturer to inspect the finished installation.
 1. If the representative cites installation problems then rectify the problems.
 2. When the representative finds the installation to be at least in accordance with the manufacturer's recommendation, then obtain from the representative and furnish to the Owner a certification from the conduit manufacturer that the installation conforms to the manufacturer's recommendations.
 3. If during the warranty period any material or the installation of any material is defective, replace or repair such material as mutually agreed between the Owner and the Contractor. Replacement or repair operations shall not adversely affect the warranty.

3.05 DUCT BANKS

- A. Encase conduits in 4000 PSI concrete. Comply with the requirements of Division 2 for earthwork and of Division 3 for concrete.
- B. Drawings show known interferences but others may exist. Where close to known interferences or where evidence of other interferences is found in the field, hand excavate trench.
- C. Install conduits using plastic spacers. Provide spacers maximum of 8 feet on center, but closer where so shown in the conduit manufacturer's instructions or where required for adequate support at elbows, offsets, or sweeps.
- D. Remove mud and other foreign substances from conduits before pouring of concrete.

- E. Provide minimum 3 inches of concrete all around the outside of conduits. Provide minimum 3 inches of concrete between walls of adjacent conduits.
- F. To prevent floating, tie down duct banks with reinforcing bars and steel wire before pouring concrete.
- G. Dye all concrete red. Use seven to eight pounds of Bayferrox CC16 Red dye, or Engineer reviewed equivalent, per cubic yard of concrete mix.
- H. Prevent loose dirt from falling into trench during concrete pouring operations.
- I. Pour each section, i.e. riser to riser, riser to pull box, pull box to pull box, etc., of duct in one operation. If such construction is not feasible, construction joints will be permitted, subject to review of Engineer, provided 40 mil PVC RMC is used a minimum of 5 feet on both sides of joint, and minimum 4 #4 by ten foot reinforcing bars are run through the joint.
- J. Make sure that concrete flows all around all conduits by suitable means, except do not use mechanical concrete vibrators and do not significantly displace conduits.
- K. Duct bank concrete may be poured without forming, provided trench walls are firm and do not cave; otherwise, use forms as specified in Division 3.
- L. After construction of duct banks is complete, pull a mandrel through each duct. Use a mandrel 1/4 inch smaller in diameter than duct unless the manufacturer recommends otherwise. If any obstructions are encountered or if there is evidence of water pocket in duct, locate, remove and replace that section at no cost to Owner.
- M. Where shown on the Drawings, install bare copper ground wire under or in concrete of duct bank. Connect to ground conductors/ground bars at each end.

3.06 APPLICATION

- A. RMC:
 - 1. Steel RMC is not permitted direct buried.
 - 2. Aluminum RMC is not permitted:
 - a. In contact with earth.
 - b. Embedded in concrete.
 - c. In contact with concrete below grade, outdoors, or in wet indoor locations.
- B. PVC RMC:
 - 1. Permitted in areas subject to corrosive environment.
 - 2. Permitted underground, direct buried.
 - 3. Use where required by other paragraphs of this Section or other Sections.
 - 4. Permitted for elbows in larger size underground installations of RNC.
 - 5. Use for all penetrations of slabs except:
 - a. Where a run of RNC comes into the bottom of an enclosure having an open bottom, such as an MCC.

- b. Where the upward continuation of a run is anchored to a block or poured concrete wall directly and close above the penetration.
 - c. Where the upward continuation of a run will be hidden within a wall.
 - d. Where Heavy Wall RTRC is used to penetrate a slab.
- C. RNC:
 - 1. Do not use where exposed to direct sunlight.
 - 2. Permitted underground or direct buried.
 - 3. Do not use RNC elbows for underground installations with conduit sizes 2 inches or greater. Elbows may be RTRC or PVC RMC.
- D. RTRC:
 - 1. Permitted in areas subject to corrosive environment.
 - 2. Permitted underground, direct buried.
 - 3. Permitted for elbows in larger size underground installations of RNC.
 - 4. Use where required by other paragraphs of this Section or other Sections.
- E. EMT:
 - 1. Use only where shown in the matrix of conduit usage.
- F. Flexible Conduits:
 - 1. Use for final connection to luminaires, motors, dry type transformers, HVAC equipment, water heaters, unit heaters, and similar applications.
 - 2. Do not install within a wall or slab. Do not install as/in a penetration of a wall or slab.
 - 3. Do not install in lengths of more than 18 inches except:
 - a. For connection of lay-in luminaires.
 - b. For connection of equipment where O&M manual recommends moving it for maintenance, such as certain models of uninterruptible power supply systems.
 - c. For connection of adjustable frequency drives.
 - d. Where proposed in writing case-by-case by the Contractor and specifically allowed by the Engineer. No other exceptions to length restrictions.
 - 4. LFMC and LFNC: Allowed as a factory component of luminaires and/or process equipment.
 - 5. FMC: Allowed as a factory component of luminaires.
 - 6. Use FMC for connections to adjustable equipment and devices in air ducts or plenums.
- G. Use XPFC for final connection to motors or other equipment subject to vibration in Class I Division 1 areas; also in Class I Division 2 areas if so required by NEC. XPFC is not shown in the matrix of conduit usage but use as required by above, by NEC, and where specifically called for on the Drawings.
- H. All Conduits:
 - 1. Use type specifically called for on the matrix of conduit usage. If not shown in the matrix of conduit usage, comply with requirements shown on the Drawings.

If not shown in either the matrix of conduit usage or on the Drawings, refer to the matrix of conduit usage for all other work.

2. No plastic conduit allowed above lay-in ceilings where the cavity functions as an air-handling plenum, regardless of matrix of conduit usage.
3. Do not install exposed conduits in finished areas, such as laboratories, offices, training rooms, and similar. Clarify any questionable area with the Engineer in the field before installing.

I. Matrix of Conduit Usage:

1. The matrix of conduit usage is shown on the Drawings.
2. If multiple columns are marked, any marked type is allowed subject to NEC restrictions and restrictions above, such as but not limited to those concerning buried conduits, elbows, penetrations, exposed installation, and use in cavities.
3. Different parts of a run may be of different type conduit, such as where a flexible connection is required.
4. If a column is marked "C" then use only where concealed in a wall or above a gypsum board or lay-in ceiling.
5. If a column is marked "CA" then use only above a gypsum board or lay-in ceiling.
6. If a column is marked "E" then use only for connections between electrical supply and control equipment, not for connection of utilization equipment and not for connection of field devices such as flow transmitters and hand switches. A marking of "E" is typically intended to be limited to electrical rooms.
7. If a column is marked "H" then use only above 6 feet or directly above equipment where not subject to damage.
8. See matrix of conduit usage for other column marking notes.
9. Where the matrix of conduit usage shows RNC for outdoor use, it is allowed only where protected from direct sun exposure, such as under a bridge or under a digester cover.

3.07 SIZE

- A. The Drawings and/or conduit schedules may show a minimum size for certain conduit runs. Where size is not shown, then comply with Paragraph C. below.
- B. If a conduit size has to be increased because a motor or other equipment furnished by the Contractor requires more power (and therefore larger wire and conduit than shown) than the specified motor or equipment, then include the cost of the larger conduit in the Bid.
- C. Minimum Size Requirements:
 1. As required by NEC, but larger if so shown on the Drawings or required below.
 2. Lighting circuits except circuits to HID pole lights: 1/2 inch.
 3. HID pole lighting circuits: 1 inch.
 4. 120/208/240V receptacle circuits:
 5. Last receptacle in run: 1/2 inch.
 6. Other runs: 3/4 inch.

7. 120/208/240V branch circuits to a single load: 1/2 inch.
8. 208/240V feeders: 3/4 inch.
9. 480V circuits: 3/4 inch.
10. 120VAC control circuits: 1/2 inch minimum: 3/4 inch for 10 to 20 #14; 1 inch minimum for more than 20 #14, then by NEC.
11. Shielded or coaxial cable: 3/4 inch.
12. Circuits of special systems: As shown on Drawings or as required in the specification section for the respective system.
13. Other circuits: 3/4 inch.

END OF SECTION

SECTION 26 05 34

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Boxes.

1.02 SUBMITTALS

- A. None required.

PART 2 PRODUCTS

2.01 BOXES LOCATED OUTDOORS AND IN PROCESS AREAS

- A. NEMA 4X stainless steel.
- B. Heavy-Duty Device Boxes for use with Rigid Metal Conduit:
 - 1. Copper-free cast aluminum.
 - 2. Conduit hubs cast integral with box.
 - 3. Hubs exterior to box.
 - 4. Conduit hubs with tapered threads (NPT).
 - 5. Integral green ground screw.
 - 6. Unless explicitly shown otherwise on Drawings, covers by same manufacturer as box.
 - 7. Crouse-Hinds FS/FD series or equivalent.
- C. Heavy Duty Device Boxes for use with PVC RMC: Same as paragraph B. but from the manufacturer of PVC RMC and coated the same as the conduit.
- D. Standard Duty Device Boxes for use with Rigid Metal Conduit:
 - 1. Die-cast aluminum.
 - 2. Conduit hubs cast integral with box.
 - 3. Hubs interior to box.
 - 4. Conduit hubs with tapered threads (NPT).
 - 5. Red Dot, or Engineer reviewed equivalent.
- E. As called out in specific Sections or on the Drawings.

2.02 BOXES LOCATED IN NON-PROCESS INDOOR AREAS

- A. NEMA 12 for starter enclosures, control panels, and similar unless a different type is called for on the Drawings or in specific Sections or as scheduled.

- B. Device Boxes for use with EMT:
 - 1. Single piece steel with conduit knock outs.
 - 2. Four inch square by 2-1/8 inch deep, with appropriate device cover.
 - 3. Steel City Catalog No. 2G4D series, or Engineer reviewed equivalent.
- C. Device boxes for use with rigid conduit: PARA 2.01 C.
- D. As called out in specific Sections or on the Drawings.

2.03 BOXES LOCATED IN HAZARDOUS AREAS

- A. Copper-free cast aluminum.
- B. UL listed for NEC Class and Division where installed.

2.04 CONDUIT CONNECTORS

- A. NEMA 4X Boxes: Watertight hubs; PVC coated watertight hubs for use with PVC RMC.
- B. Cast Boxes: Threaded portion of box.
- C. NEMA 12 Boxes: “O-ring” type lock nut connectors.
- D. NEMA 3R Boxes: Lock nut connectors for conduit connections to the bottom of the box but watertight hubs for all other conduit connections.
- E. Steel boxes used with EMT:
 - 1. Steel, not die-cast.
 - 2. Concrete-tight and rain-tight.
 - 3. Compression type, not set screw nor indenter type.
 - 4. Steel City TC-11x series, or Engineer reviewed equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Boxes: Securely support independent of conduits so that they are level and in vertical and horizontal alignment.
- B. Flush Boxes: Properly plumb, flush, and aligned with the surface surrounding it.
- C. Boxes Outside:
 - 1. Fully accessible and visible.
 - 2. Do not use “Exception” to Article 314.29 of the NEC.

D. Device Boxes.

1. Unless shown differently on Drawings or required by field conditions, inside in non-process areas mount receptacle boxes 18 inches centerline above finished floor.
2. Unless shown differently on Drawings or required by field conditions, outside and in process areas mount receptacle boxes 30 inches centerline above finished grade or floor.
3. Unless shown differently on Drawings or required by field conditions, mount toggle switch boxes 48 inches centerline above finished floor
4. Install heavy duty device boxes unless the use of standard duty device boxes are explicitly called for on Drawings.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and marking tags.

1.02 SUBMITTALS

- A. Not required.

PART 2 PRODUCTS

2.01 NAMEPLATES (NP)

- A. Minimum Character Height:
 - 1. 1/2" inch for the title of equipment which meets any of the following criteria:
 - a. Oil-filled transformers.
 - b. Engine generator sets.
 - c. Motor Control Centers (MCC).
 - d. Floor mounted PLC enclosures.
 - e. Automatic and manual transfer switches.
 - f. Service disconnecting means.
 - g. Equipment 400Amps or greater.
 - h. Equipment greater than 600Volts.
 - i. Equipment with interrupt rating greater than 22kAIC.
 - 2. Three-eighths (3/8) inch for the title of equipment which do not meet the criteria above and meets any of the following criteria:
 - a. Dry transformers.
 - b. Individual starters.
 - c. Individual MCC sections.
 - d. Panelboards rated less than 400Amps.
 - e. Motor/equipment disconnecting means.
 - f. Motor and/or control terminal boxes.
 - g. Wall mounted control panels.
 - 3. 1/8" minimum for other text but larger as specified below or if called for on the Drawings.
- B. Engraved Nameplates:
 - 1. Black engraving stock with white core, unless shown otherwise, below or on the Drawings.
 - 2. Gravoply, or Engineer reviewed equivalent.

- C. Printed Nameplates:
 - 1. Vinyl, self adhesive tape. Provide white, tan (sand) or gray for least contrast with color of surrounding surface.
 - 2. Color of lettering: Black.
 - 3. Brady™ Handimark® printer With Brady B-580 tape or Engineer reviewed equivalent.

2.02 CAUTION AND WARNING NAMEPLATES

- A. Comply with NEC and OSHA requirements.
- B. Engraved Nameplate: Red with white text.
- C. Instead of an engraved or custom-printed label, a standard, off-the-shelf label, such as from Seton, is acceptable.
- D. Character Size: One-quarter inch minimum height.

2.03 MARKING TAGS

- A. Engraved plate as in paragraph 2.01 with minimum 1/8" character height.
- B. Drill hole for attaching.
- C. Attach with tie wrap.

PART 3 EXECUTION

3.01 NAMEPLATES REQUIRED

- A. Motor Nameplates:
 - 1. Install a red nameplate on each motor or other electrically controlled equipment that has maintained (two-wire), remote, or automatic control.
 - 2. Character size: Caution: 1/2" characters; balance: 1/4".
 - 3. Text equivalent to "CAUTION. THIS EQUIPMENT MAY START AUTOMATICALLY OR REMOTELY."
 - 4. Instead of an engraved or custom-printed label, a standard, off-the-shelf label, such as from Seton, is acceptable. Comply with NEC and OSHA requirements.
- B. Voltage Warnings: As required by NEC and OSHA.
- C. Where called for in other Sections.
- D. As scheduled.
- E. As required on the Drawings. Generally, a note on a Drawing will call for a nameplate or NP. The type (engraved or printed) is mentioned on the Drawings only if an engraved NP is required in a location in which a printed nameplate might otherwise be allowed in the paragraphs below.

3.02 MOUNTING OF NAMEPLATES

- A. Engraved Nameplates:
 - 1. Use indoors or outdoors.
 - 2. On panel fronts, attach with screws or drive rivets. Elsewhere, attach with 30-year rated silicone seal.
 - 3. Attach with edge parallel to edge of enclosure or device plate.
- B. Printed Nameplates:
 - 1. Use only inside a fully enclosed and roofed building or structure.
 - 2. Do not use where exposed to sunlight, precipitation, freezing temperatures.
 - 3. Do not use where Drawings call for engraved nameplates.
 - 4. Self-adhesive.
 - 5. Attach with edge parallel to edge of enclosure or device plate.

3.03 SCHEDULE

- A. Minimum nameplate requirements. Refer to Drawings and other sections for additional requirements. Where italicized enter equipment specific information and where bold text is fixed.
 - 1. Panelboards, switchgear, MCCs and similar:
 - a. Line 1: Equipment Name
 - b. Line 2: Fed From: Source equipment
 - 2. Transformers:
 - a. Line 1: Equipment Name
 - b. Line 2: Fed From: Source Equipment
 - c. Line 3: Feeding: Destination Equipment
 - 3. Automatic and Manual Transfer Switches:
 - a. Nameplate 1:
 - Line 1: Equipment Name
 - Line 2: Feeding: Destination Equipment
 - b. Nameplate 2 (install next to respective position/indication):
 - Line 1: Source 1: Source Equipment
 - c. Nameplate 3 (install next to respective position/indication):
 - Line 1: Source 2: Source Equipment
 - 4. Equipment disconnecting means located near the respective equipment, starter/equipment controllers not located in a MCC and similar:
 - a. Line 1: Equipment Name
 - b. Line 2: Equipment Tag Number
 - c. Line 3: Fed From: Source equipment
 - 5. MCC cubicles (starters):
 - a. Line 1: Equipment Name
 - b. Line 2: Equipment Tag Number
 - c. Line 3: Starter Type and size (e.g. VFD, FVNR Size 2, RVSS)
 - d. Line 4: load HP rating

6. MCC cubicles (circuit breaker):
 - a. Line 1: Circuit breaker rating
 - b. Line 2: Feeding Equipment Name
7. MCC cubicles (feeders):
 - a. Line 1: Feeder Circuit Breaker or Feeder Lugs
 - b. Line 2: Fed From: Source equipment
8. MCC cubicles (miscellaneous):
 - a. Line 1: Description of cubical (e.g. Spare FVNR Size 1, E-Net I/O)
 - b. Line 2: Tag number if applicable

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panelboards.

1.02 SUBMITTALS

- A. Summary Sheet showing:
 - 1. Voltage, phases, and main bus ampacity.
 - 2. MLO panels: Type of main lugs.
 - 3. MCB panels: Main breaker rating.
 - 4. Neutral and ground bar ratings.
 - 5. Bus material and plating.
 - 6. Short circuit rating.
 - 7. Flush or surface mount, enclosure NEMA type, and trim details.
 - 8. Rating and arrangement of branch circuit breakers.
 - 9. Description of specified factory assembled modification including, but not limited to, sub-feed breakers, sub-feed lugs, feed-through lugs, and metering transformers.
- B. Panelboard layout showing all circuit breakers, strapping and mounting hardware for future circuit breakers, and space for future strapping and mounting hardware.
- C. If the submitted circuit breaker layout differs from the Drawings then demonstrate that the phase current balance will be substantially the same.

1.03 OPERATIONS AND MAINTENANCE DATA

- A. As-built layout drawing showing location, ampacity, and poles of each breaker.
- B. Copies of all directories.
- C. Settings used for electronic trip units and ground fault relays.

1.04 QUALITY ASSURANCE

- A. Conform to the following:
 - 1. UL 50 Enclosures for Electrical Equipment.
 - 2. UL 67 Panelboards.
 - 3. NFPA 70 National Electrical Code.
 - 4. NEMA PB1 Panelboards.
 - 5. UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures".

6. NEMA AB1, "Molded Case Circuit Breakers".

PART 2 PRODUCTS

2.01 PANELBOARDS – COMMON REQUIREMENTS

- A. Voltage, phases, and current ratings as shown on Drawings.
- B. Minimum branch circuit breaker space as shown on Drawings.
- C. Minimum Box Width:
 1. 14 inches for:
 - a. 100 amp, single phase, flush mounted.
 - b. 100 amp, 208Y/120 volt, three phase, flush mounted.
 2. 20 inches for all others.
- D. Main circuit breaker (MCB) or main lugs only (MLO) as shown on Drawings.
- E. Bus: Tin plated aluminum unless shown otherwise on the Drawings or Schedule.
- F. Ground Bar: Furnish all panelboards with a ground bar having a screw for each pole.
- G. Neutral Bar:
 1. 208Y/120 volt and 120/240 volt single phase panelboards: Provide 100 percent neutral bar with a screw for each pole unless shown otherwise on the Drawings or Schedules.
 2. 480Y/277 volt panelboards which are used as service equipment: Provide 100 percent neutral bar.
 3. 480Y/277 volt panelboards which power 277 volt loads, such as site lighting and UV systems, and elsewhere required on the Drawings: Provide 100 percent neutral bar with a screw for each pole.
 4. 480 volt panelboards which power no 277 volt loads: No neutral bar required.
- H. Furnish sub-feed breakers, sub-feed lugs, feed-through lugs or other factory options as shown on Drawings.
- I. Flush or surface mount as shown on Drawings.
- J. Listed and labeled for service entrance use if used for service entrance equipment or so indicated on Drawings.
- K. Circuit Breakers:
 1. Furnish circuit breakers recommended by the manufacturer of the panelboard for use in the panelboard furnished.
 2. Provide as shown on Drawings or Schedules.

- L. Furnish all required strapping and mounting hardware required for the future installation of a circuit breaker of the frame size shown where “FUTURE” is shown on the Drawings or Schedules.
- M. Furnish a panelboard with the required space for the future installation of strapping, mounting hardware, and circuit breakers where “SPACE” is shown on the Drawings or Schedules.”
- N. Circuit Breaker Mounting and Connection:
 - 1. Connection between line side of circuit breaker and bus by direct bolted connection, or
 - 2. Connection between line side of circuit breaker and bus by spring tension jaws designed to produce increased contact pressure under fault conditions and entire circuit breaker secured in place with bolt, and
 - 3. No restriction on ability to mount circuit breakers of different frame size or number of poles opposite each other.
- O. Manufacturers and Types:
 - 1. Cutler-Hammer: Pow-R-Line 1 and Pow-R-Line 2.
 - 2. General Electric: AQ, AE, and AD.
 - 3. Square D: NQOD and NF.
 - 4. Engineer reviewed equivalent.

2.02 ENCLOSURE AND TRIM

- A. Enclosure rated NEMA 1, NEMA 3R, NEMA 4, NEMA4X SS or NEMA 12 as shown on Drawings or Schedules.
- B. Enclosure constructed of zinc-coated sheet steel for all but NEMA4X SS.
- C. For NEMA 3R, 4, and 12, provide enclosure with exterior surfaces prepared, primed and painted in a light grey, ANSI 49 or similar color, at the factory.
- D. Flush mounted 208Y/120 volt and 120/240 volt single phase panelboards rated 100A: Furnish with decorative trim fastened to the box on four sides with screws or screwdriver operable captive latches and a hinged and latched door to cover access to circuit breaker operating handles but without access to any energized parts.
- E. Flush mounted 208Y/120 volt and 120/240 volt single phase panelboards rated greater than 100A and all flush mounted 480 volt panelboards: Furnish “door-in-door” trim.
 - 1. Inner door with hinges and latch to cover access to circuit breaker operating handles but without access to any energized parts.
 - 2. Outer door hinged on one side and secured on remaining sides with captive screws or screw driver operated latches. Provide door that provides full access to wiring gutter on all four sides when open.
 - 3. Provide decorative trim around box to cover the gap between the enclosure and the wall surface.

4. Provide trim prepared, primed and painted in a light grey, ANSI 49 or similar color, at the factory.
- F. Furnish Surface Mounted Panelboards with “Hinged Trim” Cover:
1. Inner door with hinges and latch to cover access to circuit breaker operating handles but without access to any energized parts.
 2. Trim hinged at one edge of box and secured on remaining sides with captive screws or screw driver operated latches. Provide door that provides full access to wiring gutter on all four sides when open.
 3. Provide trim prepared, primed and painted in a light grey, ANSI 49 or similar color, at the factory.
- G. Furnish latched and lockable door with metal frame cardholder with clear plastic window on inside of door for panel directory.
- H. Provide other features as shown on the Drawings or Schedules.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. General: Provide circuit breakers as integral components of panelboard with indicated features, ratings, characteristics, and settings.
- B. Future Devices: Equip compartments with mounting brackets, supports, bus connections and necessary appurtenances for future circuit breakers as show on the Drawings or Schedules.
- C. Molded-Case Circuit Breakers:
1. General: UL489, “Molded Case Circuit Breakers and Circuit Breaker Enclosures,” and NEMA AB 1, “Molded Case Circuit Breakers.”
 2. Suitable for use with conductors operating at 75°C.
 3. Characteristics: Frame size, trip rating, number of poles, and short-circuit interrupting capacity rating as shown on the Drawings or Schedules.
 4. Interrupting capacity not less than shown on the Drawings or Schedules. Furnish all circuit breakers with full interrupting capacity. Do not use series ratings.
 5. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous over-current trip protection for each pole.
 6. Adjustable instantaneous trip devices: Front adjustable; factory adjusted to low trip setting.
 7. Solid state trip devices: When called for on the Drawings, provide molded case circuit breakers that use solid-state trip devices.
 8. Furnish circuit breakers for lighting circuits that are switching duty rated.
 9. Furnish heating, air conditioning, refrigeration (HACR) rated circuit breakers when called for on the Drawings or Schedules.
 10. Furnish single pole circuit breakers with ground fault interrupting capability when called for on the Drawings or Schedules. When required furnish Class A (6ma.) or Class B (30ma.) as shown on the Drawings or Schedules.

- D. Electronic Circuit Breaker Trip Devices: True RMS sensing, microprocessor based, solid-state overcurrent trip device system that includes one or more integrally mounted current transformer or sensor per phase, a release mechanism, and the following features:
1. Temperature compensation to assure accuracy and calibration stability from -20°C to + 55°C.
 2. Time-current tripping functions, field adjustable with the breaker closed and energized, as scheduled or shown on the Drawings, often abbreviated as L, S, I, and G.
 - a. Adjustable long-time pick-up current.
 - b. Adjustable long-time-delay.
 - c. Adjustable short-time pick-up current.
 - d. Adjustable short-time-delay.
 - e. Adjustable instantaneous trip current.
 - f. Adjustable ground-fault pick-up current.
 - g. Adjustable ground-fault-delay.
 - h. Selectable I²t function on short-time-delay.
 - i. Selectable I²t function on ground-fault-delay.
 3. Clear, sealable cover over adjustments.
 4. Other factory options as shown on the Drawings or Schedules.
 5. Trip Indication: Labeled lights or mechanical indicators indicating long-time overload, short-time overload, instantaneous, or ground fault as cause of trip. If lights are used, furnish with integral power source capable of maintaining indication for not less than 48 hours.
 6. Arrangement to permit testing of all functions without removal from panelboard and to permit viewing and adjustment of all functions without removal of any metal panels.
 7. Furnish 80 percent rated circuit breakers unless otherwise shown on the Drawings or Schedules.
- E. Other devices as shown on the Drawing or Schedules.

PART 3 EXECUTION

3.01 PANELBOARD INSTALLATION

- A. Install panelboards following manufacturer's instructions.
- B. Mount panelboards plumb and rigid.
- C. Mount flush panelboards so that the trim fits flat against finished wall.
- D. For MLO panelboards, install compression lugs on conductors with press and die recommended by lug manufacturer. Bolt lug to bus.

3.02 IDENTIFICATION

- A. Properly and accurately label panel directories by hand during construction.

- B. Install neatly typed, accurate directories in holders prior to Substantial Completion.
- C. Identify panelboard and its source with a nameplate.

3.03 KEYS

- A. Keep panelboard keys properly marked and identified with panel number and location.
- B. Furnish the Owner at least 2 copies of all panelboard keys, with tag showing identifying number and location of panel.

END OF SECTION

SECTION 26 27 10

ELECTRICAL SERVICE

PART 1 GENERAL

1.01 RELATED SECTIONS

- A. Section 01 21 00 – Allowances

1.02 SYSTEM DESCRIPTION

- A. Arrange with the Jemez Mountains Electric Cooperative (JMEC) for the upgrade of the electric service as shown on the Contract Drawings. Perform all portions identified as the Customers responsibility, whether shown on the drawings or not. Equipment shall comply with JMEC standards.
- B. Constructed new portions of work prior transferring service to the new system in efforts to minimize the downtime to the existing loads.
- C. Pay JMEC the amount required in order for JMEC to begin construction.
- D. Submit to the Engineer detailed documentation related to all JMEC charges.
- E. Upon favorable review of JMEC charges by the Engineer, make complete payment to JMEC then recover the amount of payments made to JMEC under the Allowance.

1.03 CONSTRUCTION POWER

- A. Existing electrical service is available for construction power.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wiring Devices: Switches, receptacles, covers.

1.02 SUBMITTALS

- A. Complete manufacturer's catalog cuts.

PART 2 PRODUCTS

2.01 TOGGLE SWITCHES

- A. Heavy-duty, "silent" AC type, 20 A, 120 VAC – 277 VAC.
- B. Back and side wiring feature. Positive clamping with screw-activated pressure plate.
- C. Poles and Contact Action: As shown on the Drawings.
- D. Motor Switching Rated:
 - 1. 1-1/2 horsepower at 120 VAC.
 - 2. 2 horsepower at 240 VAC.
- E. Manufacturers:
 - 1. Hubbell HBL1221, HBL1222, HBL1223, HBL1224 series.
 - 2. Pass & Seymour 20AC1, 20AC2, 20AC3, 20AC4 series.
 - 3. Engineer reviewed equivalent.
- F. Other features or switches as shown on the Drawings or Schedules.

2.02 DUPLEX RECEPTACLES

- A. Commercial Grade Duplex Receptacle:
 - 1. NEMA 5-15R.
 - 2. Back and side wiring feature. Positive clamping with screw activated pressure plate.
- B. Specification Grade Duplex Receptacle:
 - 1. NEMA 5-15R.
 - 2. Back and side wiring feature. Positive clamping with screw activated pressure plate.
 - 3. Positive grounding without bonding jumpers.

- C. GFCI Receptacle:
1. NEMA 5-15R.
 2. Side wired.
 3. Flush polycarbonate face.
 4. Trip level: 4 to 6 mA.
 5. Trip time: .025 sec. nominal.
 6. Operating temperature: -35 °C to +66 °C.
 7. Hubbell GF5252A series, Leviton 6599 series, Pass & Seymour 1591 series, or Engineer reviewed equivalent.
- D. All toggle switches and duplex receptacles: By same manufacturer. Other switches and receptacles by the same manufacturer, except where shown by a different manufacturer in the Schedule or on the Drawings.

2.03 OTHER RECEPTACLES

- A. Other devices as scheduled or as shown on the Drawings.

2.04 DEVICE PLATES

- A. Proper for the device(s) installed.
- B. Use a single plate for multiple devices.
- C. Oversize Polycarbonate or Nylon:
1. Premium grade.
 2. Match device color.
 3. Use on flush boxes in appropriate areas.
 4. Use standard size plate if oversized plate is not manufactured.
 5. Hubbell PJ series or Engineer reviewed equivalent.
- D. Standard Size Polycarbonate or Nylon:
1. Premium grade.
 2. Match device color.
 3. Use on surface-mounted boxes in appropriate areas.
 4. Use on flush boxes in appropriate areas if oversized plate is not manufactured.
 5. Same manufacturer, material, and appearance as oversize Polycarbonate or Nylon.
- E. 302/304 Stainless Steel: Hubbell S1, or Engineer reviewed equivalent.
- F. Telephone Plates: Match material and general appearance of other device plates in the area.
- G. Special Plates: As scheduled or as shown on the Drawings.
- H. Outdoor Toggle Switch Covers: Wet location lift cover, self-closing.

- I. Damp Location Duplex Receptacle Cover and Box:
 - 1. Single horizontal self-closing lid.
 - 2. Die cast aluminum or polycarbonate.
 - 3. UL listed as raintight in the closed position.
 - 4. Meet NEC 406.8 (A).
 - 5. Box: Designed for the specific cover and device combination and recommended by the manufacturer of the cover for use with the particular weatherproof cover.
- J. Wet Location Duplex Receptacle Cover and Box:
 - 1. Single horizontal self-closing.
 - 2. Polycarbonate.
 - 3. Paintable.
 - 4. Other features as shown on the Drawings or Schedules.
 - 5. UL listed as NEMA 3R with a cord connected.
 - 6. Meet NEC 406.8 (B) (1).
 - 7. Unless shown differently on the Drawings or Schedules, furnish Carlon E9UHG, TayMac 60310, or Engineer approved equivalent.
 - 8. Box: Designed for the specific cover and device combination and recommended by the manufacturer of the cover for use with the particular weatherproof cover.

PART 3 EXECUTION

3.01 DEVICE COLOR

- A. Special Colors:
 - 1. Where scheduled.
 - 2. Where called for on the Drawings.
 - 3. Where manufacturer's or industry standard for device, such as orange for isolated ground receptacles and red for emergency power receptacles.
- B. All others: White.

3.02 USAGE OF RECEPTACLES

- A. Furnish GFCI Type Receptacles at Each Location:
 - 1. Where required by NEC or
 - 2. Where scheduled or
 - 3. Where called for on the Drawings.
- B. Unless shown otherwise on the Drawings or Schedules, use commercial grade receptacles as specified herein.

3.03 COVER TYPE

- A. Wet Location, In-use: Outdoors and in process areas not excepted immediately below.

- B. Damp Location: Indoor, above-grade process areas except spaces, such as blower rooms, that have no piping that carries sewage or sludge.
- C. Stainless Steel: In laboratories, offices, meeting rooms, lobbies and other similar office/commercial type areas.
- D. Standard Size Polycarbonate/Nylon or Galvanized Steel: Indoor surface-mounted device boxes.
- E. Oversize Polycarbonate/Nylon: Indoor flush-mounted device boxes.
- F. As scheduled or as called for on the Drawings.

3.04 INSTALLATION POSITION

- A. Mount toggle switches at 42 inches centerline above finished floor unless shown otherwise on the Drawings.
- B. Indoors: Mount duplex receptacles at 18 inches centerline above finished floor, unless shown otherwise on the Drawings.
- C. Outdoors and In Areas Considered Wet Location: Mount duplex receptacles at 30 inches centerline above finished grade or finished floor unless shown otherwise on the Drawings.

3.05 IDENTIFICATION

- A. Mount nameplate above cover plate of each receptacle and switch.
- B. Text:
 - 1. Receptacles: Panelboard designation and circuit number(s). For example: "PP3-2, 4, 6" or "LP2IG-17."
 - 2. Switches: Circuit designation as above and description of lights controlled.
 - 3. Otherwise as shown on the Drawings or Schedules.

END OF SECTION

SECTION 26 27 27

WIRE CONNECTORS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wire connectors and accessories.

1.02 SUBMITTALS

- A. If products from manufacturer and of the model shown in Part 2 are to be furnished, submittals are not required and will not be reviewed.
- B. If products from a different manufacturer or of a different model than shown in Part 2 are to be furnished:
 - 1. Submit complete manufacturer's cuts.
 - 2. Furnish other material demonstrating product equivalence as directed by the Engineer.
- C. If a manufacturer and model are not shown in Part 2, furnish complete manufacturer's cuts.

PART 2 PRODUCTS

2.01 600V WIRE NUTS

- A. UL listed and CSA certified for 600V maximum building wire, 1000V maximum fixture wire, 105° C. maximum temperature rating.
- B. Color coded outer shell to identify manufacturer approved wire combinations.
- C. Nylon insulated.
- D. Reusable.
- E. Scotch 3M Ranger 312 or Ranger 512, or Engineer reviewed equivalent.

2.02 BUTT CONNECTORS

- A. Non-insulated, brazed seam or seamless, compression type.
- B. Insulation: Tubular pre-stretched EPDM rubber cold shrink insulators. 3M 8420 series or Engineer reviewed equivalent.

2.03 MEDIUM DUTY TERMINAL BLOCKS

- A. UL component recognized.
- B. Voltage Rating: 600V UL.
- C. Material: Nylon with elevated marking strip.
- D. Spacing: 0.375 inch center to center.
- E. Contacts:
 - 1. Electrical grade copper alloy.
 - 2. Tubular clamp type.
 - 3. 40A.
- F. Wire Range: #22 to #10 AWG.
- G. Maximum Service Temperature: 105° C.
- H. Buchanan #0715, #0730, #64, #68, #99, and #52, or Engineer reviewed equivalent.

2.04 HEAVY DUTY TERMINAL BLOCKS

- A. UL component recognized.
- B. Voltage Rating: 600V UL.
- C. Material: Nylon with elevated marking strip.
- D. Spacing: 0.5 inch center to center.
- E. Contacts:
 - 1. Electrical grade copper alloy.
 - 2. Tubular clamp type.
 - 3. 70A
- F. Wire Range: #18 to #6 AWG.
- G. Maximum Service Temperature: 125° C.
- H. Buchanan #0243; #0250; #64; #68; #99; and #52, or Engineer reviewed equivalent.

2.05 POWER DISTRIBUTION BLOCKS

- A. UL component recognized.
- B. Tin plated high conductivity aluminum.
- C. Main and branch conductor size and number as shown on the Drawings or Schedules.

- D. Number of poles as shown on the Drawings or Schedules.
- E. Manufacturers:
 - 1. Square D: Class 9080 – Type LB.
 - 2. Cooper/Bussman: 16 Series.
 - 3. Engineer reviewed equivalent.

PART 3 EXECUTION

3.01 WIRE NUTS

- A. For splices on copper conductors #8 AWG and smaller.
- B. Consult manufacturer's instructions for approved wire nut based on combination of wires being spliced.
- C. Do not use for splices that may become submerged, such as in manholes, handholes, underground pull boxes, and wet wells.
- D. Do not use for control or instrumentation conductors.

3.02 COMPRESSION TYPE CONNECTORS

- A. Use only the tool and die specified by the manufacturer for installation.

3.03 BUTT CONNECTORS

- A. For splices on 120, 240, 480V circuit conductors #6 AWG and larger (except at motors). Use only where specifically required on Drawings.

3.04 MOTOR LEAD CONNECTORS

- A. Solid wire: 600V wire nuts.
- B. Stranded Wire:
 - 1. Install non-insulated, brazed seam or seamless, ring terminal compression lugs on each conductor, then bolt together.
- C. Insulate with Scotch 5300 - 5204 Series pigtail kits, or Engineer reviewed equivalent.

END OF SECTION

SECTION 26 28 13
LOW VOLTAGE FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.
- B. Fuse blocks and holders.

1.02 SUBMITTALS

- A. Catalog cuts.
- B. Time-current characteristic curves.
- C. Current limitation curves.
- D. Operating temperature characteristics.
- E. Submit only for the types of fuses, blocks, and holders required by the Drawings.

1.03 EXTRA MATERIALS

- A. Section 26 00 60 – Extra Materials for Electrical Systems

PART 2 PRODUCTS

2.01 CURRENT LIMITING, DUAL-ELEMENT, TIME DELAY FUSES

- A. Time Delay: 10 seconds minimum at 5 times rated current.
- B. Note Well: Overload portion of dual element shall open at a temperature not greater than 300° F.
- C. Interrupting Rating at rated voltage: 300,000A RMS symmetrical.
- D. UL Class RK-5.
- E. 250VAC: Bussmann Fusetron FRN-RK_SP or Engineer reviewed equivalent.
600VAC: Bussmann Fusetron FRS-RK_SP or Engineer reviewed equivalent.

2.02 FAST CURRENT LIMITING, DUAL-ELEMENT, TIME DELAY FUSES

- A. Time Delay: 10 seconds minimum at 5 times rated current.

- B. Note Well: Overload portion of dual element shall open at a temperature not greater than 300 degrees F.
- C. Interrupting Rating: 300,000A RMS symmetrical.
- D. UL Class RK-1.
- E. 250VAC: Bussmann Low Peak LPN-RK or Engineer reviewed equivalent.
600VAC: Bussmann Low Peak LPS-RK or Engineer reviewed equivalent.

2.03 HIGH AMPACITY, FAST CURRENT LIMITING, TIME DELAY FUSES

- A. Open at 150 percent of rated current within 4 hours.
- B. Time Delay: 4 seconds minimum of 5 times rated current.
- C. Interrupting Rating: 300,000A RMS symmetrical.
- D. U.L. Class L.
- E. 600 VAC: Bussmann Low-Peak KRP-C or Engineer reviewed equivalent.

2.04 CONTROL TRANSFORMER PRIMARY AND INSTRUMENT FUSES

- A. Open at 135 percent of rated current within 1 hour.
- B. Time Delay: 4 seconds minimum at 3 times rated current.
- C. Interrupting Rating: 200,000A RMS symmetrical.
- D. UL Class CC, with rejection feature.
- E. 600 VAC: Bussmann CC-Tron FNQ-R or Engineer reviewed equivalent.

2.05 SMALL DIMENSION CONTROL CIRCUIT FUSES

- A. Bussmann AGC, ABC, MDL, MDQ, MDX, or Engineer reviewed equivalent, to match current and voltage of circuit. Use dual-element fuses unless recommended otherwise by equipment manufacturer or shown as fast acting on the Drawings.

2.06 REJECTION FUSE BLOCKS FOR 2.01 AND 2.02 FUSES

- A. Base: Phenolic.
- B. Box terminals.
- C. Bussmann Class R Phenolic or Engineer reviewed equivalent.

2.07 REJECTION FUSE BLOCKS FOR 2.04

- A. Base: Phenolic.
- B. Copper alloy box terminals.
- C. Bussmann BC603-1B, BC603-2B, BC603-3B, or Engineer reviewed equivalent.

2.08 REJECTION FUSE HOLDERS FOR 2.04

- A. Body: Phenolic, with mounting holes for bolting to panel, and screw knob.
- B. Combination 1/4 quick connect/solder terminals.
- C. Bussmann HPF-RR or Engineer reviewed equivalent.

2.09 FUSEHOLDERS FOR 2.05

- A. Body: Phenolic with bayonet knob.
- B. Voltage Rating: 250V
- C. Maximum fuse size: 20A
- D. Terminals: 1/4" right angle quick connect
- E. Bussmann HTB-48I or Engineer reviewed equivalent.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

- A. Enclosed switches.
- B. May also be referred to as disconnect switches, safety switches, and/or service disconnects switches.

1.02 SUBMITTALS

- A. Not required.

PART 2 PRODUCTS

2.01 ENCLOSED SWITCHES

- A. Type of Enclosure: See Paragraph 3.02.
- B. Service Disconnect Switches: 3 pole plus neutral and ground. Other switches: 3 pole plus ground unless neutral is required by the Drawings.
- C. 600 Volt unless shown otherwise on the Drawings.
- D. Ampere Rating: As shown on the Drawings.
- E. Heavy duty, padlockable to the off position.
- F. Switch Mechanism: Positive action quick-make, quick-break, with visible blades.
- G. Non-fusible: Where shown on Drawings.
- H. Fusible:
 - 1. Where shown on Drawings.
 - 2. Fuse clips reject all except Class R current limiting fuses.
- I. Provide electrical interlock kits, as shown in the Drawings, on those switches through which the control circuit wiring is routed. The kit shall have 1 NO and 1 NC contact rated 10 A resistive and 6 A inductive or 2 NO where noted. The contacts, when actuated, shall break the control circuit before the safety switch opens.
- J. Switches with non-metallic NEMA 4X enclosures: Square D Class 3110 Krydon® or Engineer reviewed equivalent.

- K. Switches with NEMA 1, 3R, 12, 4X SS enclosure: General Electric Type TH, Cutler-Hammer DH, Square D Class 3110, or Engineer reviewed equivalent.
- L. Switches with NEMA 7, 8, or 9 enclosure: Crouse Hinds FLS, or Engineer reviewed equivalent.

PART 3 EXECUTION

3.01 MARKING

- A. Furnish engraved nameplate on each switch.
- B. Text as shown on the Drawings, but if not shown, then:
 - 1. Source of power to the switch, example “Fed From MCC1.”
 - 2. Name and Tag Number of equipment served, example “Influent Lift Pump 1, PMP1011.”

3.02 TYPE OF ENCLOSURE

- A. Comply with the matrix which is appended to this Section.
- B. If not shown in matrix, comply with requirements shown on Drawings.
- C. If not shown in either place, then:
 - 1. NEMA 1 in indoor non-process areas, such as: blower rooms, electrical rooms, administration building offices and mechanical rooms.
 - 2. NEMA 4X non-metallic in indoor process areas where there is liquid piping but no open liquid, such as a room with sludge pumps.
 - 3. NEMA 4X SS in indoor process area where there is open liquid, such as a membrane basin.
 - 4. NEMA 3R outdoors in areas more than 100 feet from a primary/secondary process structure. This includes structures containing raw or partially treated sewage but not a UV disinfection structure.
 - 5. Stainless steel NEMA 4X in all other indoor and outdoor areas, including but not limited to areas less than 100 feet from a primary/secondary process structure.
 - 6. Regardless of any/all other requirements above: NEMA 7 in classified (hazardous) areas, whether indoors or outdoors.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTIVE DEVICES FOR LOW VOLTAGE SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for low voltage electrical power systems.

1.02 SUBMITTALS

- A. Manufacturer's literature, including rating information.

1.03 O&M MANUAL

- A. List of suppressors used on this project with manufacturer's name, SPD type, part (catalog) number, and (for each part so provided) serial number. The use of a generic or typical part number will not be acceptable. Provide the part number which was used to order the part with all choices and options included. If a part number is given on a nameplate on the actual part, then include that number on this list. If the ordering number and the nameplate number differ, include both numbers and explain the difference.

PART 2 PRODUCTS

2.01 SURGE PROTECTIVE DEVICES (SPD): COMMON REQUIREMENTS

- A. Comply with the requirements of:
 - 1. UL 1449 – Third Edition.
 - 2. IEEE C62.41. Location/exposure Categories below refer to this standard.
 - 3. IEEE C62.45 for test methods.
 - 4. ISO 9001: 2000 certified.
- B. Testing:
 - 1. Performed by an independent testing laboratory.
 - 2. Test as a complete unit. Testing of the surge current capacity of a single MOV or SAD and extrapolation of overall rating from that is not acceptable.
- C. Voltage: As shown on the Drawings.
- D. Surge Capacity: As shown on Drawings or Schedule.
- E. Protection modes for units installed at service equipment and at the transformer or first panelboard of a separately derived system: line to neutral and line to ground.

- F. Protection modes for units installed downstream of the above units: Line to neutral, line to ground, and neutral to ground.
- G. Repetitive impulse: 5,000 hits
- H. Response Time: Less than 1 nanosecond.
- I. Voltage Protection Rating, (VPR – 3kA): Not more than shown in the following table using tests as defined in UL1449 – Third Edition.

<u>Voltage</u>	<u>Type</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>In</u>	<u>SCCR</u>	<u>MCOV</u>
208/120	1	700	700	700	1000	20kA	200kA	150
480/277	1	1200	1200	1200	1800	20kA	200kA	320
480V Delta	1	-	1800	-	2000	20kA	200kA	550
240/120	2	330	-	330	700	10kA	200kA	150

- J. Environmental:
1. Temperature: -25°C to + 60°C.
 2. Humidity: 0% to 95%, non-condensing.
- K. Internally protected against short-circuit and overload. Suitable for connection to the circuit which it is protecting by means of a molded-case switch.
- L. Warranty:
1. Type 1: Ten-year full replacement warranty.
 2. Type 2: Five-year full replacement warranty.
- M. Enclosure as shown on the Drawings.
- N. Hard-wired.
- O. Where sine wave tracking is required in “Type” paragraphs below, provide hybrid design incorporating filters, capacitors, or other technology in addition to MOVs and SADs to remove low voltage high frequency disturbances at any phase angle that will limit the let-through voltage of an A1 Ring Wave voltage relative to the applied 60 Hz. voltage to not more than shown in the following table.
- P. Other Features:
1. LED indication of operational state of suppressor for each phase/mode.
 2. Modular plug-in suppressor units for easy replacement.
 3. Symmetrically balanced metal oxide varistors (MOV).
 4. As required in “Type” paragraphs below.
 5. As shown on the Drawings or Schedule.

2.02 TYPE

- A. Surge Capacity of 250kA and greater
 1. High surge current device designed for service equipment and rated for location/exposure Category C3.
 2. Features: Dry form C contact for external alarm indication.
- B. Surge Capacity greater than 100kA and less than 250kA
 1. High surge current device designed for service equipment and rated for location/exposure Category C3.
 2. Features: Dry form C contact for external alarm indication.
 3. Sine wave tracking.
- C. Surge Capacity of 100kA or less
 1. Sine wave tracking.
 2. Dry form C contact for external alarm indication, only if shown on the Drawings or Tag List.

PART 3 EXECUTION

3.01 INSTALLATION OF HARD-WIRED SPD

- A. Plan the installation in advance so that an SPD is installed immediately adjacent to (above, left, right, or below) the protected equipment.
- B. Connect to circuit being protected by means of a molded case switch (non-automatic circuit breaker) or circuit breaker as shown on the Drawings.
- C. Connect SPD with minimum #8 stranded wire or as shown on the Drawings, whichever is greater. If manufacturer recommendation is different, the Engineer will resolve conflicts.
- D. Make connecting conductors as short as practical: Maximum 24 inches. Sharp bends in conductors are not acceptable. If the configuration of the SPD is such that shorter lead length can be achieved by mounting the enclosure rotated 90 or 180 degrees from "normal" then do so if allowed by the manufacturer of the SPD. Do not mount with hinge on bottom.

3.02 SCHEDULE

- A. Type and surge capacity as shown below unless shown otherwise on Drawings.
 1. 480V Switchboards: type 1, 250kA surge capacity.
 2. 480V MCCs: type 1, 150kA surge capacity.
 3. 480V Panelboards: type 1, 150kA surge capacity.
 4. 208/120V Panelboards: Type 2, 80kA surge capacity.
 5. 240/120V Panelboards: Type 2, 80kA surge capacity.

END OF SECTION

SECTION 26 50 10

LED LUMINAIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Luminaires, lamps, mounting hardware, and accessories for interior and exterior lighting applications as specified and/or as shown in the Luminaire Schedule and/or Drawings.

1.02 SUBMITTALS

- A. For luminaires which are listed by manufacturer and type and/or catalog number in the Luminaire Schedule or Drawings, provide:
 - 1. Bill of Material:
 - a. Type Number
 - b. Manufacturer's name and model name
 - c. Complete catalog number
 - d. Driver voltage and current
 - e. Catalog number
 - 2. Cut sheets for each luminaire.
- B. For manufacturers, type, and catalog numbers not listed in the Luminaire Schedule or Drawings:
 - 1. Comply with Section 01 25 00 – Substitution Procedures.
 - 2. Unless waived in writing by the Engineer, provide pre-wired sample for Engineer review, which will be returned, or prepare a presentation to engineer on proposed luminaires.
 - a. Pre-wired with 15A, 120VAC plug.
 - 3. NRTL certification and verification.
 - 4. Lighting layout showing performance of proposed luminaires which shall meet minimum maintained fc levels as shown on the in the Schedule or on Drawings.
 - 5. IES photometric files.
 - 6. Supporting data for L_{xx} value with respect to site conditions.
 - 7. All data as required in paragraph A above.

1.03 OPERATION AND MAINTENANCE DATA

- A. Bill of Material, meeting the requirements of 1.02 A., for all luminaires. If some items were allowed as substitutions, add them to the Bill of Material. It is not necessary to provide cut sheets or literature except as required below for replacement parts.
- B. Manufacturers maintenance data, including replacement parts list. Provide illustrations of parts and their location in the luminaire assembly.

1.04 CATALOG NUMBERS

- A. Recognize that a particular catalog number shown below or in the Schedule may not exactly represent the features required in the description below or in the Schedule, such as:
 - 1. Type of driver for a multi level or diming luminaire.
 - 2. Battery backup provisions.
 - 3. Integral photocell.
 - 4. Integral motion detection.
- B. Provide luminaires having all required features and show complete, detailed catalog numbers and options in the submittal.

PART 2 PRODUCTS

2.01 LED LUMINAIRES

- A. Voltage: 120VAC unless shown otherwise in the Schedule or on the Drawings.
- B. Modular Design. Capable of replacing driver, LED light bars, and accessories independently for failure replacement or upgrades.
- C. CRI: 70 minimum.
- D. Driver Current: 350mA unless shown otherwise in the Schedule or on the Drawings.
- E. Temperature: 3500K unless shown otherwise in the Schedule or on the Drawings.
- F. Foot Candle (FC) Levels: As recommended by IESNA or as shown in the Schedule or on the Drawings, whichever is greater.
- G. Mounting: As shown on the Drawings.
- H. Proper UL listings for dry/damp, wet, and hazardous (wet locations and vapor tight NEMA 4X) locations.
- I. Driver:
 - 1. Power Factor: > .90.
 - 2. Total Harmonic Distortion (THD): <20%.
 - 3. Integral surge suppression protection in accordance with IEEE C62.41.2 and ANSI 62.41.2.

2.02 BATTERY BACKUP LUMINAIRES

- A. Where shown in the Luminaire Schedule and/or Drawings, furnish self-diagnostic battery system for standby operation.
- B. Provide a minimum 1300 lumens per luminaire of illumination for 90 minutes during a power outage.
- C. Furnished, installed in the driver channel, and wired by luminaire manufacturer. Indicator lights easily visible from below.

2.03 OCCUPANCY SENSOR

- A. Wall-mounted with manual override.
- B. Single-point or 3-way as required on Drawings.
- C. Infrared and ultrasonic motion sensors, plus photocell.
- D. Cooper OSW-DT or Engineer reviewed equivalent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's recommendations and the Drawings. If not available from the manufacturer of the specific equipment and not shown on the Drawings, install according to the best trade practice.
- B. Furnish fittings, hangers, stems, parts, etc., as required for proper installation.
- C. Securely support luminaires so that they are level and in vertical and horizontal alignment unless specifically shown otherwise on the Drawings.
- D. Clean luminaires, install lamps, and test systems prior to acceptance by the Engineer.

3.02 SCHEDULE

- A. Provide luminaires which comply with the requirements of this Section and with the requirements of the Luminaire Schedule on the Drawings.

END OF SECTION

SECTION 31 00 00

EARTHWORK BACKFILLING AND COMPACTION FOR STRUCTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Preparing and grading subgrades for slabs-on-grade, and walks.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage and moisture-control fill course for slabs-on-grade.
 - 4. Subbase course for walks.
 - 5. Subsurface drainage backfill for walls and trenches.
 - 6. Excavating and backfilling trenches within building lines.
 - 7. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.

1.03 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.
- E. Base Course: The layer placed between the subbase and surface pavement in a paving system.
- F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.04 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
 - 1. Each type of plastic warning tape.
 - 2. Filter fabric.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: A qualified independent Geotechnical engineering testing agency will classify proposed on-site and borrow soils to verify that soils comply with specified requirements, and will perform required field and laboratory testing. The testing laboratory shall mail a copy of each test report to the Architect. Laboratory tests for soil classification will be performed in accordance with Section 01 45 00, "Quality Control" and Sheet S-002 Quality Assurance Plan.
- C. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Coordination."
 - 1. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided.
 - 1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations. See Geotechnical Report.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials.
- E. Subbase and Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, ASTM D 2940, with at least 95 percent passing a 1-1/2 inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Subbase or base materials.
- G. Bedding Material: Subbase or base materials with 100 percent passing a 1 inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 8 sieve.
- I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 50 sieve.

- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.
 - 1. Tape Colors: Provide tape colors to utilities as follows:
 - a. Red: Electric.
 - b. Yellow: Gas, oil, steam, and dangerous materials.
 - c. Orange: Telephone and other communications.
 - d. Blue: Water systems.
 - e. Green: Sewer systems.
- C. Filter Fabric: Manufacturer's standard nonwoven pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.
 - 1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
 - a. Grab Tensile Strength (ASTM D 4632): 100 lb.
 - b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.
 - c. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

- D. Tree protection is specified in 1500-3.06.B.

3.02 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.03 EXCAVATION

- A. Explosives: Do not use explosives.
- B. Classified Excavation: Excavation is classified and includes excavation to required subgrade elevations. Excavation will be classified as earth excavation or rock excavation as follows:
 - 1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with soil and other materials encountered that are not classified as rock or unauthorized excavation.
 - a. Intermittent drilling or ripping to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

3.04 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus **1.2 inches**. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Excavate to rough grade all building and pavement areas and scarify to a depth of eight inches below rough grade elevations. Any soft and “spongy” areas shall be removed as directed by the geotechnical engineer.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.
 - 2. Clearance: As indicated
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
 - 1. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - 3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

3.08 APPROVAL OF SUBGRADE

- A. Notify Architect when excavations have reached required subgrade.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect.
 - 1. Fill unauthorized excavations under other construction as directed by the Architect.

2. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for record documents.
 3. Testing, inspecting, and approval of underground utilities.
 4. Concrete formwork removal.
 5. Removal of trash and debris from excavation.
 6. Removal of temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Concrete backfill trenches that carry below or pass under footings and that are excavated within **18 inches** of footings. Place concrete to level of bottom of footings.
- C. Provide **4 inch** thick concrete base slab support for piping or conduit less than **30 inches** below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of **4 inches** of concrete before backfilling or placing roadway subbase.
- D. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than **1 inch**, to a height of **12 inches** over the utility pipe or conduit.
 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
 - 1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required density.
- C. Place fill material in layers to required elevations for each location listed below.
 - 1. Under grass, use satisfactory excavated or borrow soil material.
 - 2. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.
 - 3. Under steps and ramps, use subbase material.
 - 4. Under building slabs, use drainage fill material.
 - 5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
 - a. Stockpile or spread and dry removed wet satisfactory soil material.

3.15 COMPACTION

- A. Place backfill and fill materials in layers not more than **8 inches** in loose depth for material compacted by heavy compaction equipment, and not more than **4 inches** in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, behind retaining walls, and pavements, compact the top **12 inches** below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
 - 2. Under walkways, compact the top **6 inches** below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
 - 3. Under lawn or unpaved areas, and non-structural areas compact the top **6 inches** below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between existing adjacent grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus **1.2 inches**.
 - 2. Walks: Plus or minus **1.2 inches**.
 - 3. Pavements: Plus or minus **1/2 inch**.
- C. Grading Inside Building Lines: Finish subgrade to a tolerance of **1/2 inch** when tested with a **10 foot** straightedge.

3.17 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.
 - 1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.

2. Shape subbase and base to required crown elevations and cross-slope grades.
 3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
 4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
- B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.18 FIELD QUALITY CONTROL

- A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.
 - a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
 - b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.
 2. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Architect.
 3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
 4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
 5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but no fewer than two tests.

- B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

3.19 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY OF THE WORK

- A. Site clearing work includes, but is not limited to:
 - 1. Removal of trees and other vegetation.
 - 2. Topsoil stripping.
 - 3. Clearing and grubbing.
 - 4. Removing above-grade improvements.
 - 5. Removing below-grade improvements.
- B. Extent of Site Clearing is shown on the Drawings.

1.02 JOB CONDITIONS

- A. Traffic: Conduct site clearing operations to avoid interference with roads, streets, walks and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements:
 - 1. Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 2. Protect improvements adjoining properties and on Owner's property.
 - 3. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

- A. General: Remove trees, shrubs, grass and other vegetation, improvements or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.
 - 1. Carefully and cleanly cut roots and branches of trees indicated to be left standing where such roots and branches obstruct new construction.

- B. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter and without weeds, roots and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
 - a. Remove heavy growths of grass from areas before stripping.
 - b. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.
 2. Stock Topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.
- C. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.
- D. Removal of Improvements: Remove existing above-grade and below grade improvements necessary to permit construction and other work as indicated.
1. Abandonment or removal of certain underground pipe or conduits may be shown on mechanical or electrical drawings and is included under work of those sections. Removal of abandoned underground piping or conduit interfering with construction is included under this section.

3.02 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off site in legal manner.

END OF SECTION

SECTION 31 23 01

EXCAVATION AND FILL FOR SITE WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Site Excavation, Filling and Backfilling.
- B. Compaction of Fill and Backfill.
- C. Finish Grading.

1.02 RELATED WORK

- A. Section 31 23 00 – Excavation and Fill for Structures
- B. Section 31 23 33 – Trenching and Backfilling

1.03 REFERENCES

- A. ASTM C33 – Standard Specification for Concrete Aggregates.
- B. ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates.
- C. ASTM D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- D. ASTM D4318 – Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

- A. Section 01 33 23 – Shop Drawings, Product Data, and Samples:
 - 1. Laboratory Test Results for Select Fill, Ordinary Fill, and Pea Gravel:
 - a. Moisture-density relationships (ASTM D1557).
 - b. Gradation (ASTM C136).
 - c. Liquid limit, plastic limit, plasticity index (ASTM D4318).

1.05 PROTECTION

- A. Protect trees, shrubs, lawns, and other features remaining as a portion of final site.
- B. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from equipment and vehicular traffic.
- C. Protect above and below grade utilities which are to remain.

- D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- F. Grade excavation top perimeter to prevent surface water run-off into excavation.
- G. Protect structure walls, foundation, and similar features from structural stress during backfilling operations.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Material removed from excavations may be used for fill or backfill provided such material meets the requirements for fill and backfill specified in this Section. Some blending of materials may be necessary.
- B. Exclude debris, large rocks, roots, organic material, expansive material and other deleterious materials.
- C. Provide additional fill materials if necessary from off-site locations obtained by Contractor.
- D. Do not use any materials containing any contaminants that may endanger public health. Do not use mine tailings.
- E. Do not use any materials which have not been reviewed by the Engineer.

2.02 MATERIALS

- A. Select Fill:
 - 1. Clean, well graded, relatively cohesionless material free of organic or frozen matter.
 - 2. Largest rock or clod dimension, 1”.
 - 3. Plasticity index less than 8.
 - 4. Maximum percent passing sieve (unless otherwise reviewed by Engineer):
 - a. #10, 50%.
 - b. #40, 30%.
 - c. #200, 15%.
- B. Ordinary Fill:
 - 1. Clean, free of organic or frozen matter.
 - 2. Largest rock or clod dimension, 3”.
 - 3. Normally acceptable are Unified Soil Classification System Classified Materials: GW, GP, SW, SP, GM, SM, or GC.

- C. Normal Backfill:
 - 1. Excavated earth or sand thoroughly mixed to create uniform material.
 - 2. Free of trash, debris, organic or frozen matter.
 - 3. Largest rock or clod dimension, 2".
- D. Pea Gravel:
 - 1. Mineral aggregate graded 0.25" to 0.38".
 - 2. Free of soil, clay and shale; free of organic, frozen debris, or foreign matter.
- E. Sandfill:
 - 1. Clean, well-graded material conforming to requirements of ASTM C33 for fine aggregate.
- F. Moisture Barrier: 10 mil minimum polyethylene sheet.

PART 3 EXECUTION

3.01 GENERAL

- A. The type of bearing material and the thickness and extent of structural fill (if required) are shown on the Drawings.
- B. Interior non-structural slabs-on-grade are to be supported on granular fill not less than 6 inches thick on structural fill not less than one foot thick. See Drawings for location where sand fill over polyethylene moisture barrier is required over granular fill.
- C. Do not place or compact fill or backfill when the atmospheric temperatures are below 35 degrees Fahrenheit. Protect completed fill or backfill areas from freezing. Recondition, reshape and recompact to the requirements of this section without additional cost to the Owner any areas which are damaged by freezing.

3.02 SHEETING, SHORING AND BRACING

- A. Provide sheeting, shoring and bracing where required to hold walls of excavation and to protect workers and existing construction. Contractor shall be responsible for proper sizing and placement of Work.
- B. Remove sheeting, shoring and bracing in manner to avoid damage to disturbance to Work. Leave sheeting and shoring in place where removal will endanger Work, adjacent construction or personnel. If sheeting or shoring is to be left in place, remove all traces of sheeting or shoring to a minimum depth of 2'-0" below finish grade unless otherwise reviewed by the Engineer.

3.03 CLEARING AND GRUBBING

- A. General: Clearing and grubbing are required for all areas shown on the plans to be excavated or where fill is to be constructed.

- B. Clearing:
 - 1. Remove and dispose of trees and other vegetation, downed timber, snags, brush, and rubbish within areas to be cleared.
- C. Grubbing:
 - 1. Remove stumps, matted roots, and roots larger than 2 inches in diameter from within 6 inches of the surface of areas on which fills are to be constructed, and within 18 inches of finished subgrade of roadways.
 - 2. Areas disturbed by grubbing shall be filled as specified in this section for embankment.

3.04 PREPARATION

- A. Excavation:
 - 1. Identify required lines, levels, contours, and datum.
 - 2. Identify all underground utilities and other facilities. Stake and flag locations.
 - 3. Identify and flag surface and aerial utilities.
 - 4. Maintain and protect existing utilities remaining which pass through work area.
- B. Backfilling:
 - 1. When necessary, compact subgrade surfaces to density requirements for backfill material.
 - 2. Cut out soft areas of subgrade not readily capable of in situ compaction. Backfill with select fill and compact to density equal to requirements for subsequent backfill material.

3.05 EXCAVATION

- A. Earth excavation shall consist of the excavation and removal of suitable soils for use as embankment as well as the satisfactory disposal of all vegetation, debris, and deleterious materials encountered within the area to be graded and/or in a barrow area.
- B. Excavate soil to the extent required for structure foundations, construction operations, and other work. See Drawings for extent of excavation required beneath and adjacent to structures.
- C. Barricade open excavations, keep spoil piles out of the way of the Owner's personnel and otherwise maintain safe access by the Owner's employees to the Owner's facilities during construction.
- D. Do not undercut existing construction.
- E. Do not permit surface water to enter open excavations. Provide barriers and positive drainage away from excavations as necessary. Remove promptly any water which may enter excavations from any source.
- F. Machine slope banks.

- G. After excavations are complete, notify Engineer for inspection of completed excavation. Do not begin placement of fill or begin other construction operations until excavation is reviewed by Engineer.
- H. Fill unauthorized over excavated areas beneath structures with select fill and compact to density required for subsequent fill or backfill. If unauthorized excavation will result in structure being supported partly on select fill and partly on native material, extend excavation under entire structure and fill as specified below. Fill unauthorized overexcavated areas away from structures with fill of the type specified for subsequent fill compacted to the density specified.
- I. Dispose of all excess excavated material and material unsuitable for backfilling generated by construction activities, off-site or as directed by Owner, unless otherwise stated in Contract Documents at no additional cost to Owner. Properly dispose of all materials in accordance with regulatory requirements.

3.06 SUBGRADE TREATMENT

- A. At areas to receive structural fill, scarify the exposed native soils to a depth of not less than 12 inches. Add or remove water as necessary to bring the scarified material to optimum moisture content (within -0, +2 percentage points). Compact the scarified soil to not less than 95 percent of maximum dry density as determined by ASTM D1557.

3.07 FILLING AND BACKFILLING

- A. Provide all fill material required to complete Work, either from on-site excavations or imported from off-site, at no additional cost to Owner.
- B. Backfill areas to contours and elevations shown on Drawings using unfrozen materials.
- C. Place fill under structures and elsewhere as shown on the Drawings. Fill all unauthorized or excess excavations to the elevations shown or specified.
- D. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.
- E. Backfilling Around Structures:
 - 1. Backfill after concrete has attained sufficient strength to withstand backfill pressures without detrimental effects.
 - 2. Prevent displacement of construction during backfilling operations; backfill opposite sides simultaneously.
- F. Placement:
 - 1. Maintain surfaces free of water, debris, and other deleterious materials.

2. Place backfill and fill materials in successive horizontal layers not more than 8" in loose depth.
 3. Place material at optimum moisture content (plus or minus two percentage points).
 4. Material too dry or too wet shall be moistened or aerated to extent necessary to bring moisture content to within specified limits.
- G. Compaction:
1. Compact fill and backfill using appropriate equipment as needed to achieve the densities specified below. Densities are expressed as percentages of the maximum dry density as determined by ASTM D1557.
 2. Do not use heavy equipment in areas where existing construction may be damaged by the use of such equipment. Repair or replace without additional cost to the Owner, any damage to existing construction caused by earthwork operations.
- H. Slope grade away from building minimum 2 inches in 10 feet unless noted otherwise. Fill depressions and provide for positive drainage away from buildings and structures.
- I. Make changes in grade gradual. Blend slopes into level areas. Finish grade to smooth uniformly sloping surfaces to elevations required for drainage.
- J. Finish surface by grading to provide finished appearance.
- K. Place polyethylene moisture barrier at locations shown on the Drawings. Overlap not less than 6 inches at all joints; tape joints securely. Protect from damage during placement of sand fill. Repair any rips or tears. Place not less than 3 inches of sand fill over polyethylene moisture barrier beneath slabs-on-grade where shown on Drawings.

3.08 TOLERANCES

- A. Top Surface of Backfill: Plus or minus 2 inches.
- B. Top Surface of Fill Beneath Structures: Minus 1 plus 0 inches.

3.09 FIELD QUALITY CONTROL

- A. Section 01 45 23 – Testing Laboratory Services.
- B. Test Schedule:
 1. One field density test for each 250 square yards of prepared subgrade.
 2. One field density test for each 100 cubic yards of fill or for each layer of fill, whichever results in the greater number of tests.
 3. Or where directed by Engineer.

- C. If tests indicate that work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

3.10 SCHEDULE OF FILL AND BACKFILL

<u>Area</u>	<u>Type of Material</u>	<u>Degree of Compaction</u>
Beneath footings and slabs more than 10 inches thick and for a distance outside their perimeters equal to the depth of fill	Select fill	95%
Beneath slabs less than 10 inches thick; pavements (except roadways) unless otherwise shown on Drawings	Select fill	90%
General fills and embankments on the site	Ordinary fill	90%
Non-structural areas except as otherwise shown on Drawings or directed by the Engineer	Ordinary fill	85%
Backfill behind walls and below or adjacent to additional construction	Select fill	95%
Backfill behind retaining walls	Ordinary fill	90%
Backfill except as described above	Normal backfill	90%
Where indicated on Drawings	Select fill	95%
Fill within treatment structures, fill beneath interior slabs on grade over moisture barrier	Sand fill	95%

END OF SECTION

SECTION 31 23 13

SUBGRADE PREPARATION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Preparing the completed subgrade prior to placement of subsequent pavement section components to the grade and dimensions indicated on the Drawings. This is inclusive of all processing, shaping, compacting, watering, protecting and any removal and replacement of unsuitable material to prepare the subgrade satisfactorily for completion of the pavement section.

1.02 REFERENCES

- A. American Society for Testing and Materials International:
 - 1. ASTM D1556 – Density of Soil in Place by the Sand-Cone Method
 - 2. ASTM D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - 3. ASTM D2167 – Density of Soil in Place by the Rubber-Balloon Method
 - 4. ASTM D2216 – Laboratory Determination of Moisture Content of Soil
 - 5. ASTM D6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.03 QUALITY ASSURANCE

- A. Testing Laboratory:
 - 1. Contractor shall provide material testing for quality control during subgrade preparation.

PART 2 PRODUCTS

2.01 SUITABLE MATERIALS

- A. Suitable materials shall consist of materials obtained on site reviewed by the Engineer for the purpose of subgrade preparation.
- B. Any underlying soft or otherwise unsuitable material shall be removed and replaced with suitable material.
- C. Provide free of vegetation.

2.02 WASTE

- A. Disposal of excavated materials shall be the responsibility of the Contractor. Excess material to be placed in location designated by Owner or Engineer.

PART 3 EXECUTION

3.01 PREPARATION

- A. Excavations and embankments for the roads and site grading shall be finished to the shapes, dimensions, and elevations shown on the Drawings.
- B. Perform clearing operations prior to beginning excavation, grading, and embankment operations.
- C. Processed, watered, and compacted to not less than 90% of modified Proctor density (ASTM D1557) at optimum moisture content $\pm 2\%$, to a depth of 12" minimum.
- D. Material that cannot be processed satisfactorily to meet these specifications shall be considered unsuitable.

3.02 GRADING

- A. Provide uniform slopes and rounded changes in slope, free of low spots.
- B. The degree of grade control shall not deviate from true grade and profile more than one-half inch as measured by a ten-foot straight edge.
- C. Drainage:
 - 1. Provide and maintain positive surface water drainage around and away from open excavations.
 - 2. Keep opened excavations dry.
 - 3. Remove free water in excavation promptly.

3.03 FIELD QUALITY CONTROL

- A. Sample and Test:
 - 1. At intervals not to exceed 200 feet.
 - 2. At locations designated by the Engineer.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Trenching, Backfilling, and Compacting for Buried Pipes and Manholes
- B. Bedding of Buried Pipes
- C. Pipe Marking Systems

1.02 REFERENCES

- A. ASTM C12 – Installing Vitrified Clay Pipe Lines
- B. ASTM D256A – Determining the Izod Pendulum Impact Resistance of Plastics, Method A
- C. ASTM D638 – Tensile Properties of Plastic
- D. ASTM D695 – Compressive Properties of Rigid Plastics
- E. ASTM D790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- F. ASTM D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
- G. ASTM D1593 – Non-Rigid Vinyl Chloride Plastic Film and Sheeting
- H. ASTM D2321 – Underground Installation of Flexible Thermoplastic Sewer Pipe
- I. ASTM D2583 – Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
- J. ASTM D2774 – Underground Installation of Thermoplastic Pressure Piping
- K. ANSI/AWWA C150/A21.50 – Thickness Design of Ductile-Iron Pipe
- L. ANSI/AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
- M. ANSI/AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances

N. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fitting for Water

O. OSHA Regulations, 29 CFR 1926 Subpart P – Excavations

1.03 SUBMITTALS

A. Section 01 33 23 – Shop Drawings, Product Data, and Samples:

1. Testing laboratory results on bedding materials to demonstrate compliance with specifications.
2. Product data for identification tape, marker posts, tracer wire system, and electronic marker device system, if scheduled.

1.04 JOB CONDITIONS

A. All trenching is unclassified.

B. Protect adjacent structures and surrounding areas.

C. Work to remain within available easements.

D. Weather:

1. No backfill placement during freezing weather.
2. No frozen materials, ice, or snow in backfill or fill.
3. No backfill or fill on frozen surfaces.

1.05 REGULATORY REQUIREMENTS

A. Comply with OSHA Standard 29 CFR Part 1926, Subpart P – Excavations, during all excavation, trenching, and shoring operations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bedding Materials:

1. Bedding materials are those materials located a maximum of 8 inches below bottom of pipe to bottom or spring line of pipe, depending on bedding class or condition required.
2. Material shall be granular and free flowing:
 - a. Maximum particle or clump size:
 - 1) Plastic Pipe 8" Diameter and Smaller: 0.25".
 - 2) All other Pipe: 0.75".
 - b. Portion Passing No. 200 Sieve: 50% maximum.
 - c. Free from refuse, organic material and frozen soils.
3. Materials require prior written approval.
4. Concrete: Division 03.

B. Initial Backfill Materials:

1. Initial backfill material is that material placed above the bedding material, around and over the pipe to 12 inches over the top of the pipe.
2. Material to be defined and required by applicable ASTM standard for installation for bedding class or type required or scheduled.
3. In no case shall initial backfill material contain particles or clumps with any dimension greater than:
 - a. Plastic Pipe 8" Diameter and Smaller: 0.25".
 - b. All Other Pipe: 0.75".
4. If not otherwise defined, same as bedding material.

C. Backfill Materials:

1. Backfill materials are those materials placed in the trench between the initial backfill material and the top of the trench.
2. Material to be as defined and required by applicable ASTM standard for installation for bedding class or type required or scheduled.
3. Backfill shall have no particles or clumps having a dimension larger than 6" within 3' of the top of the pipe.

D. Materials Not Allowed:

1. All pipe bedding, initial backfill, and backfill material shall be clean and free of roots, vegetable or organic material, frozen material, mine tailings, or any contaminants that could endanger public health.

E. Identification Tape:

1. Identification tape shall consist of high visibility, color coded inert polyethylene tape that is impervious to all known alkalis, acids, chemical reagents and solvents found in the soil.
2. The tape shall have the following properties:
 - a. Minimum overall thickness: ASTM D1593: Plain, 4.0 mils; detectable, 4.5 mils.
 - b. Minimum tensile strength (longitudinal): ASTM D638: Plain, 1500 psi; detectable, 4,544 psi.
 - c. Maximum imprint length: 36".
 - d. Width: 3 inches for plain tape without metallic foil stripes.
 - e. Detectable Tape Metallic Foil Stripes: Permanently laminated to the polyethylene tape so that tape may be more readily located using a metal detector. Refer to Part 3 for application of use. Width: 3".
3. Tape to meet the APWA Uniform Color Code for utilities.
4. Imprinted message, "Caution Buried Utility Line Below", printed with black letters on APWA approved colors.
5. Acceptable Manufacturers:
 - a. Seton Identification Products, Branford, CT or Engineer reviewed equivalent.

PART 3 EXECUTION

3.01 INSPECTION

- A. Field verify location of underground utilities and obstructions.

3.02 CLEARING AND GRUBBING

- A. General: Clear and grub all areas within the construction limits that will be disturbed by trenching or stockpiling.
- B. Clearing: Remove and dispose of trees and other vegetation, downed timber, snags, brush, and rubbish within areas to be cleared.
- C. Grubbing: Remove stumps, matted roots, and roots larger than 2" in diameter from areas to be excavated and from within 6" of surface of areas to receive stockpiled material. Do not allow grubbed material to mix with trench backfill.
- D. Disposal: Properly dispose of all waste material in accordance with Section 31 23 01 – Excavation and Fill for Site Work.

3.03 DEWATERING

- A. Provide and maintain adequate dewatering equipment to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the Work.
- B. Keep excavation dry during subgrade preparation and continuously thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.
- C. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12" below the bottom of the excavation.
- D. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property.
- E. Contractor is responsible for the condition of any pipe or conduit he uses for drainage; all drainage pipes, ditches, etc. shall be left clean and free of sediment.

3.04 BLASTING

- A. Blasting is not allowed.

3.05 SHEETING

- A. If used, cut off at top of pipe and leave in place unless removal is specifically reviewed by Engineer.

3.06 STABILIZATION

- A. Thoroughly compact and consolidate trench bottoms so they remain firm, dense, and intact during required construction activities.
- B. Remove all mud and muck during excavation.
- C. Reinforce trench bottom with crushed rock or gravel if it becomes mucky during construction activities.
- D. Allow no more than 1/2" depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon.
- E. Where trench bottoms-out in rock, rock is to be removed to 8" below bottom of pipe and replaced with bedding material.

3.07 TRENCH EXCAVATION

- A. Slope, bench, or support all trenches in conformance with OSHA Excavation Regulations, and follow all specified safety requirements.
- B. Do not open more trench in advance of pipe laying than is necessary to expedite the Work; not more than 400', unless otherwise authorized by Engineer.
- C. Except where jacking and boring is indicated on the Drawings, specified or permitted by Engineer, excavate trenches by open cut from the surface.
- D. Alignment, Grade, and Minimum Cover:
 - 1. Establish alignment and grade or elevation from offset stakes.
 - 2. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the Drawings.
 - 3. Comply with pipe specification sections regarding vertical and horizontal alignment and max joint deflection.
 - 4. Water lines to have minimum bury as shown on the Drawings, and in general, grade shall follow surface contours unless otherwise shown on the Drawings.
- E. Limiting Trench Widths:
 - 1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment.
 - 2. If needed to reduce earth loads to prevent sloughing cut banks back on slopes which extend not lower than 1' above the top of the pipe.
 - 3. Trench widths and minimum clearances between installed pipe and trench wall:

<u>Pipe Size</u>	<u>Minimum Trench Width</u>	<u>Minimum Clearance</u>	<u>Maximum Trench Width at Top of Pipe</u>
18" or less	O.D. plus 16"	8"	O.D. plus 24"
Larger than 18"	O.D. plus 24"	12"	O.D. plus 24"

- F. Mechanical Excavation:
1. Do not use where its operation would damage trees, buildings, culverts, or other existing property, structures, or utilities above or below ground; hand-excavate only in such areas.
 2. Use mechanical equipment of a type, design, and construction and operated so that:
 - a. Rough trench bottom elevation can be controlled.
 - b. Uniform trench widths and vertical sidewalls are obtained from 1' above the top of the installed pipe to the bottom of the trench.
 - c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls.
 - d. Do not undercut trench sidewalls.
- G. Cuts in Existing Paved Surfaces:
1. Applies to streets, sidewalks, curbs, driveways, and other existing paved surfaces.
 2. No larger than necessary to provide adequate working space.
 3. Cut a clean groove not less than 1-1/2" deep along each side of trench or around perimeter of excavation area.
 4. Remove pavement and base pavement to provide shoulder not less than 6" wide between cut edge and top edge of trench.
 5. Do not undercut trenches, resulting in bottom trench width greater than top widths.
 6. Make pavement cuts to and between straight or accurately marked curved lines parallel to trench centerline or limits of excavation.
 7. Where the trench crosses existing paved surfaces, remove and replace the paved surface between saw cuts as specified for pavement.
- H. Excavation Below Pipe:
1. Except as otherwise required, excavate trenches below the underside of pipes as indicated on the Drawings to allow placement of granular pipe bedding material.
 2. Where excavating in earth for 6" and smaller pipe, Contractor has the following options for excavating trench bottoms:
 - a. Excavate below pipe subgrade and place granular embedment.
 - b. Grade trench bottom to provide uniform and continuous support between bell holes or end joints.
- I. Excavation for Bell Holes:
1. Excavate to provide adequate clearance for tools and methods of pipe installation.
 2. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined.

- J. Excavated Material: Place stockpiled excavated materials in a manner that will not obstruct work or endanger personnel or the public.
 - 1. Excavated materials shall not obstruct sidewalks or driveways for extended periods of time.
 - 2. Excavated materials shall not obstruct hydrants, valve pit covers, valve boxes, or other utility controls.
 - 3. Excavated materials shall not obstruct gutters, unless other temporary provisions have been made for street drainage.
 - 4. Excavated materials shall not obstruct natural drainage ways.
- K. Surplus Excavated Material: Excavated material in excess of that needed to backfill to the limits indicated in the Contract Documents shall be properly disposed off-site in compliance with regulatory requirements at no additional cost to the Owner.

3.08 PIPE BEDDING

- A. Class D per ASTM C12
- B. Class C per ASTM C12
- C. Class B per ASTM C12
- D. Crushed Stone Encasement per ASTM C12
- E. Class A-I: ASTM C12 Class A-1 using plain concrete.
- F. Class A-II: ASTM C12 Class A-1 using reinforced concrete; No. 4 A-36 steel reinforcing bars parallel to pipe with steel area not less than 0.4% of the area of concrete above top of pipe.
- G. Class A-III: ASTM C12 reinforced concrete encasement; 3000 psi concrete; No. 4 A-36 steel reinforcing bars; reinforcing parallel to pipe with steel area not less than 0.4% of the area of concrete above and below pipe; reinforcing bars wrapped around parallel bars at 36" maximum spacing.
- H. Bedding class or type as scheduled.
- I. Carefully place bedding in accordance with ASTM C12 to provide uniform and continuous support to pipe barrel, except at bell holes in all cases. No bridging will be allowed.

3.09 MANHOLE SUBGRADE

- A. Subgrade Material: Use same bedding class as specified for adjacent pipe bedding.
- B. Compaction: 90 percent ASTM D1557.

3.10 TRENCH BACKFILL

- A. Material as defined by applicable reference for installation for type of pipe used.
- B. Bedding, Initial Backfill, and Backfill: If native materials cannot meet the requirements of Part 2 specified herein or if the specified field compaction cannot be obtained, Contractor shall import suitable material at no additional cost to the Owner.
- C. Bedding: Carefully “shovel-slice” or tamp bedding so that the material fills and supports the haunch area under the pipe without voids.
- D. Initial Backfill: Place in layers that do not exceed 8” in height of backfill material in its uncompacted state.
- E. Backfill: Place in layers heights suitable to enable the Contractor to achieve the specified compaction throughout the full depth of backfill using Contractor’s selected means and methods and without damaging the pipe.
- F. Paved Traveled Areas:
 - 1. 90 percent ASTM D1557 compaction.
 - 2. Top 12” below subgrade, 95 percent ASTM D1557 compaction.
- G. Unpaved Traveled Areas and Treatment Plant/Pump Station Sites:
 - 1. 90 percent ASTM D1557 compaction.
- H. Untraveled Areas: Compacted to at least undisturbed natural density but not less than 85 percent ASTM D1557.
- I. Water Settled Backfill: Use only where permitted by Engineer:
 - 1. Where permitted, apply to obtain effective settlement with a minimum of water.
 - 2. Do not permit trench to overflow.
 - 3. Do not settle by water puddling until after trench has been backfilled to ground surface.
 - 4. Introduce water above the pipe embedment through a long pipe nozzle so disturbance of granular embedment or compacted material is held to an absolute minimum.
 - 5. Add backfill material to compensate for settlement below surface grade and settled during puddling operations.
- J. Install identification tape in backfill 24” directly above top of all buried pipe, unless otherwise scheduled or shown on Drawings. Use tape with metallic foil stripes for all non-metallic pipes.
- K. Upper 18” of trench shall contain no particles larger than 6” in any dimension.

- L. Surface Finish:
 - 1. For placement of paving or gravel surfacing, subgrade where applicable.
 - 2. Match existing and surrounding contours.
 - 3. Graded finished appearance.

3.11 FIELD QUALITY CONTROL

- A. Section 01 45 00 – Quality Control
- B. Section 01 70 00 – Execution Requirements
- C. Test Schedule unless otherwise directed by the Engineer:
 - 1. Minimum of one field density test for each compacted layer of trench backfill for each 250 linear feet of trench in traveled areas.
- D. Minimum of one field density test for each compacted layer of trench backfill for each 500 linear feet of trench in untraveled areas.
- E. Minimum of two field density tests for each compacted layer of trench backfill at each road crossing.

3.12 PIPE BEDDING SCHEDULES

- A. Cast or Ductile Iron Pipe:
 - 1. Minimum Bedding Class:

<u>Pipe Diameter</u>	<u>Trench Depth To Top of Pipe</u>	<u>Bedding Class</u>
14" or less	5' or less	D
	5' – 12'	C
	More than 12'	B
Larger than 14"	12' or less	C
	More than 12'	B

- B. PVC, HDPE, and Other Plastic Type Pipes:
 - 1. As recommended by manufacturer.
 - 2. Minimum bedding class:
 - a. Trench depth to top of pipe less than 10'; Class C
 - b. Trench depth to top of pipe 10' or more; Class B
 - 3. Gravity sewer lines bedded to meet maximum deflection requirements given with pipe specifications.
- C. Corrugated Metal Pipe:
 - 1. Minimum bedding class:
 - a. Trench depth to top of pipe less than 5'; Class C
 - b. Trench depth to top of pipe more than 5'; Class B

- D. Unstable Trench Conditions Due to Groundwater:
 - 1. Crushed Stone Encasement

3.13 PIPE MARKING SCHEDULE

- A. Identification Tape: 3” metallic foil for each utility pipe type.

END OF SECTION

SECTION 31 34 19.16

FILTER FABRIC

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish and install filter fabric used in riprap, and/or other construction, as shown on Drawings or scheduled.

1.02 SUBMITTALS

- A. Two samples of filter fabric, nominal size 8" x 10", along with product data.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Filter Fabric: Needle punched non-woven polypropylene geotextile, inert to biological degradation, and with property values as listed below:

<u>Fabric Property</u>	<u>Unit</u>	<u>Test Method</u>	<u>Min. Average Value*</u>
Weight	oz/yd ²	ASTM D5261	4.8
Thickness	mils	ASTM D5199	40
Grab Tensile Strength	lbs	ASTM D4632	120
Grab Tensile Elongation	%	ASTM D4632	50
Trapezoidal Tear Strength	lbs	ASTM D4533	50
Mullen Burst Strength	psi	ASTM D3786	225
Puncture Strength	lbs	ASTM D4833	65
Apparent Opening Size	US Std. Sieve	ASTM D4751	70
Permittivity	Sec-1	ASTM D4491	1.7
Water Flow Rate	gpm/ft ²	ASTM D4491	135
UV Resistance, after 500 hrs.	% Strength Retained	ASTM D4355	70

*Values per roll of fabric

- B. Fabric specifically designed for drainage applications.

PART 3 EXECUTION

3.01 PREPARATION

- A. Excavate area upon which the cloth is to be placed to conform to the lines, grades and details shown on the Drawings.
- B. Prepare surface to receive cloth to a condition that is free of obstructions, depressions, and debris.

3.02 INSTALLATION

- A. Filter Fabric for Riprap:
 - 1. Lay fabric loosely with long dimension perpendicular to channel centerline.
 - 2. Do not stretch cloth when laying.
 - 3. Splice fabric so that upstream edge overlaps downstream edge a minimum of 12".
 - 4. Splice and install in accordance with manufacturer's printed instructions.
 - 5. Hold fabric tightly to the ground with vertically driven staples.
 - 6. Replace and repair damaged filter.

3.03 SCHEDULE

- A. As shown on Drawings.

END OF SECTION

SECTION 31 37 16

RIPRAP SURFACE TREATMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The construction of riprap surface treatment shall consist of furnishing and placing stone, with or without grout, with or without wire mesh, or sacked concrete riprap. The depth and type of riprap shall be as shown on the construction plans.

1.02 REFERENCES:

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T 96 – Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 2. AASHTO T 103 – Soundness of Aggregates by Freezing and Thawing (Procedure A Total Immersion in Water).
 - 3. AASHTO T 104 – Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
- B. American Society for Testing and Materials International:
 - 1. ASTM C127 – Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.

1.03 SUBMITTALS

- A. Submit in accordance with Section 01 33 23 – Shop Drawings, Product Data, and Samples:
 - 1. Certify that materials comply with specification requirements.

PART 2 PRODUCTS

2.01 STONE

- A. Sound and durable, free from seams and coatings, and of such characteristics that it will not disintegrate when subjected to the action of water. Riprap stone or rock shall meet the following criteria:
 - 1. Specific gravity of 2.65, as determined by ASTM C127. If available rock does not meet this density, then the size and depth of riprap shall be increased according to the following table:

Specific Gravity

Percent Increase in
Size and Depth

2.65	0
2.60	5
2.50	15
2.40	25

2. Los Angeles abrasion wear of not more than 50 percent as determined by AASHTO T 96.
3. Soundness loss of not more than 21 percent, as determined by AASHTO T 104.
4. Freeze thaw loss of not more than 10 percent after 12 cycles, per AASHTO T 103, Procedure A.
5. The size and gradation of riprap stone shall be as designated on the Drawings, and as further designated in the Table at the end of this Section.
6. Stone shall be of shapes which will form a stable protection structure of the required depth. Rounded boulders or cobbles shall not be used on slopes steeper than 2 to 1 unless grouted. Angular shapes may be used on any slope. Flat or needle shapes will not be acceptable unless the thickness of the piece is more than 1/3 the length.
7. Waste concrete may be used if the pieces are sound, free from coatings, meet the size requirements specified for stone, and is specifically approved on the Drawings.

CLASSIFICATION AND GRADATION OF ORDINARY RIPRAP

Riprap Designation	% Smaller Than or Equal To Given Size by Weight	Minimum Dimension Inches	Km* Inches
Type L (Light)	100 35-55 10	12** 9 2	9

*km = mean particle size

**At least 30% of all stones by weight shall be this dimension.

2.02 FILTER CLOTH

- A. Non-Woven Polyester Geotextile, such as:
 1. Mirafi No. 140N Drainage Fabric, Mirafi Inc., Charlotte, North Carolina
 2. or ENGINEER reviewed equivalent.

PART 3 EXECUTION

3.01 PREPARATION OF GROUND SURFACES

- A. The bed for riprap shall be shaped and trimmed to provide even surfaces.

- B. Specified filter cloth shall be placed on earth bed prior to placement of stone.
- C. Earth surface shall be shaped and trimmed to conform to the construction plans prior to the placement and compaction of the gravel type of filter material.

3.02 PLACING FILTER CLOTH

- A. The surface to receive the cloth shall be prepared to a relatively smooth condition free of obstructions, depressions, and debris. The cloth shall not be laid in a stretched condition but shall be laid loosely with a long dimension perpendicular to the channel centerline. The cloth shall be placed so the upstream edge overlaps the downstream edge a minimum of 12 inches, with securing pins inserted through both layers at no greater than two-foot intervals. Cloth damaged or displaced before or during installation or placement of the overlaying riprap shall be replaced or repaired to the satisfaction of the ENGINEER at the CONTRACTOR'S expense.

3.03 PLACING RIPRAP STONE

- A. When the required riprap is less than 20 inches in depth, stone shall be placed by hand unless otherwise authorized by the ENGINEER. Stone shall be placed to provide a minimum of voids. The larger stone shall be placed in the toe return, foundation course, and on the outer surface of the riprap. Stones shall be placed with their longitudinal axis normal to the face of the embankment and so arranged that each rock above the foundation course has at least a 3 point bearing on the underlying stones. Bearing on smaller stones used to chink voids will not be acceptable. Interstices between stones shall be chinked with small stones and spalls. The finished surface shall be even and tight and shall not vary from the planned surface by more than 3 inches per foot of depth. When the required riprap is 20 inches or more in depth, the stone may be placed by dumping and spread in layers by bulldozers or other suitable equipment.
- B. Riprap shall be placed to its full design thickness (depth) in one operation.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING FOR SMALL AREAS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish and place asphalt pavement as detailed on the Drawings.
- B. Establish grades set grading stakes to the designed elevation. In establishing grades, make adjustments for existing improvements, accessibility, proper drainage, adjoining property rights and appearance.
- C. Preparation of Subgrade:
 - 1. Remove debris, vegetation, or other perishable materials from the job site, except for trees or shrubs designated for preservation.
 - 2. Grade site to be paved to the required section and remove excess material from the location of the work.
 - 3. Remove material in soft spots to a depth required to provide a firm foundation and replace with a material equal to, or better than, the best subgrade material on the site.
 - 4. Compact the entire subgrade area thoroughly at the lowest moisture content at which a handful of the soil can be molded by a firm closing of the hand. The surface of the subgrade after compaction shall be hard, uniform, smooth, and true to grade and cross-section.
 - 5. Treat subgrade areas with a soil sterilant at the rate specified by the manufacturer to prevent the growth of weeds.
 - 6. Prime the subgrade.
- D. Thickness of Structure: Provide crushed aggregate base course on the prepared subgrade to the compacted thickness shown on the Drawings. Place plant mixed asphalt surface course in a single course to a compacted thickness shown on the Drawings.
- E. Tack Coat: If laying plant-mix asphalt in more than one lift, apply a tack coat of asphalt applied at the rate of 0.1 gallons per square yard between lifts.
- F. Sampling and Testing: If specified, furnish samples of the materials to be used in the work for test and analysis representative.
- G. Equipment, Materials, and Labor: Provide the necessary equipment, materials, and labor to complete the job acceptable to the owner. Variations in the size and amount of equipment will depend on the size of the area being paved.

- H. Smoothness: The surface of the completed work, when tested with a 10-foot straightedge, shall not contain irregularities in excess of 1/4 in.

1.02 JOB CONDITIONS

A. Weather Limitations:

1. Apply bituminous tack and prime coats only when the ambient temperature is 40°F and when the temperature has not been below 35°F for 12 hours immediately prior to application.
2. Do not apply tack and prime coat when the subgrade surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
3. Construct each bituminous pavement structure course only when an atmospheric temperature is above 40°F and rising, when the underlying base is dry, and when weather is not rainy, foggy, or stormy.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subgrade: Existing in-place soil except organic materials, solid obstructions, muck and other unsuitable materials shall be removed. Filling pockets in the subgrade with base course material or asphalt will generally not be permitted.
- B. Crushed Aggregate Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940, with at least 90 percent passing a 1-1/2 inch sieve and not more than 8 percent passing a No. 200 sieve.
- C. Prime and Tack Coats: Emulsified asphalt suitable for the intended use and local soil conditions. Tack Coat of diluted SS-1, SS-1 h, CSS-1 or CSS-1h. The asphalt emulsion should be diluted with equal parts of water
- D. Asphalt: The asphalt for the plant mix asphalt shall meet the requirements of ASTM Standard Specification D3515 Type 1, Grade B, or the appropriate NMSHTD specification for plant mix, hot laid asphalt for the job site area.

PART 3 INSTALLATION

3.01 CONSTRUCTION

A. Spreading Base and Surface Courses: Asphalt Base and Surface:

1. For all areas of more than 1,000 square yards, spread asphalt base and surface courses and strike off with a paver. Correct irregularities in the surface of the pavement course directly behind the paver. Remove excess material forming high spots with a shovel or a lute. Fill in indented areas with hot mix and

smooth with a lute or the edge of a shovel pulled over the surface. Casting of mix over such areas shall not be permitted.

2. If it is impractical to use a paver or spreader box in areas of 1,000 square yards or less, asphalt base and surface courses may be spread and finished by hand. Wood or steel forms, rigidly supported to ensure correct grade and cross-section, may be used. Perform placing by hand to avoid segregation of the mix. Broadcasting of the material shall not be permitted. Any lumps that do not break down readily shall be removed.

B. Prime Coat: Apply prime coat to penetrate and seal, but not flood, the base course surface. Dry up excess prime coat with blotter sand approved by the Engineer. Properly cure prime coat.

C. Compaction: Asphalt Base and Surface: Start rolling as soon as the hot-mix asphalt can be compacted without displacement. Continue rolling until the hot-mix asphalt is thoroughly compacted and roller marks have disappeared.

1. In areas too small for the roller, a vibrating plate compactor or hand tamper may be used to achieve thorough compaction.

3.02 PROTECTION

A. After final rolling, do not permit traffic on bituminous pavement until it has cooled and hardened, and in no case sooner than 6 hours.

B. Provide barricades and warning devices as required to protect pavement and the general public.

3.03 GUARANTEE

A. Guarantee in writing the workmanship and materials of the completed pavement for a period of (1) one year.

END OF SECTION

SECTION 32 16 00

SITE IMPROVEMENTS CONCRETE WORK CURBS, GUTTERS, SIDEWALKS, PATIOS, AND DRIVEWAYS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Construction of Portland cement concrete curb, gutter, combination curb and gutter, and driveways of the dimensions and design as indicated, and placed in one course on the prepared subgrade or base, at the locations and to the required lines and grades; as shown on the drawings

1.02 QUALITY ASSURANCE

- A. Allowable Tolerances:
 - 1. Finished surfaces will not be acceptable if varying from a straight line by more than 1/8 inch when checked with a 10-foot straightedge.

1.03 SUBMITTALS

- A. Concrete mix design.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Forms:
 - 1. The formwork shall be designed in accordance with ACI 347.
 - 2. Chamfer Strips: Clear white pine, surface against concrete planed.
 - 3. Form Coating: Industrial lubricants "Nox-crete Form Coating", "L&M Debond", Protex "Pro-Cote", Richmond "Rich Cote", or A/E approved equivalent.
 - 4. Form Ties: Removable end, permanently embedded body type not requiring auxiliary spreaders, with cones on outer ends, embedded portion 1" minimum back from concrete face. If not provided with threaded ends, construct for breaking off ends without damage to concrete.
 - 5. Earth cuts shall not be used as forms for vertical surfaces, unless indicated on project drawings.
- B. Reinforcing:
 - 1. AASHTO M55
 - 2. Bars: ASTM A615, Grade 60

3. Bar supports: PS7; CRSI Class B, fabricated from galvanized wire.
 4. Welded Wire Fabric: ASTM A185 or A497: 6 x 6 – 10 x 10 welded wire fabric with supporting chairs shall be installed in:
 - a. Drivepads
 - b. Sidewalks crossing drivepads
 - c. Indicated sidewalks
 - d. Patios
 - e. Concrete playing sports surfaces
- C. Portland Cement Concrete:
1. Cement: ASTM C150, Type I or II. Fly ash: ASTM C618, Class F, except loss on ignition not more than 5%.
 2. Fine aggregate: Clean, natural sand, ASTM C33.
 3. Coarse aggregate: Crushed rock, natural gravel or other inert granular material, ASTM C33 except clay and shale particles no more than 1%.
 4. Water: Clean, fresh and potable.
 5. Admixtures:
 - a. Retarder: ASTM C494, Type D; Grace “Duratard-HC”, Master Builders “Pozzolith 300-R”, Protex “Protard”, Sika Chemical “Plastiment”, or A/E approved equivalent.
 - b. Plasticizer: ASTM C494, Type A; Grace “WRD A-HC”, Master Builders “Rheobuild 1000”, Sika Chemical “Plastocrete”, or A/E approved equivalent.
 - c. Air entraining agent: ASTM C260; Grace “Darex AEA”, Master Builders “MB-VR”, Protex “AES”, Sika Chemical “AEK”, or A/E approved equivalent.
 - d. Water reducing agent ASTM C494, Type A; Master Builders “Polyheed 997”, or A/E approved equivalent.
- D. Accessories:
1. Polyethylene film: PS17, 6 mil
- E. Joint Fillers:
1. Preformed expansion joint filler: AASHTO M33 or M153.
 2. Exterior expansion joint material: Asphalt impregnated fiberboard: ASTM D994.
- F. Joint Sealers: AASHTO M173
- 2.02 CONCRETE MIX
- A. Comply with ASTM C94
- B. Schedule:
1. Water to Cementitious Material Ratio: Maximum 0.50

2. 4000 psi, unless otherwise scheduled or shown on the Drawings.
 3. Volumetric Air Content: 4.5% to 7.5%
 4. Compressive strength at 28 days:
 5. Design slump: 4 inches maximum
- C. Admixtures:
1. Content, batching method, and time of introduction in accordance with the manufacturer's recommendations for compliance with this specification. Include a water-reducing admixture. Calcium chloride shall not be used.
- D. Coarse Aggregate Maximum nominal dimension 3/4" for 8" concrete members.
- E. Consistency:
1. Suitable for the placement conditions.
 2. Slump uniform.
 3. Aggregate floating uniformly throughout the concrete mass.
 4. Flow sluggishly when vibrated or spaded.
 5. Adjust mix in field, with A/E's approval, as required to meet specifications.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to placing forms, check to see that the subgrade has been compacted to the degree as noted on the Drawings.

3.02 INSTALLATION

- A. Forms: In accordance with ACI 347:
1. Mortartight, exposed concrete surfaces free from irregularities, true to line, grades, and dimensions shown on the drawings, rigid and properly braced, ties arranged so that metal will not show or discolor concrete surface, bevel or chamfer exterior corners.
 2. Coat forms with acceptable release material.
- B. Reinforcing Steel:
1. Remove rust, scale, grease or any coating which may impair bond to concrete.
 2. Provide supports to provide minimum cover and spacing.
 3. Provide splice lengths as required by ACI 318.
- C. Concrete:
1. Place before initial set has occurred, but in no event after the concrete has contained its water content for more than 30 minutes.
 2. Place concrete on compacted moist surfaces, free from standing or running water.

3. Concrete to be conveyed and placed in an approved manner to prevent segregation of the coarse aggregate.
4. Cold weather comply with ACI 306, hot weather comply with ACI 305.
5. Concrete shall be poured to thicknesses and dimensions shown on Drawings.

D. Finishing:

1. Curb and Gutter:
 - a. Unless otherwise noted, give concrete a light broom finish with the brush marks parallel to the curb line or gutter line.
2. Sidewalks, Sports Playing Surfaces and Patios:
 - a. Unless otherwise noted, give concrete a light broom finish with the brush marks perpendicular to the curb line, gutter line or edge of concrete.
3. Drivepads:
 - a. Unless otherwise noted, give concrete a light broom finish with the brush marks perpendicular to the curb line or gutter line.

E. Joints:

1. Provide control joints at intervals indicated on the Drawings.
 - a. Extend joint into the concrete for at least one-third of the depth and make it approximately 1/8 inch wide.
2. Provide 1/2" preformed expansion joints at 36' on center maximum, at curb returns and adjacent to buildings, walls and other immovable objects.
3. Edge all edges not specifically dimensioned with a 1/4" or a 3/8" edging tool.
4. Seal all joints.

F. Backfilling:

1. Remove all forms.
2. Do not place earth backfill or pavement adjacent to curb and gutter or sidewalk until at least seven (7) curing days have elapsed.
3. Backfill with approved material.
4. Thoroughly compact backfill to the same density as the subgrade and at the proper moisture content.

3.03 FIELD QUALITY CONTROL

- A. Test cylinders shall be taken as ordered, during placement of each 1500 feet of curb and gutter. Two cylinders for 7 day and two cylinders for 28-day tests shall be required for the footage specified. Furnish cylinders and pay all transportation and testing charges. Bid amount for curb and gutter shall include such charges.

3.04 PROTECTION AND CURING

- A. Protect new work from traffic damage. This includes erection and maintenance of barricades, warning lights or signs, and watchmen to direct traffic. Traffic shall be excluded from the new construction for not less than 7 days when the temperatures

are 70 degrees F. or higher and not less than 10 days when temperatures are not lower than 60 degrees F. If the temperatures are lower than 60 degrees F, traffic shall be kept off for any length of time the engineer may require up to 21 days.

3.05 CLEANUP OF SITE OF OPERATIONS

- A. Remove materials, equipment, and miscellaneous debris from the street and boulevard promptly upon completion of concreting and other operations,

END OF SECTION

SECTION 32 84 23

TEMPORARY IRRIGATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Install a complete automatic irrigation system as shown on the Drawings and as specified herein.
- B. Furnish all labor, equipment, materials and permits necessary for the completion of the system.
- C. Decommission and remove irrigation system one year after installation of plants.

1.02 REFERENCES

- A. ANSI/ASAE S376.2: Design, Installation and Performance of Underground, Thermoplastic Irrigation Pipelines
- B. ASAE EP405.1 Design and Installation of Micro-irrigation Systems
- C. ASAE S398.1 Procedure for Sprinkler Testing and Performance Reporting
- D. Uniform Plumbing Code
- E. National Electrical Code
- F. Manufacturer's Standardization of Valves and Fittings Industry, Specifications SP-80.

1.03 SUBMITTALS

- A. Submit items in accordance with Division 1, "Submittals" section
- B. Manufacturer's Product Data for system major components including:
 - 1. Backflow Preventers
 - 2. Manual Valves
 - 3. PVC Fittings
 - 4. Sprinkler Heads/Nozzles
 - 5. Low-Flow Emitters
 - 6. Conductors and Splice Kits
 - 7. PVC Flex Nipples
 - 8. Sch. 80 PVC Nipples

9. Main Line Piping
 10. Automatic Controllers and Vaults
 11. Joint Materials: Cement & Primer, Thread Sealers, Gasket Lubricants
 12. Automatic Control Valves
 13. Valve Boxes and Extensions
 14. Lateral Piping
 15. Sleeve Piping
 16. Vaults
 17. Filters
 18. Freeze Protection
 19. PVC Ball Valves
 20. 24 Volt Wire
 21. Quick Coupler Valves
- C. Electrical Shop Drawings:
1. Complete, detailed, layout drawings covering design of system showing location and mounting details of electrical control equipment.
 2. Complete wiring diagram of 120-volt and 24-volt routes showing color of wires and wire sizes.
 3. Wiring details and source of current and connections to services.
- D. Closeout Submittals:
1. Record drawings of the system as installed.
 2. Operations and Maintenance Data and Information
 3. Maintenance Materials

1.04 QUALITY ASSURANCE

- A. Qualifications:
1. The Contractor shall have a current New Mexico Lawn Sprinkler or Irrigation System Contractor's License.
 2. The Contractor shall have 5 years of experience with type and scale of work.
- B. Regulatory Requirements:
1. All work and materials shall be in full accordance with current codes, rules, and regulations of safety.
 2. Furnish and maintain all warning signs, shoring, barricades, red lanterns, etc., as required by the Safety Orders of the Division of Industrial Safety and Local Ordinances.

1.05 WARRANTY AND GUARANTEE

- A. The Contractor shall Warranty and Guarantee the complete irrigation system for one full year beginning from date of final acceptance.

- B. Warranty shall cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment, and workmanship to the satisfaction of the Owner.
- C. In case of questions regarding the condition of the irrigation system warranty, and/or guarantee, the replacement or repair decision shall be made by the A/E which will be final.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a secure area to protect from damage:
 - 1. Screen polyvinyl chloride (PVC) pipe and fittings from direct sunlight.
 - 2. Store pipe on beds which are full length of pipe.
 - 3. Do not use any damaged or dented pipe fitting or irrigation component.

1.07 MAINTENANCE

- A. Maintenance Materials: Provide to the Owner prior to Final Acceptance.
 - 1. Two sets of special tools needed to adjust, repair and/or replace sprinkler heads.
 - 2. Two keys each for any assembly in need of key access, such as, but not limited to:
 - a. Backflow Preventer Vaults
 - b. Irrigation Controllers
 - c. Valve Boxes
 - d. Manual Valves
 - e. Water Meters
 - f. Automatic Valves
- B. Maintenance Service: Provide to the Owner prior to Final Acceptance:
 - 1. Name and address of Contractor's permanent maintenance service organization(s) that will render satisfactory service within twenty-four hours of receipt of notification that service is requested.
 - 2. Manufacturer and/or distributors do not qualify as permanent service organizations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The controllers, automatic valves and sprinkler heads and other components shall be by manufacturer scheduled on the Drawings, or approved equal.
- B. Deviations from scheduled products shall be allowed only by express written permission of the A/E and shall be executed at no cost to the Owner. The decision of

the A/E shall be final in determination of the quality of materials, equipment and installation of any and all substitutions

2.02 SOURCE QUALITY CONTROL

- A. The A/E reserves the right to take and analyze samples of materials for conformity to specifications at any time. The Contractor shall furnish the samples on request to the A/E.
- B. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense.
- C. Cost of testing materials not meeting the specifications shall be borne by the Contractor.

2.03 MATERIALS

- A. Materials throughout the system shall be new and in perfect condition. Material components shall be laid out as shown on the Drawings.
- B. Piping:
 - 1. Main Line piping 2.5" and larger shall be Class 200, SDR-21, O-ring gasket end PVC.
 - 2. Main Line 2" and smaller and Lateral piping shall be Sch. 40 PVC, bell end, solvent weld.
 - 3. Sleeve piping shall be class 200, SDR-21 PVC, bell end, solvent weld. Sizes shall be two sizes larger than pipe it will enclose. Sleeves for wire shall be 2" unless noted otherwise on plans.
 - 4. All piping shall be of domestic manufacture and shall be supplied in 20-foot lengths.
 - 5. If noted on plan or if utilizing non-potable water, all piping shall be permanently purple in color to signify non-drinkable.
- C. Fittings:
 - 1. Mainline fittings 2.5" and larger shall be Class 200, O-ring gasket PVC. All assemblies attached to main line shall be Gasket x Gasket x F.I.P.T. service tees.
 - 2. Main Line fittings 2" and smaller and Lateral fittings shall be schedule 40 PVC, solvent weld fittings.
 - 3. Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings, using plastic male adapters.
 - 4. All fittings shall be of domestic manufacture.

D. Solvents, Primers and Cements:

1. Use lubricants, primers and cements on PVC pipe and fittings recommended by pipe manufacturer. The pipe cement and pipe primer shall be of the same manufacture.
2. Use cement on Sch. 80 PVC fittings approved by the manufacturer for Sch. 80 PVC.

E. Conductors:

1. Electrical conductors shall be per NEC.
2. 120-Volt Conductors:
 - a. Single conductors suitable for 120-Volt AC current, having one black wire, one white wire and one green.
 - b. The power wire shall be properly sized as per plan or electrical drawings.
 - c. Conductors shall be solid copper and insulated.
3. 24-Volt Conductors:
 - a. Solid copper single conductor.
 - b. PVC insulated and approved for direct burial.
 - c. Common wire shall be white, 12 gauge AWG.
 - d. Control wire shall be red, 14 Gauge AWG.
 - e. Supplied in 2,500' rolls.

F. Splicing Kits:

1. Waterproof Scotch-Lok #3576 and/or #3570 or approved equal.

G. Valves:

1. Manual valves shall be as scheduled on the Drawings.
2. Remote control valves shall be operated by a 24-Volt AC electric solenoid unless otherwise noted or specified on Drawings.
3. Valves shall have manual shut-off, flow control adjustment and manual bleed control.
4. Valve pressure rating shall not be less than 150 psi.

H. Valve Boxes:

1. Valve boxes containing gate, manual, and remote control valves set flush with finish grade.
2. Provide circular cutout to accommodate piping and large enough so that valve box does not come into contact with or rest on piping.

I. Backflow Preventer:

1. Installed to meet or exceed the most recent prevailing codes.

J. Automatic Control Equipment:

1. The controller shall have at least the number of stations as described on the irrigation legend and 3 independent programs.

- K. Sprinkler Heads and Low-Flow Emitters:
 - 1. Low-flow emitters.
 - 2. Fixed spray sprinkler heads and nozzles.
 - 3. Gear drive sprinkler heads and nozzles.

- L. PVC Nipples:
 - 1. PVC flex nipples shall be pre-assembled by the manufacturer.
 - 2. Flex nipples assembled by the Contractor will be rejected.
 - 3. Rigid PVC nipples shall be Sch. 80 PVC.

PART 3 EXECUTION

3.01 SITE VERIFICATION OF CONDITIONS

- A. Before starting work of this section examine related work and surfaces.

- B. Report to the A/E in writing any and all conditions which will prevent proper execution and installation.

- C. Deviations from plans shall be executed only with the written permission of the A/E and at no additional cost to the Owner.
 - 1. Reasonable changes in the location of piping and automatic irrigation valves or other valves shown on the Drawings shall be considered prior to installation.
 - 2. Locations of irrigation heads are schematic; coordination with site conditions may be necessary.
 - 3. The Contractor shall bear the responsibility of coordinating all contractor-initiated changes with all other work effected by those changes.

3.02 INSTALLATION

- A. System Design:
 - 1. Sprinkler head locations shown on the drawings are schematic; make minor layout adjustments as necessary to avoid planting and other obstructions and to adjust for topographic conditioning.

- B. Layout:
 - 1. Install the irrigation system as shown on plans.
 - 2. Where connection to existing water supply is required, make necessary adjustments should the water source not be located exactly as shown on plans at no additional cost to the Owner.
 - 3. The location of the backflow device (if utilizing an atmospheric or pressure type vacuum breaker) shall be field located so that the assembly is at least 12" above any sprinkler or bubbler on that zone.

C. Sleeve Piping:

1. Place sleeves wherever piping and/or wires cross under existing or proposed pavement.
2. Coordinate and install sleeve piping prior to paving operations.
3. Bore under existing pavement as needed to install sleeve piping.
 - a. All borings shall be made with engine driven equipment designed and manufactured for the purpose of boring. See Section ????? Horizontal Directional Drilling.
 - b. Water drills under pavement will not be accepted.

D. Excavating, Trenching, Routing Operations:

1. Perform all excavations required for installation of the work included under this section, including shoring of earth banks, if necessary.
2. Locate all utilities prior to excavation.
3. Dig trenches wide enough to allow a minimum of 6" between parallel pipes. Trenches shall be of sufficient depth to provide a minimum cover from finish grade to top of piping or wires as follows:
 - a. Over 24-volt and 120-volt wires – 36".
 - b. Over continuous pressure mainline piping – 28".
 - c. Over non-continuous pressure mainline piping – 18".
 - d. Over Lateral piping – 18".

E. Control Wires:

1. Install control wires in common trenches for irrigation main line and laterals wherever possible. Wires shall be placed to one side in trench and below piping.
2. Provide slack at valves and corners and "snake" the wires to allow for contraction.
3. Tape wires in bundles at 10' intervals.
4. Splices will be allowed only on runs greater than 2,500'.
5. Crimp wires and seal connections with specified splicing kits.
6. Wire splices shall be made in valve box or pull box locations only.
7. Buried splices will not be permitted.
8. Expansion loops at valve boxes shall extend 36" above finish grade for maintainability.

F. Pipeline Assembly:

1. Install pipe in accordance with manufacturer's instructions including concrete thrust blocks on O-ring fittings.
2. Solvent-weld PVC pipe and fittings (except where threaded connections are required), using solvents, cements and methods recommended by the manufacturer. Where threaded connections are required use jointing materials and procedures as recommended by the manufacturer.
3. Make all connections between PVC pipe and metal valves or pipe-threaded fittings using a Sch.80 nipple with a coupling.

4. Pipe joint sealant shall be used on galvanized threaded steel and threaded PVC fittings as recommended by the manufacturer.
 5. Use cement on Sch. 80 PVC glued connections which is manufactured and approved for use on Sch. 80 PVC.
 6. During installation prevent rocks, dirt and other debris from entering pipe.
 7. No piping shall be assembled or installed at temperatures below 32F. PVC will expand or contract at a rate of 1" per 100' per 10 degrees F of change in temperature.
- G. Irrigation Control Valves:
1. Install automatic valves in valve boxes and group together where practical.
 2. Valve boxes may be placed no closer than 12" to walk edges, curbs, fences, buildings, and walls.
 3. Valve boxes shall be installed flush with finish grade.
 4. Install one valve per valve box.
 5. Valve boxes shall be supported by 4 CMU blocks, minimum.
- H. Closing Pipe and Flushing Lines:
1. Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe and shall be left in place until removal is necessary for completion of work.
 2. Flush all water lines thoroughly before installing valves, and other irrigation components.
- I. Backfilling and Compacting Operations:
1. After the system is operating and testing and inspections are completed, backfill excavations and trenches with clean soil.
 2. Backfill material shall contain no stones larger than 1" in diameter.
 3. Backfill shall be applied in 6" lifts and mechanically compacted after each lift.
 4. Compaction by use of vehicles or by flooding techniques will be rejected.
 5. Backfill for all trenches regardless of type of pipe covered shall be compacted to a minimum of 95% Modified Proctor density under pavements and footings and 85% under planted areas.
 6. All areas shall be dressed to smooth finish grades.

3.03 REPAIR/RESTORATION

- A. Repair/restore to original condition all existing improvements, under or above ground, damaged or cut, as a result of irrigation system installation work.
- B. Repair/restore to its original condition, all utilities and improvements damaged as a result of irrigation system installation work.

3.04 FIELD QUALITY CONTROL

- A. The following inspection and tests shall be the minimum required during the course of construction. Additional inspections shall be made at any time at the discretion of the Owner or Architect. Notify the A/E, in writing, 48 hours in advance of each required inspection and test.
- B. Do not proceed with work of the next sequence without written approval from the A/E stating that the work of previous sequence has passed inspection.
- C. Layout Inspection:
 - 1. Stake locations of valves and lines.
 - 2. Paint stakes for valves and lines with different colors for easy identification.
 - 3. Paint routes for 24-volt wires, mains and onto ground with EZ Marker paint of two different colors.
 - 4. The Contractor shall receive written approval to proceed with installation upon a successful layout inspection.
- D. Inspections Prior to Backfilling:
 - 1. 120-volt and 24-volt wire installations.
 - 2. Controller installations.
 - 3. Backflow preventer assembly.
- E. Inspection prior to backfilling and installation of sprinkler heads:
 - 1. All piping on the non-pressure side of the control valves shall pass a visual operation inspection.
- F. Inspections and Pressure Testing:
 - 1. Mainline installation.
 - 2. Automatic valves and lateral irrigation installation, (does not include irrigation head assemblies).
- G. Inspections and Testing Prior to Planting Operations:
 - 1. Controller operations.
 - 2. Line and emitter placements.
 - 3. Coverage test to determine if the water coverage for planting areas is complete and adequate; if coverage is deemed inadequate, retesting will be necessary after inadequacies have been corrected.
- H. Hydrostatic Tests:
 - 1. Shall be made when welded PVC joints have cured at least 24 hours. Leaking piping shall be repaired and retested.
 - 2. All piping on the pressure side of the control valves shall be tested under continuous static water pressure of 100 PSI for a period of 24 hours.

3. Prior to installation of sprinkler heads and backfilling, all piping on the non-pressure side of the control valves to include swing joint and riser assemblies. This test shall be made under the maximum available line pressure.

I. Final Inspection:

1. After the system is balanced and adjusted, after all work and clean up is completed, and after punch list items are complete, issue a notice of completion to the A/E requesting a final inspection at a given date and time.
2. At the arranged time and date, demonstrate in the presence of the A/E and the Owner, each system in its entirety. In judging the work, no allowance for deviation from the original plans and specifications will be made unless prior approval was obtained in writing.
3. Any work deemed not acceptable shall be reworked to the complete satisfaction of the A/E before a written acceptance of the project work will be granted.

3.05 CLEANING

- A. Keep all areas of work clean, neat and orderly at all times:
 1. Paved areas shall be kept clean during installation.
 2. Collect and remove all debris from the entire work area on a daily basis.
- B. Remove from the site all excess and unsightly soil, stones, general debris and left over construction materials.

3.06 REMOVAL AND DECOMMISSIONING

- A. Remove and decommission irrigation system one year after installation of plants.
- B. Point of disconnection is shown on the Drawing details. Cap main line underground. Decommission power to controller.
- C. Remove appurtenances indicated on the details. Salvage removed backflow preventer, valves and controller to Owner.
- D. Fill all holes and depressions remaining after removal of valves and valve boxes and dress over with mulch matching that specified.

END OF SECTION 32 84 23

SECTION 32 92 13

REVEGETATIVE SEEDING

PART 1 GENERAL

1.01 SCOPE

- A. Work consists of soil stabilization through revegetative seeding including but not limited to: preparing the soil and seeding areas stripped of vegetation during construction operations.
 - 1. Refer to the Drawings, Schedules and Details for type and location of work required herein.
 - 2. Furnish labor, materials, equipment and supervision for the installation of work including
 - a. Seeding
 - b. Mulching
 - c. Hydraulically Applied Mulch
 - d. Site Cleanup
 - e. Maintenance and Guarantee
- B. Related Work
 - 1. Site Grading
 - 2. Erosion and Sedimentation Control

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Perform Work in accordance with applicable laws, codes and regulation required by authorities having jurisdiction over such work
 - 2. Provide for inspections and permits required by Federal, State and local authorities in furnishing, transporting and installing materials.

1.03 SUBMITTALS

- A. Samples: Furnish samples of materials demonstrating conformity to this specification as requested by the Owner.
- B. Manufacturer's Literature and/or Laboratory Analysis of products supplied
 - 1. Fiber Mulch
 - 2. Tank mix fertilizer
 - 3. Top dress fertilizer
- C. Certifications of seed and seed mixes from a certified testing laboratory
 - 1. Certification for Seed Mix to be dated within 12 months of placement
 - 2. Provide Certification that the seed has been stored in appropriate conditions in the 12 months before arriving at the project.

1.04 QUALITY ASSURANCE

- A. Submit a work schedule for approval at least fifteen (15) days prior to start of work under this section.
- B. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.05 DELIVERY, HANDLING AND STORAGE

- A. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis, and name of manufacturer.
- B. Seeds must arrive in original sealed containers from the Certified Supplier and labeled with contents
- C. Store in protected area

PART 2 PRODUCTS

2.01 SEED

- A. Species, varieties or origins and minimum rates of seeding are as specified herein.
- B. Seed substitutions:
 - 1. Substitution may be acceptable if specified seed or seed mix is not available at the time of installation.
 - 2. Provide letters from, three sources confirming that the originally specified seed is not available at the time of installation.
- C. Provide certified seed of named varieties in accordance with the minimum standards of the appropriate seed certification agency.
 - 1. Seed varieties shall be shall be certified weed-free in accordance with New Mexico Seed Law NMSA 1978, § 76-10-13.
 - 2. Seed shall be furnished in sealed standard containers unless exception is granted in writing the A/E.
- D. Seed shall labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. (U.S.C. § 1551 et seq.), and NMSA seed labeling requirements (NMSA 1978, § 76-10-11 et seq.).
 - 1. Every species and every bag shall be tagged with the following information
 - a. Variety (specify if certified)
 - b. Kind of Seed
 - c. Lot Number
 - d. Purity
 - e. Germination
 - f. Percentage crop seed, percentage inert, percentage noxious weeds
 - g. Origin
 - h. Test date
 - i. Weight in pounds of this species or percentage of lot

2. Provide seed analysis results that are not older than 12 months at the time of placement.
- E. Seed which has become wet, moldy or otherwise damaged in transit or in storage shall not be accepted.
- F. Seed Mix
1. Furnish pre-formulated seed mix containing specimens from Grass List, Wildflowers & Forbes List, and the Quick Cover. Install at specified rate for each type of plant seed, or as recommended by acceptable seed suppliers. Submit seed mix for review in accordance with Submittals Section 01 33 00 or Product Data 01 33 23. The seed mix specimen types are listed below.
 - a. Grass: *Achnatherum hymenoides* – Indian Ricegrass, *Bouteloua curtipendula* – Sideoats Grama, *Bouteloua gracilis* – Blue Grama, *Bromus marginatus* – Mountain Brome, *Hilaria jamesii* – Galleta Grass, *Nassella viridula* – Green Needlegrass, *Pascopyrum smithii* – Western Wheatgrass, *Schizachyrium scoparium* – Little Bluestem, *Sporobolus cryptandrus* – Sand Dropseed
 - 1) Application rate: [Drill Seeding: 5 oz. per 1,000 square feet of area (15 lbs. per Acre)] or [Broadcast Seeding: 10 oz. per 1,000 square feet of area (30 lbs. per Acre)]
 - b. Wildflowers & Forbes: *Baileya multiradiata* – Desert Marigold, *Cleome serrulata* – Rocky Mountain Bee Plant, *Coreopsis tinctoria* – Plains Coreopsis, *Eschscholzia californica ssp. mexicana* – Mexican Gold Poppy, *Gaillardia aristata* – Common Blanketflower, *Gaillardia pulchella* – Indian Blanketflower, *Linum lewisii* – Blue Flax, *Machaeranthera bigelovii* – Bigelow's tansyaster, *Mirabilis multiflora* – Desert Four O'Clock, *Penstemon strictus* – Rocky Mountain Penstemon, *Ratibida columnifera* – Mexican Hat, *Rudbeckia hirta* – Black-eyed Susan
 - 1) Application Rate: [Drill Seeding: 2 oz. per 1,000 square feet of area (5 lbs. per Acre)] or [Broadcast Seeding: 4 oz. per 1,000 square feet of area (10 lbs. per Acre)]
 - c. Quick Cover: *Leptochloa dubia* – Green Sprangletop or Sterile *Triticale hybrid* – QuickGuard
 - 1) Application Rate: [Drill Seeding: 2 ounces per 1,000 square feet of area (5 ½ lbs. per Acre)] or [Broadcast Seeding: 4 ounces per 1,000 square feet of area (11 lbs. per Acre)]
- G. Adjust rate of pure live seed using the following equation: $P \times G/100 = PLS$ where 90% or greater cannot be achieved:
1. P is the percent Purity
 2. G is the percent Germination (including dormant seed)
 3. PLS is the percent Pure Live Seed

Seed	Minimum % PLS Required	Pounds of PLS per Acre

- H. Provide documentation for premixed seed as if the Supplier sold or bagged the seeds separately.

2.02 AMENDMENTS

A. Fertilizer for Tank Mix

1. Grade 4-2-4 pelleted, uniform in composition and free flowing
2. Delivered in bags, fully labeled and conforming to state fertilizer laws and bearing the name or trademark and warrant of the producer
3. Rate per Acre = ADD WEIGHT/RATE PER ACRE

2.03 MULCH

A. Straw Mulch:

1. Free of noxious weeds as certified by an industry recognized forage certification authority.
2. Rotten and moldy straw will not be accepted

B. Hay Mulch:

1. Perennial native or introduced tough and wiry grasses and grass-like plants found in the lowland areas of the Rocky Mountain region; or prairie hay composed of grass of species specified in the Contract Documents
2. Provided in bales containing at least 65% (by weight) ten-inch or longer herbage
3. Harvested and cured at least 60 days before use.
4. Free of noxious weeds as certified by an industry recognized forage certification authority.
5. Rotten, brittle or moldy hay will not be accepted

C. Wood Chip Mulch:

1. Certified weed-free core material (woodchips).
2. 100% untreated wood chips and free of inorganic debris, such as plastic, glass, metal, etc.
3. Certified by manufacturer to be free of noxious weeds.
4. Size not be smaller than one (1) inch and not exceed three (3) inches in diameter;
5. Shavings shall not be more than five percent (5%) of the total mass.

2.04 HYDRAULICALLY APPLIED MULCH

A. Wood Fiber Mulch

1. Thermally processed 100% virgin wood fiber, heated to a temperature greater than 380 degrees Fahrenheit for 15 minutes at a pressure greater than 80 psi
2. Dyed green color to allow visual metering of application
3. Moisture Content: 12% +/- 3%
4. Water-Holding Capacity: 1,100% minimum
5. Maximum slope inclination: 2:1
6. Appl. rate on maximum slope: 3,000 pounds/acre
7. Maximum slope length: 28 feet
8. Functional longevity: up to 3 months

- B. Tackifiers:
1. Guar derived from the seeds of the cluster bean plant, processed into water-soluble paste guar gum paste; a natural product, environmentally benign.
 2. Plantago plant-based tackifier, also known as psyllium. Good for stabilizing soils, in both hydro-seeding and dust control applications.
 3. Anionic polyacrylamide (PAM), biodegradable chemical used in controlling dust and stopping sedimentation flows on construction sites..
 4. Pre-mixed in mulch or added [with seed], type dependent on use and soil conditions.
 5. Rate: Based manufacturer's recommendations for slope/gradient conditions

2.05 WATER

- A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product
- B. Water sources other than the local municipal domestic water supply must be approved by the A/E.
- C. If onsite reclaimed water sources are used, tanks and appurtenances shall be clearly marked with "NON-POTABLE" signage

PART 3 EXECUTION

3.01 SEQUENCING

- A. Do not schedule seeding before the middle of May
- B. Do not schedule seeding after the middle of September.

3.02 SURFACE PREPARATION

- A. Till the seedbed with a disc, harrow, or chiseling tools to at least 2 inches in depth. Uproot competitive vegetation during seedbed preparation, and uniformly work the soil to a surface free of clods, large stones, or other deleterious material that would interfere with seeding equipment.
- B. Till across the slope. Do not till the seedbed if the moisture content of the soil is outside the limits recommended by the seed supplier for planting, or the ground is in a non-tillable condition.
- C. Do not prepare more seedbed area on which the entire seeding operation can be applied before the surface crusts or loses seed and fertilizer to erosion.
- D. If erosion or crusting occurs, perform seedbed preparation again.

3.03 INSTALLATION

- A. Materials shall be submitted for approval prior to installation.

3.04 HERBICIDE/CHEMICAL APPLICATIONS

- A. all noxious weed growth on the site shall be controlled by the Contractor during the construction period and until the final inspection by spot application of herbicides which have been pre-approved by the A/E. Spot application of herbicides means detailed application of only the targeted weed species by wand or wick with a backpack applicator. No herbicides will be permitted for general application (broadcast).
- B. Herbicides or other chemicals, if required, shall be applied using well-maintained spraying equipment by individuals working for Contractor who are appropriately licensed by any State and/or Federal agency having jurisdiction over such applications. It shall be the responsibility of Contractor to be knowledgeable of any and all current laws and regulations pertaining to herbicide and other chemical applications, and to advise A/E immediately if any requests for these applications made are inappropriate as they pertain to these laws and regulations. Herbicide application shall be conducted by trained weed control personnel who also can recognize the targeted weed species.
- C. Herbicides and other chemicals shall not be applied during periods when wind or other physical conditions cause the herbicides or chemicals to be transported a distance of more than five feet from the immediate area where they are being placed. It shall be the responsibility of the Contractor to stop work immediately and to notify A/E if any weather or other physical condition exists which would make the application of herbicides or other chemical inappropriate.
- D. All herbicides or other chemical used (except solid fertilizers, article fertilizers) shall be applied at a rate and strength, and by the method recommended by the manufacturer of the product being used. Failure to properly apply herbicides (spot treatment) may result in the A/E requiring the Contractor to reseed the damaged area at no additional cost to the Owner.

3.05 DRILL SEEDING

- A. Plant seed approximately $\frac{1}{4}$ - $\frac{3}{8}$ inch deep, unless otherwise specified or recommended by seed supplier.
- B. The distance between drilled furrows shall be no greater than 8 inches. If furrow openers on the drill exceed 8 inches, re-drill the area.
- C. Perform seeding with grass seeding equipment that is in good working order. Equipment shall have the following:
 - 1. Double disc openers
 - 2. Depth bands
 - 3. Drop tubes
 - 4. Packer wheels or drag chains
 - 5. Rate control attachments
 - 6. Seed boxers with agitator for trashy seed
- D. Drill Seeder and Drop Seeder may be used interchangeably.

3.06 BROADCAST SEEDING

- A. Some portions of project areas may be inaccessible to a drill. In these areas, which shall be agreed upon by the A/E seed shall be uniformly broadcast at twice the specified PLS per acre and covered with soil to a depth of 1/4 inch to 3/8 inch by hand raking or harrowing by some other means acceptable to A/E.
- B. Broadcast seeding shall be accomplished using hand-operated “cyclone-type” seeders or rotary broadcast equipment attached to construction or revegetation machinery. All machinery shall be equipped with metering devices. Broadcasting by hand shall be acceptable on small, isolated sites. Prior to hand broadcast seeding, divide the seed required into two portions. Apply the first half of the seed and then follow-up by applying the second portion to ensure complete coverage by seed. When broadcast seeding, passes shall be made over each site to be seeded in a manner to ensure an even distribution of seed. When using hopper type equipment, seed shall be frequently mixed within the hopper to discourage seed settling and uneven planting distribution of species.
- C. Broadcast seeding shall take place immediately following the completion of final seedbed preparation techniques and upon inspection and approval of A/E. Broadcast seeding should not be conducted when wind velocities would prohibit even seed distribution.

3.07 HYDROSEEDING

- A. Do not hydro-seed non-irrigated areas unless specified on the plans.

3.08 MULCHING

- A. Do not perform mulching when wind velocity exceeds 15 mph.
- B. Spread the mulch uniformly over the area either by hand or with a mechanical mulch spreader.
 - 1. If spreading by hand, tear apart the bales of mulch and fluff it before spreading.
 - 2. If spreading with a mechanical mulch spreader, anchor or tack the mulch with an approved tackifier. Use the Materials and rate of application recommended by the manufacturer. The tackifier shall be Incidental to the seeding.
- C. Apply hay mulch at a rate of two (2) tons per acre of air-dry hay.
 - 1. Anchor hay mulch using a crimper with flat serrated discs at least one (1) inch thick with dull edges, spaced no more than nine (9) inches apart. Disc diameter must be large enough to prevent the frame of the Equipment from dragging in mulch.
 - 2. Anchor hay mulch a minimum of two (2) inches deep and do not cover with soil. Anchor hay mulch across the slope with no more than two (2) passes of the anchoring Equipment.
 - 3. Hay mulch have at least 50% of fibers exceeding ten (10) inches long on the ground after application.

- D. Apply straw mulch at a rate of two (2) tons per acre of air-dry straw.
 - 1. Anchor straw mulch with an approved tackifier at the rate of application recommended by the manufacturer.
 - 2. Straw mulch have at least 50% of fibers exceeding ten (10) inches long on the ground after application.

3.09 HYDRAULIC MULCHING ON PREPARED FINISHED GRADE.

- A. Special Mulching Equipment and Procedures:
 - 1. Hydraulic equipment used for the application of fertilizer, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient of agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water.
 - 2. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded.
 - 3. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste.
 - 4. The A/E may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.
- B. Mixing:
 - 1. Care shall be taken that the slurry preparation should be accomplished per the material supplier's recommendations and the equipment manufacturer's written operations manual.
 - 2. Spraying shall commence immediately when the slurry is mixed and the tank is full.
 - 3. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.
- C. Application:
 - 1. Contractor shall obtain approval of hydro-mulch area preparation from the A/E prior to application.
 - 2. Operators of hydro-mulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
 - 3. Keep hydro-mulch within areas designated and keep from contact with other plant material.
 - 4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.
 - 5. After application, the Contractor shall not operate any equipment over the covered area.

6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.
7. Refer also to the maintenance portion of this section.
8. Areas designed to be seeded on the drawings shall be covered uniformly with specified materials using hydro-mulching processes.
 - a. If surfaces remain uncovered within the designated area, the Contractor shall seed with required grasses or ground cover materials those areas missed by the hydro-mulch application.
 - b. Method used to seed these missed surfaces shall be an alternate seeding operation approved by the A/E and Owner and shall be accomplished at no additional cost to the Owner.

3.10 CLEAN UP

- A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations.
- B. Clean up and removal all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of A/E.

3.11 PROJECT CLOSEOUT

- A. Make written request for inspection prior to seeding and after areas have been seeded.
- B. Submit requests for inspections to A/E at least two (2) days prior to the anticipated inspection date.

3.12 MAINTENANCE BY THE CONTRACTOR

- A. The Contractor shall begin maintenance after seeding is installed and continue until Final Acceptance.
- B. The Contractor's Maintenance Period shall begin upon review and approval at Substantial Completion and shall be for the period of 60 days.
- C. The Contractor's maintenance of new seeding shall consist of watering, weeding, repair of all erosion and reseeding as necessary to establish a uniform stand of the specified grasses and forbs.

3.13 TOP DRESS

- A. Apply top dress fertilizer (16-6-8) at the rate of ten (10) pounds per 1,000 square feet at no less than nor more than twenty five (25) days after seeding unless approved in writing by the Owner.

3.14 GUARANTEE

- A. Contractor shall guarantee establishment of satisfactory stand that a minimum of ninety percent (90%) of the area planted will be covered with specified planting and have no bare spots greater than ten (10) square feet after one complete growing season, minimally one year.
- B. Contractor shall reseed and re-mulch areas determined by the A/E as deficient in coverage. Such rework shall be performed immediately upon notification by A/E, if within seeding season; rework shall be scheduled immediately if not within seeding season.

3.15 FINAL ACCEPTANCE

- A. Work under this Section will be accepted by A/E upon satisfactory completion of all work, but exclusive of reapplication under the Guarantee Period.
- B. Final Acceptance of grass establishment shall be as follows:
 - 1. Uniform coverage of seed and mulch. No single bare spot of seeded areas will be accepted.

END OF SECTION

SECTION 33 12 01

WATER SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Pipes, Materials, Valves, and Appurtenances for buried potable water and non-potable water service or uses as scheduled.
- B. Installation.

1.02 RELATED WORK

- A. Section 31 23 33 – Trenching and Backfilling
- B. Section 33 13 13 – Disinfection of Domestic Water Systems

1.03 REFERENCES

- A. American Society for Testing and Materials International (ASTM):
 - 1. ASTM A153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A307 – Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
 - 3. ASTM A536 – Ductile Iron Castings.
 - 4. ASTM D523 - Test Method for Specular Gloss.
 - 5. ASTM D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable.
 - 6. ASTM D1784 – Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 7. ASTM D1785 – Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 8. ASTM D2239 – Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 - 9. ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 10. ASTM D2464 - Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 11. ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 12. ASTM D2467 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 13. ASTM D2564 - Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 14. ASTM D2672 - Joints for IPS PVC Pipe Using Solvent Cement.
 - 15. ASTM D2737 – Polyethylene (PE) Plastic Tubing.
 - 16. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

17. ASTM D3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
18. ASTM D3350 – Polyethylene Plastics Pipe and Fittings Materials.
19. ASTM E8 - Test Methods for Tension Testing of Metallic Materials.
20. ASTM E23 - Test Methods for Notched Bar Impact Testing of Metallic Materials.
21. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
22. ASTM F714 - Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
23. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

B. American Water Works Association (AWWA):

1. ANSI/AWWA C104/A21.4 – Cement Mortar Lining for Ductile-Iron Pipe and Fittings.
2. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. ANSI/AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings.
4. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C115/A21.15 – Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.
6. ANSI/AWWA C116/A21.16 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
7. ANSI/AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast.
8. ANSI/AWWA C153/A21.53 – Ductile-Iron Compact Fittings.
9. AWWA C207 – Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
10. ANSI/AWWA C213 – Fusion-Bonded Epoxy Coating for the Interior of Steel Water Pipelines.
11. ANSI/AWWA C219 – Bolted, Sleeve-Type Couplings for Plain-End Pipe.
12. ANSI/AWWA C228 – Stainless-Steel Pipe Flange Joints for Water Service – Sizes 2 In. Through 72 In. (50 mm Through 1,800 mm).
13. ANSI/AWWA C303 – Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
14. ANSI/AWWA C500 – Metal-Seated Gate Valves for Water Supply Service.
15. ANSI/AWWA C502 – Dry-Barrel Fire Hydrants.
16. ANSI/AWWA C504 – Rubber-Seated Butterfly Valves.
17. ANSI/AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
18. ANSI/AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
19. ANSI/AWWA C550 – Protective Interior Coatings for Valves and Hydrants.
20. ANSI/AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances.

21. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
 22. ANSI/AWWA C700 – Cold-Water Meters – Displacement Type, Bronze Main Case.
 23. ANSI/AWWA C701 – Cold-Water Meters – Turbine Type, for Customer Service.
 24. ANSI/AWWA C704 – Propeller-Type Meters for Waterworks Applications.
 25. ANSI/AWWA C800 – Underground Service Line Valves and Fittings.
 26. ANSI/AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm), for Water Transmission and Distribution.
 27. ANSI/AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. (19 mm) Through 3 In. (76 mm), for Water Service.
 28. ANSI/AWWA C906 – Polyethylene (PR) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Waterworks.
 29. AWWA Manual M23 – PVC Pipe – Design and Installation.
 30. AWWA Manual M55 – PE Pipe – Design and Installation.
- C. National Sanitation Foundation International (NSF):
1. NSF/ANSI 61 – Drinking Water System Components – Health Effects.
 2. NSF/ANSI 372 – Drinking Water System Components – Lead Content.

1.04 SUBMITTALS

- A. Section 01 33 00 – Shop Drawings, Product Data, and Samples:
1. Product data for pipe materials, including pipe size, dimensions, pressure class, and color; valves, and appurtenances.
 2. Non-Toxic and Lead-Free Certification: Written statement that all materials in contact with potable water or raw water supply shall be NSF/ANSI 61 compliant, and shall be lead-free, as certified by the Water Quality Association to comply with NSF/ANSI 372.
 3. Manufacturer's installation instructions for pipe materials.
 4. Layout drawings for DIP furnished with ring-type integral buried joint restraint.
 5. Submit joint restraint layout drawings of all areas of piping containing bends, fittings, and valves. Indicate proposed method of restraint, such as external devices and integral restrained joints
- B. Section 01 78 23 – Operation and Maintenance Data:
1. Operation and maintenance data for valves 4-inches and larger and hydrants.

1.05 GENERAL REQUIREMENTS

- A. Pipes, fittings, and materials to be new.

- B. Use appropriate equipment and methods for unloading, reloading, hauling and laying pipe as well as proper trench excavation. Use slings with broad, well padded contact surfaces for pipe protection.
- C. All pipe of the same type shall be made by the same manufacturer. All fittings of the same type shall be made by the same manufacturer. Pipe manufacturer need not be the same as the fittings manufacturer.
- D. Provide labor, equipment, and materials for pipe field testing.

1.06 QUALITY ASSURANCE

A. Ductile Iron Pipe and Fittings:

- 1. Tests:
 - a. ASTM E8: Tension Testing of Metallic Materials.
 - b. ASTM E23: Impact Test.
- 2. Marking: Cast on each pipe length.
 - a. Weight, class, nominal thickness, and casting period.
 - b. Manufacturer's name, year of production, and letters "DI" or "Ductile Iron".

B. PVC Pipe and Fittings:

- 1. Tests: ASTM D3034, ANSI/AWWA C900, ASTM D 1784, and ASTM D 1785, as applicable.
- 2. Marking: Indelible, in each pipe.
 - a. Nominal pipe diameter and cell classification.
 - b. Manufacturer's name or trade name, PVC, ASTM and SDR designation, AWWA pressure class, and date of production.
 - c. Service designation.
 - d. NSF-61 certified.
- 3. Gasket rings: Marked with the manufacturer's identification, size, year of production, and classes of pipe in which they are to be used.

C. High Density Polyethylene (HDPE):

- 1. Tests: ASTM D2239 or ASTM D2737, ASTM F714, ANSI/AWWA C906, AWWA Manual M55, PPI Handbook of Polyethylene Pipe.
- 2. Marking: indelible, each pipe.
 - a. Nominal pipe size and material designation
 - b. Manufacturer's name or trade name, HDPE, ASTM and DR designation, and date of production.
- 3. Gasket Rings: Marked with the manufacturer's identification, size, year of production, and classes of pipe in which they are to be used.
- 4. Fusion: ASTM F 2620

PART 2 PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Ductile Iron:

1. Pipe:
 - a. ANSI/AWWA C151/A21.51: ASTM A536, Grade 60-42-10.
 - b. Thickness: Pressure Class 350 for pipes 12" diameter or smaller; Pressure Class 250 for pipes 14" diameter or larger unless otherwise scheduled.
2. Fittings: Cast from ductile iron: ANSI/AWWA C110/A21.10 full body or ANSI/AWWA C153/A21.53 short body.
3. Joints: ANSI/AWWA C111/A21.11:
 - a. Mechanical Joint: 350 psi working pressure.
 - b. Flange: Also ANSI/AWWA C115/A21.15 and ANSI/ASME B16.42, ductile iron; 150 lb. pattern, unless scheduled otherwise.
 - c. Bolts, Tie Bolts, and Nuts:
 - 1) Low carbon steel, ASTM A307.
 - 2) Bolts smaller than ¾-inch: With heavy hex heads for flange and T-head for MJ, and heavy hex nuts.
 - 3) Bolts ¾-inch and larger: With hex heads for flange and T-heads for MJ, and heavy hex nuts.
 - 4) Coating, Exposed Service: Grade B zinc coat per ASTM A153.
 - 5) Coating, Buried Service: Liquid applied fluoropolymer coating matrix consisting of lubricating compounds, UV stabilizers and coloring agents or pigments, heat cured, 0.7 to 1.0 mil total DFT.
 - d. Gaskets for mechanical joint, push-on and flanged joints:
 - 1) Conformance: ANSI/AWWA C111/A21.11.
 - 2) Material: Synthetic rubber as specified in referenced standard. Natural or reclaimed rubber not acceptable.
 - e. Lubricant: Suitable for potable water use and in conformance with ANSI/AWWA C111/A21.11.
4. Joint Restraint: Furnish external mechanical restraint devices, including restrained flange adaptors for exposed piping as specified herein, or integral joint restraints for buried joints if specified herein. Furnish restraint devices where scheduled or noted on Drawings, as specified in Part 2 of this Specification.
 - a. Integral Buried Joint Restraint:
 - 1) Minimum Pressure Rating: 350 psi to 18-inch, 250 psi to 24-inch, 150 psi to 30-inch.
 - 2) Gasket Type: U.S. Pipe Field Lok 350® Gasket, American Ductile Iron Pipe Fast-Grip® Gasket or Engineer reviewed equivalent.
 - 3) Ring Type: U.S. Pipe TR FLEX® Joint, American Ductile Iron Pipe Flex-Ring® Joint, American Ductile Iron Pipe Lok-Ring® Joint, or Engineer reviewed equivalent.

- 4) For gasket-type integral restraint:
 - a) Pipe manufacturer shall furnish to Contractor two (2) feeler gages capable of determining depth of gasket and presence of metal locking segments.
 - b) Contractor shall wrap bell of each restrained joint with factory furnished tape with words "Restrained Joint".
- 5. Corrosion Protection:
 - a. Outside Coating (buried or submerged service):
 - 1) Pipe: Bituminous per ANSI/AWWA C151/A21.51.
 - 2) Fittings: Bituminous per ANSI/AWWA C110/A21.10 and ANSI/AWWA C153/A21.53 or fusion-bonded epoxy per ANSI/AWWA C116/A21.16.
 - b. Inside Coating:
 - 1) Pipe: Cement mortar lined with asphaltic seal coat per ANSI/AWWA C104/A21.4.
 - 2) Fittings: Cement mortar lined with asphaltic seal coat per ANSI/AWWA C104/A21.4 or fusion-bonded epoxy per ANSI/AWWA C116/A21.16.
 - c. Polyethylene Encasement:
 - 1) Conformance: ANSI/AWWA C105/A21.5.
 - 2) Material: ASTM D4976, Group 2.
 - 3) Configuration: Seamless tube or sheet.
 - 4) Film Requirements:
 - a) Linear Low-density Polyethylene:
 - i. Thickness: 8 mil.
 - 5) Color: Weather-resistant black containing not less than 2 percent carbon black.
 - 6) Pipe Wrap Tape:
 - a) Material: 10 mil all weather polyvinyl film.
 - b) Durability: Resistant to moisture and corrosive soil.
 - c) Adhesion: Adheres to metal and plastic, and conforms to irregularities in substrate surfaces.
 - d) Elongation: 245 percent.
 - e) Tensile Strength: 30 psi.
 - f) Width: 2 inches.
 - g) Printed Identification Marking: UPC code and mil thickness.
 - h) Acceptable Manufacturer: Northtown Company, or Engineer reviewed equivalent.
 - 7) Strapping: Non-metallic, water resistant FS PPP-S-760.
 - 8) Install on buried ductile iron piping, fittings, and restraint assemblies in accordance with AWWA C105, unless scheduled otherwise.

- B. Polyvinyl Chloride (PVC):
1. Water Service Condition:
 - a. Potable Water Service:
 - 1) Pipe manufactured from compounds certified by the National Sanitation Foundation (NSF).
 - 2) Color: Blue pigment.
 2. Pipe and Fittings:
 - a. Pipe sizes 4-inch through 60-inch:
 - 1) ANSI/AWWA C900.
 - 2) Pressure class as scheduled.
 - a) Class 235 psi (DR 18) minimum for 12" and smaller if not scheduled or indicated otherwise.
 - b) Class 165 psi (DR 25) minimum for 14" and larger if not scheduled or indicated otherwise.
 - 3) Fittings: Cast from ductile iron; ANSI/AWWA C110/A21.10, full body or ANSI/AWWA C153/A21.53, short body; mechanical joint ANSI/AWWA C111/A21.11, external mechanical restraint devices as specified herein. Encase fittings and all external restraint assemblies with polyethylene encasement per ANSI/AWWA C105, unless scheduled otherwise.
 - b. Pipe sizes 3.5-inch and smaller:
 - 1) Unless otherwise scheduled or shown on the Drawings.
 - a) ASTM D2241.
 - b) 1.5-inch and smaller: SDR 21.
 - c) 2-inch through 3.5-inch: SDR 26.
 - d) Pressure rating as scheduled; 160 psi minimum if not scheduled.
 - 2) If scheduled or shown on the Drawings:
 - a) Schedule 40 and 80 Pipe Dimensions and Workmanship: ASTM D1785.
 - b) Schedule 40 minimum unless otherwise scheduled or shown on Drawings.
 - c) Material: ASTM D1784, Class 12454-B.
 - d) Fittings:
 - i. ASTM D2466, Schedule 40.
 - ii. ASTM D2464, Schedule 80, threaded.
 - iii. ASTM D2467, Schedule 80, socket type.
 3. Joints:
 - a. Gasket Bell End: ASTM D3139 for plastic pressure pipes using elastomeric seals.
 - b. Gaskets: ASTM F477, elastomeric.
 - c. Solvent Cement Bell End: ASTM D2672.
 - d. Solvent-Cement: ASTM D2564, NSF approved.
 - 1) Use only where specifically scheduled, shown on Drawings or reviewed by Engineer.

4. Joint Restraint: Furnish external mechanical restraint devices, including restrained flange adaptors, as specified herein, or integral joint restraints for buried joints if specified herein. Furnish restraint devices where scheduled, noted on Drawings, and where specified in this specification.
- C. External Mechanical Restraint Devices:
1. Works on principle of multiple wedging action against pipe, which increases its resistance as line pressure increases while maintaining joint flexibility. Set screw devices are not acceptable. Split non-serrated back-up rings behind bells are acceptable. Split serrated restraint rings are not acceptable, except on spigot end of bell restraint harness of C900 PVC pipe up to 12-inches. EBAA Iron Sales, Inc. or Engineer reviewed equivalent.
 2. Gland: Ductile iron with dimensions which match standard mechanical joint bells per ANSI/AWWA C153/A21.53, ASTM A536, Grade 65-45-12.
 3. Wedges: Heat-treated ductile iron with minimum Brinell hardness of 370 BHN.
 4. Wedges tightened during installation via twist-off nuts.
 5. Devices shall be designed for the following working pressure:
 - a. 250 psi for 18" to 48" DIP, with 2:1 safety factor.
 - b. 350 psi for 3" to 16" DIP, with 2:1 safety factor.
 - c. Meets or exceeds standardized pressure rating of host PVC piping.
 6. Devices shall be designed for the type of pipe material and pipe joint being harnessed.
 7. An identification number shall be cast into each gland body with the following information: Date and shift of manufacture, and plant location.
 8. All physical and chemical test results shall be made available to Engineer for review upon request by referencing the identification number.
 9. Coating for wedges, wedge actuators, bolts, tie bolts, nuts, and related fastener and gripping components:
 - a. Surface Preparation: Cleaner wash, phosphatizing, rinse, and drying.
 - b. Coating: Liquid applied fluoropolymer-matrix consisting of lubricating compounds, UV stabilizers, and coloring agents or pigments. Heat cured. Two coats, 0.7 to 1.0 mil total DFT .
 - c. Low VOC, resin bonded and thermally cured, single film, dry lubricant, primarily formulated for use on fasteners.
 - d. Designed to prevent corrosion and facilitate make-up torque.
 - e. Provide lubricity of coating for proper dispersion of PTFE.
 10. Coating for Cast Bodies:
 - a. Surface Preparation: Cleaner wash, phosphatizing, rinse, and drying.
 - b. Coating: Electrostatically applied TGIC polyester-based powder. Heat cured. 1.5 to 4.0 mils total DFT.
 - c. Designed to prevent corrosion, impact and UV resistance.
 - d. Appearance: Class 5 (orange peel) PCI smoothness standard; 75% to 85% gloss at 60 degrees per ASTM D523; pinhole free.

D. Couplings:

1. Use only where indicated on Drawings or reviewed by Engineer. Do not use where restrained fittings are specified.
2. For buried service, furnish factory-applied fusion-bonded epoxy coating in accordance with AWWA C213, and corrosion-resistant alloy bolts equivalent to Dresserloy.
3. Shall meet AWWA C219: Described by reference to couplings manufactured by Dresser Industries, Inc., Bradford, PA; equivalent couplings by Ford Meter Box, JCM Industries, Romac Industries, or by other manufacturers may be used:
 - a. Dresser Style 38 for exposed steel, cast iron, and ductile iron pipe, unless indicated otherwise on Drawings or scheduled.
 - b. Dresser Style 253 cast iron couplings for buried steel, cast iron, ductile iron, and asbestos cement pipe, unless indicated otherwise on Drawings.
 - c. Dresser Style 40 long couplings where long couplings are indicated.
 - d. Dresser Style 62 Type reducing couplings where reducing couplings are indicated.
 - e. Dresser Style 162 couplings for transition between different pipe materials.
 - f. Dresser Style 63 expansion coupling where expansion coupling is indicated; type as indicated on Drawings or scheduled.
 - g. Dresser Style 227 and 128 coupling with flanged adaptor where indicated on Drawings.
 - h. Dresser Style 131 dismantling joint.

E. Tapping Saddles and Service Lines:

1. Service Lines $\frac{3}{4}$ -inch to 3-inch:
 - a. Conformance: AWWA C901.
 - b. Resin: High density polyethylene (HDPE) PE4710 having minimum cell classification 445474C/E as rated by the Plastic Pipe Institute (PPI) and in conformance with ASTM D3350.
 - c. Wall Thickness Design:
 - 1) ASTM D2239, controlled inside diameter, SDR-9 unless scheduled otherwise, or
 - 2) ASTM D2737, copper pipe size, SDR-9, unless scheduled otherwise,
 - 3) Contractor's option unless scheduled otherwise,
 - 4) Minimum Pressure Rating: 150 psi at 73 degrees F.
2. Joints:
 - a. Compression fittings.
 - b. Compatible with heavy duty copper service fittings.
3. Tapping Saddles:
 - a. AWWA C900 PVC Host Pipe:
 - 1) Body Material: Bronze or brass.
 - 2) Strap Material: Type 304L stainless steel.
 - 3) Style: Two strap.
 - 4) Rated Working Pressure: At least 200 psig.

- 5) Outlet Seal: EPDM O-ring.
- 6) Tap Size: As indicated on Drawings.
- 7) Conformance: Applicable portions of AWWA C800.
- 8) Non-Toxic: NSF/ANSI 61 certified.
- 9) Lead Free: Certified by the Water Quality Association to comply with NSF/ANSI 372.
- 10) Acceptable Manufacturers: Mueller BR2S, Romac 202BS, Ford 202BSD, or Engineer reviewed equivalent.
- b. Ductile Iron Host Pipe:
 - 1) Body Material: Ductile iron, ASTM A536 with 10 to 12 mil nylon or epoxy coating.
 - 2) Strap Material: Type 304L stainless steel.
 - 3) Style: Two strap.
 - 4) Rated Working Pressure: At least 200 psig.
 - 5) Outlet Seal: EPDM O-ring.
 - 6) Tap Size: As indicated on Drawings.
 - 7) Conformance: Applicable portions of AWWA C800.
 - 8) Non-Toxic: NSF/ANSI 61 certified.
 - 9) Lead Free: Certified by the Water Quality Association to comply with NSF/ANSI 372.
 - 10) Acceptable Manufacturers: Mueller DR2S, Romac 202N, Ford FCD202, or Engineer reviewed equivalent.
4. Corporation Stops:
 - a. Material: Bronze or brass.
 - b. Style: Ball type, suitable for use with tapping machine.
 - c. Rated Working Pressure: At least 300 psig.
 - d. Size: As indicated on Drawings.
 - e. Conformance: AWWA C800.
 - f. Threaded Connections: Compatible with tapping saddle.
 - g. Non-Toxic: NSF/ANSI 61 certified.
 - h. Lead Free: Certified by the Water Quality Association to comply with NSF/ANSI 372.
- F. High Density Polyethylene (HDPE) 3-inch to 54-inch:
 1. Conformance: AWWA C906, AWWA Manual M55, PPI Handbook of Polyethylene Pipe.
 2. Resin: High density polyethylene (HDPE) PE4710 having minimum cell classification 445474C/E as rated by the Plastic Pipe Institute (PPI) and in conformance with ASTM D3350.
 3. Wall Thickness Design: ASTM F714, DR pipe dimension ratio based on controlled outside diameter, DIPS sizing system.
 - a. Unless scheduled otherwise, DR 11.
 4. Joints: Thermal fusion ASTM F2620.

5. Connections to Other Piping and Valves: Fusion bonded HDPE Flange adapters with ductile iron back-up rings, ANSI B16.5 150 lb. flange pattern, or fusion bonded restrained MJ adapters.

2.02 APPURTENANCES

A. Cold Water Meters:

1. Size as shown on Drawings or scheduled.
2. Displacement type:
 - a. AWWA C700.
 - b. Invensys Metering Systems.
 - c. Or Engineer reviewed equivalent.
3. Displacement Type with Electronic Register, Touchread:
 - a. AWWA C 700.
 - b. Invensys Metering Systems.
 - c. Cases, bolts, washers, all conform to Sensus Technologies specifications.
 - d. Or Engineer reviewed equivalent.
4. Each displacement-type meter supplied and installed with:
 - a. Meter box with cast iron cover.
 - b. Setter.
 - c. Corporation stop.
 - d. Other installation appurtenances and accessories as shown on Drawings.
5. Turbine Type:
 - a. AWWA C701.
 - b. Invensys Metering Systems.
 - c. Or Engineer reviewed equivalent.
6. Propeller Type:
 - a. AWWA C704.
 - b. Invensys Metering Systems.
 - c. Or Engineer reviewed equivalent.

B. Resilient Wedge Gate Valves 2"-24" (Buried Service):

1. Size as shown on Drawings.
2. AWWA C509 or AWWA C515.
3. Mueller A-2361 series or Engineer reviewed equivalent.
4. Fully unobstructed, oversize flow way. The sealing mechanism is withdrawn from the flow way in a full open position. No pockets in bottom of flow way to trap sediment or debris.
5. Anti-friction washers above and below the thrust collar portion of stem to reduce friction.
6. Triple O-ring seals on the stem, two above and one below the thrust collar to protect from contamination.
7. A symmetrical rubber encapsulated disc with no exposed iron.
8. Forged bronze stem for added strength and reliability.
9. Coating: AWWA C550 and NSF-61 certified epoxy coating on all interior and exterior cast iron surfaces 10 mils nominal thickness.

10. 2 inch AWWA operating nut.
11. Ends: Mechanical joint, or as required for pipe or as shown on Drawings.
12. Threaded operator: Open left (counter clock-wise) unless scheduled otherwise.
13. Lead Free: Furnish certification as specified in Submittals section of this specification.

C. Tapping Sleeves:

1. Minimum working pressure: 250 psi.
2. Welded, fabricated type 304 stainless steel body with the following features:
 - a. Buna-N rubber gasket, gridded, 360 degree pipe coverage.
 - b. Type 304 stainless steel bolts and nuts.
 - c. Flat face steel flange per AWWA C228, Class D 150 lb. pattern per AWWA C207.
 - d. Test Plug: ¾-inch NPT, no-lead brass.
3. Ford FTSS, Smith-Blair 663, or JCM 432.
4. Sizes as shown on Drawings.

D. Tapping Valves:

1. Minimum working pressure: 150 psi.
2. Sizes as shown on Drawings.
3. Mueller Type T-2360 Resilient Wedge Gate Valve; Mechanical Joint on outlet side and Flange End on opposite side, or Engineer reviewed equivalent.
4. AWWA C509.
5. AWWA C550 and NSF-61 certified epoxy coating on all interior and exterior ferrous metal surfaces 10 mils nominal thickness.
6. Operator: 2-inch AWWA nut.

E. Pipe Marking Systems: Refer to Section 31 23 33 – Trenching and Backfilling.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install as indicated on Drawings.
2. Trenching, Backfilling, and Compacting: Section 31 23 33 – Trenching and Backfilling.
3. Pipe cutting measurement taken at site.
4. Clean all pipe, accessories, and appurtenances before use. Thoroughly clean interior of each section of pipe after installing it in trench.
5. Protection of stored materials: Section 01 60 00 – Product Requirements.
6. Securely close the end of the pipe at the end of each day or whenever the work ceases with a watertight seal.
7. Take precautions necessary to prevent uplift and floating of the pipe prior to backfilling.

B. Jointing and Assembling, General:

1. Manufacturer's recommendations.
2. Lubricants: Vegetable soap solution suitable for use on potable water systems.
3. Prevent entrance of soil and other contaminants.
4. Use mechanical or push-on for exterior locations.

C. Delivery, Handling, and Storage of PVC Pipe:

1. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Engineer.
2. Inspect each pipe shipment prior to unloading to see if the load has shifted or otherwise been damaged. Notify Engineer immediately if more than immaterial damage is found. Check each pipe shipment for quantity and proper pipe size, color, and type.
3. Off-load and handle pipe in accordance with AWWA M23 and AWWA C605, and all of the Pipe Supplier's guidelines.
4. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
5. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
6. Lower pipe from trucks carefully. Do not drop pipe.
7. Mark as rejected and remove at once from the work any pipe showing a crack or which has received a blow that could have caused an incident fracture, even though no such fracture can be seen.
8. Any scratch or gouge greater than 10 percent of the wall thickness will be considered significant and shall be rejected unless determined acceptable by the Engineer.
9. Store and place pipe lengths on level ground. Store pipe at the job site in the unit packaging provided by the Pipe Supplier. Exercise caution to avoid compression, damage, or deformation to the ends of the pipe. Keep the interior of the pipe, as well as all end surfaces, free from dirt and foreign matter.
10. Handle and support pipe using woven fiber pipe slings or approved equivalent. Exercise care when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.
11. If pipe is to be stored for periods longer than ninety (90) days, the pipe and gaskets should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe shall be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
12. Store and stack pipe in accordance with the Pipe Supplier's guidelines.

D. PVC Pipe Joint Assembly:

1. Conformance to AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water:
 - a. Assemble PVC pipe in conformance with AWWA C605, section 5.5.2 – Joint Assembly, which states:
 - 1) “Pipe spigot ends are pre-marked at the factory with a circumferential insertion line. This line references how far the spigot should be inserted into the adjoining PVC pipe bell. Field-cut spigot ends shall be marked and beveled to match the manufacturer’s insertion line. Pipe-to-pipe joints shall be assembled only to the insertion line. After assembly, the insertion line shall remain visible and be nearly flush with the lip of the adjoining PVC pipe bell. Joints assembled beyond the insertion line shall be considered over-assembled and may result in damaging stresses or leakage.”
2. Field Quality Control to Prevent Over-Assembly (Over-Insertion):
 - a. If a joint is found to be over-inserted, Contractor shall expose previously assembled joints until properly assembled joints are found. All over-inserted joints shall be properly re-assembled.
 - b. Contractor is permitted to use mechanical bell stop devices that meet the following criteria:
 - 1) Designed specifically to handle pipe insertion forces to prevent insertion beyond the marked insertion line.
 - 2) Incorporates a resilient expansion retention spring that allows for pipe expansion and contraction.
 - 3) Ebaa Iron Mega-Stop™ Series 5000 Bell Protection System, or Engineer reviewed equivalent.

E. PVC Pipe Tapping:

1. Tapping shall be performed using standard tapping saddles designed for use on PVC piping in accordance with AWWA C605 and as specified herein. Tapping shall be performed only with use of tap saddles or sleeves. **NO DIRECT TAPPING WILL BE PERMITTED.** Tapping shall be performed in accordance with the applicable sections for Saddle Tapping in accordance with Uni-Pub-08.
2. All connections requiring a larger diameter than that recommended by the Pipe Supplier, shall be made with a pipe connection as specified and indicated on the Drawings.
3. Equipment used for tapping shall be made specifically for tapping PVC pipe:
 - a. Tapping bits shall be slotted “shell” style cutters, specifically made for heavy-walled PVC pipe and designed to retain the coupon. “Hole saws” made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
 - b. Manually operated or power operated drilling machines may be used.
4. Taps may be performed while the pipeline is filled with water and under pressure (“wet” tap,) or when the pipeline is not filled with water and not under pressure (“dry” tap).

- F. Clean all lines by repeated flushings after installations.
- G. Disinfection: Section 33 13 13 – Disinfection of Domestic Water Systems.
- H. Pipe Sleeves:
 - 1. For all pipes passing through concrete or masonry.
 - 2. Install before concrete is placed where practical.
 - 3. Sleeve seal: Watertight, modular sealing element when sleeve is placed in slabs with one side against soil.
- I. Buried Pipe Anchorage:
 - 1. Furnish and install thrust blocking, anchors, joint restraint devices, or other acceptable means of preventing pipe movement whether indicated or not for:
 - a. Unlugged bell and spigot or all unflanged tees.
 - b. Y branches.
 - c. Bends deflecting 22-1/2 degrees or more.
 - d. Plugs.
 - e. Fittings in fills or unstable ground.
 - f. Above grade or exposed piping.
 - 2. Concrete thrust blocking:
 - a. Install so joints are accessible for repair.
 - b. Install as shown on Drawings for buried pipe unless otherwise scheduled or reviewed by Engineer.
 - c. Use bond breaker, such as 8 mil polyethylene sheets, between concrete and surfaces of all piping, fittings, and appurtenances.
- J. Valves: Installed as shown on Drawings with valve boxes and blocking.
- K. Fire Hydrants: As indicated on Drawings with concrete supports.

3.02 FIELD QUALITY CONTROL

- A. Ductile Iron Pipe: AWWA C600, except as specified otherwise herein.
- B. PVC Pipe and Fusible PVC Pipe: AWWA C605 for pressure rated, and AWWA Manual M23, except as specified otherwise herein.
- C. HDPE Pipe: AWWA C901, AWWA C906, AWWA Manual M55, and PPI Handbook of Polyethylene Pipe, except as specified otherwise herein.
- D. All pipes and fittings tested in presence and to the satisfaction of the Engineer.
- E. Test Conditions:
 - 1. Working Pressure: See Schedule.
 - 2. Medium: **Water only. Do not test PVC, FPVC or CPVC with air** because pipe failure from pressurized air may result in explosive shards.

3. Unless otherwise scheduled, perform test at 50% greater than working pressure, or 150 psi, whichever is greater, for two hour minimum.

F. Procedure:

1. Coordinate pressure testing with filling, disinfection and flushing procedures as submitted in the Disinfection Plan submittal specified in Section 33 13 13 – Disinfection of Domestic Water Systems.
2. Disconnect fixtures, equipment and accessories which may be damaged by test pressure.
3. Plug ends as required.
4. No installation will be accepted unless the leakage is less than the number of gallons per hour as determined by the following formula, except HDPE waterlines:
 - a. $L = (N) (D) (P^{0.5}) / 133,200$
 - b. Where:
 - 1) L = allowable leakage in gallons per hour.
 - 2) N = length of pipeline tested in feet.
 - 3) D = nominal diameter of pipe in inches.
 - 4) P = average test pressure during test, psig.
5. HDPE Waterlines: Unless scheduled otherwise, perform test at 50% greater than working pressure.
 - a. Fill Phase: Fill the restrained test section completely with water. Evacuate air from all high points.
 - b. Initial Expansion Phase: After the piping and water have equalized to a common temperature, gradually pressurize test section to test pressure, and maintain test pressure for three (3) hours. During the initial expansion phase, HDPE pipe will expand slightly. Add additional water to maintain pressure. It is not necessary to monitor the amount of water added during the initial expansion phase.
 - c. Test Phase: Immediately following the initial expansion phase, reduce test pressure by 10 psi, and stop adding test water. If test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is indicated.
 - d. Depressurization Phase: Gradually release the test pressure by controlling the release of water.
 - e. Total Test Duration: Limit the time the pipe is pressurized at test pressure to eight (8) hours. If pipe must be pressurized again to test pressure, depressurize pipe first and allow it to relax for at least eight (8) hours before repressurizing.
 - f. Supervision: Do not leave the test section unsupervised at any time during leak testing.
6. If leakage is indicated, locate and repair leaks.
7. Retest repaired joints, pipes, and fittings until system complies with above criteria for allowable leakage.

- G. Sequence for Pressure Testing:
 - 1. If an isolation valve is used to isolate a segment of pipe for pressure testing, the piping on both sides of the valve shall be installed with backfill and compaction fully completed on both sides of the valve for a minimum distance of 250 feet.

3.03 SCHEDULE

- A. The waterline shall be constructed using any combination of the following pipe materials, unless noted otherwise in the Contract Documents for specific areas:
 - 1. PVC Pipe:
 - a. C900, Pressure Class 235, DR 18.
 - b. C905, Pressure Class 235, DR18
 - c. 12" and smaller: Pressure Class 350.
- B. Buried Ductile Iron Piping, Fittings, and All External Restraint Assemblies; and Buried Metal Valves and All Metal Appurtenances: Install with polyethylene encasement.

END OF SECTION

SECTION 33 31 01

SANITARY SEWERAGE SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage piping, non-pressure drain lines, sewer service lines, fittings, and accessories.

1.02 RELATED WORK

- A. Section 31 23 33 – Trenching and Backfilling.

1.03 GENERAL REQUIREMENTS

- A. Pipes, fittings, and materials to be new.
- B. Use appropriate equipment methods for unloading, reloading, and handling the pipe.
- C. Pipe, Fittings, and Appurtenances of the Same Type: Made by the same manufacturer.
- D. Provide labor, equipment and materials for field pipe testing.

1.04 QUALITY ASSURANCE

- A. PVC Pipe and Fittings:
 - 1. Tests: ASTM D2665, ASTM D3034, and ASTM F79, as applicable.
 - 2. Marking: Indelible, in each pipe.
 - a. Nominal pipe diameter and cell classification.
 - b. Manufacturer's name or trade name, PVC, ASTM and SDR designation, and date of production.
 - c. Service designation.

1.05 REFERENCES

- A. American Society for Testing and Materials International:
 - 1. ASTM D1784 – Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 3. ASTM D2412 – Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
 - 4. ASTM D2564 – Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

5. ASTM D2665 – Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
6. ASTM D3034 – Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
7. ASTM D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
8. ASTM D3311 – Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
9. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
10. ASTM F679 – Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
11. ASTM F1417 – Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.
12. ASTM F1668 – Procedures for Buried Plastic Pipe.
13. ASTM F1866 – Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings.

B. American Water Works Association:

1. ANSI/AWWA C104/A21.4 – Cement Mortar Lining for Ductile-Iron Pipe and Fittings.
2. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. ANSI/AWWA C110/A21.10 – Ductile-Iron and Gray-Iron Fittings.
4. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. ANSI/AWWA C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast.
6. ANSI/AWWA C153/A21.53 – Ductile-Iron Compact Fittings.
7. ANSI/AWWA C219 – Bolted, Sleeve-Type Couplings for Plain-End Pipe.
8. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
9. AWWA Manual M23 – PVC Pipe – Design and Installation.

C. PVC Pipe Association (Uni-Bell PVC Pipe Association):

1. UNI-B-06 – Recommended Low-Pressure Air Testing of Installed Sewer Pipe.

1.06 SUBMITTALS

A. Section 01 33 23 – Shop Drawings, Product Data, and Samples:

1. Product data for pipe and appurtenances.
2. Manufacturer's installation instructions.
3. Certifications showing conformance to standards specified herein.

PART 2 PRODUCTS

2.01 MATERIALS

A. PVC Non-Pressure Pipe:

1. Pipe and Fittings:
 - a. 18-inch and Larger: Solid wall, ASTM F679, SDR 35 (Pipe Stiffness PS 46 psi in accordance with ASTM D2412).
 - b. 15-inch and Smaller: Solid wall, ASTM D3034, SDR 35 (Pipe Stiffness PS 46 psi in accordance with ASTM D2412).
 - c. PVC plastic minimum cell classification per ASTM D1784: 12454 or 12364.
 - d. Laying Length: Standard 20 ft. or 14 ft.
2. Joints:
 - a. Internally cast bell with one sealing ring.
 - b. Leak-Proof, Rubber Rings: ASTM D3212 and F477.
 - c. Lubricant: Manufacturer's recommendations.

B. PVC Drain, Waste, Vent Pipe:

1. Pipe: ASTM D2665
2. PVC Plastic minimum cell classification per ASTM D1784: 12454.
3. Molded Fittings: ASTM D2665 and D3311 (patterns)
4. Fabricated Fittings: ASTM F1866.
5. Joints:
 - a. Joints shall be solvent welded.
 - b. Cement: ASTM D2564

C. Service Wye/Tee: In-line connections required unless not available as an industry standard for a particular size of line.

D. Pipe Marking Systems: Refer to Section 31 23 33 – Trenching and Backfilling.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPE

A. General:

1. Install as indicated on Drawings.
2. Trenching, Backfilling, and Compacting: Section 31 23 33 – Trenching and Backfilling.
3. Pipe Cutting: Measurement taken at site.
4. Handling and Installation: ASTM D2321, AWWA C605, and manufacturer's recommendations.
5. Securely close the end of the pipe at the end of each day or whenever the work ceases with a watertight seal.
6. Take precautions necessary to prevent uplift and floating of the pipe prior to backfilling.

B. Delivery, Handling, and Storage of PVC Pipe:

1. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Engineer.
2. Inspect each pipe shipment prior to unloading to see if the load has shifted or otherwise been damaged. Notify Engineer immediately if more than immaterial damage is found. Check each pipe shipment for quantity and proper pipe size, color, and type.
3. Off-load and handle pipe in accordance with AWWA M23 and AWWA C605, and all of the Pipe Supplier's guidelines.
4. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.
5. During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.
6. Lower pipe from trucks carefully. Do not drop pipe.
7. Mark as rejected and remove at once from the work any pipe showing a crack or which has received a blow that could have caused an incident fracture, even though no such fracture can be seen.
8. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and shall be rejected unless determined acceptable by the Engineer.
9. Store and place pipe lengths on level ground. Store pipe at the job site in the unit packaging provided by the Pipe Supplier. Exercise caution to avoid compression, damage, or deformation to the ends of the pipe. Keep the interior of the pipe, as well as all end surfaces, free from dirt and foreign matter.
10. Handle and support pipe using woven fiber pipe slings or approved equivalent. Exercise care when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way.
11. If pipe is to be stored for periods longer than ninety (90) days, the pipe and gaskets should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe shall be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.
12. Store and stack pipe in accordance with the Pipe Supplier's guidelines.

C. PVC Pipe Joint Assembly:

1. Conformance to ASTM D2321 and manufacturer's instructions.
2. Pipe spigot ends are pre-marked at the factory with a circumferential insertion line. This line references how far the spigot should be inserted into the adjoining PVC pipe bell. Field-cut spigot ends shall be marked and beveled to match the manufacturer's insertion line. Pipe-to-pipe joints shall be assembled only to the insertion line. After assembly, the insertion line shall remain visible and be nearly flush with the lip of the adjoining PVC pipe bell. Joints assembled beyond the insertion line shall be considered over-assembled and may result in damaging stresses or leakage.
3. Field Quality Control to Prevent Over-Assembly (Over-Insertion):

- a. If a joint is found to be over-inserted, Contractor shall expose previously assembled joints until properly assembled joints are found. All over-inserted joints shall be properly re-assembled.
- D. Use rigid rubber gasket on exterior of pipe to seal pipe into grout at manholes.
- E. Clean sewer lines of all sand, gravel, dirt, and other foreign materials after installation.
- F. Service Lines as indicated on Drawings:
 - 1. Locations generally determined by Owner or Engineer at time of construction.
 - 2. Service lines to extend to the edge of the right-of-way or to the edge of the permanent easement.

3.02 FIELD QUALITY CONTROL

- A. All gravity pipes shall be tested for exfiltration and/or infiltration and deflection, as specified. All pipe shall be backfilled prior to testing. All leakage tests shall be completed and approved prior to placing of permanent resurfacing. When leakage or infiltration exceeds the allowable amount, the Contractor at its expense, shall locate the leaks and make the necessary repairs or replacements in accordance with the Specifications to reduce the leakage or infiltration to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests.
- B. Leakage Tests: Performed as scheduled, but no less than on 25% of the reaches of sewer between manholes as selected by the Engineer. Reaches not passing leakage test are not counted initially or when retested in determining percent of reaches tested. Test as follows:
 - 1. Gravity pipelines 24 inches or less in diameter, where difference in elevation between inverts of adjacent manholes or structures is 10 feet or less; water exfiltration test or water infiltration test as approved. The Engineer may allow substitution of an air pressure test for the water exfiltration test.
 - 2. Gravity pipelines 24 inches or less in diameter, where difference in elevation between inverts of adjacent manholes or structures is greater than 10 feet; air pressure test or water exfiltration test, or as approved.
 - 3. Gravity pipelines greater than 24 inches in diameter; air pressure test.
 - 4. Methods used, scheduling, and duration of tests must be reviewed by Engineer.
- C. Water Exfiltration Test:
 - 1. Contractor to provide the water supply and all required materials and equipment.
 - 2. Block off all manhole openings except those connecting with the reach under test.
 - 3. At the upper ends, fill the line a minimum depth of 5 feet above the high point of the pipe or 5 feet above adjacent groundwater level, whichever is higher.

4. Add and measure water as required to maintain a constant level.
 - a. Maximum exfiltration: 100 gallons per day per inch nominal diameter per mile of pipe.
 - b. Manholes considered section of 48 inch pipe.
 - c. Testing period shall last 4 hours.
- D. Water Infiltration Test:
1. If, in the opinion of the Engineer, excessive ground water is encountered in the construction of a section of the sewer, the exfiltration test for leakage shall not be used and an infiltration test shall be used.
 2. Block off the upper end of the reach to be tested.
 3. Discontinue pumping of groundwater for at least 3 days after which the section shall be tested for infiltration.
 4. The infiltration into each individual reach of sewer between adjoining manholes shall not exceed 100 gallons per day per inch of nominal diameter per mile of pipe.
 5. Testing period shall last 4 hours.
 6. Unless otherwise specified, infiltration shall be measured by the Contractor using measuring devices reviewed by the Engineer.
- E. Air Pressure Test:
1. Safety Procedures: Follow jobsite safety procedures described in ASTM F1417, Section 6, including:
 - a. No one shall be allowed in the manholes during testing.
 - b. When lines are tested, it is mandatory that all the caps and plugs be braced as an added safety factor.
 - c. A regulator or relief valve set no higher than 9 psi shall be included on all pressurizing equipment.
 2. Block off all manhole and line openings.
 3. Introduce low pressure air into the plugged line until the internal line pressure is raised to approximately 4.0 psi.
 4. Test pressures shall not exceed 9 psi.
 5. After the internal line pressure has stabilized at or above 3.5 psi, start the test.
 6. The line is presumed to have failed the test if the pressure drop exceeds 0.5 psi during the specified test duration.
 7. Run the test for the time duration determined by the equations and procedures contained in Uni-Bell Standard UNI-B-6 – Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe. For convenience, the table at the end of this section is from Uni-Bell Standard UNI-B-6 for the 0.5 psi pressure drop procedure (Table II).
 8. For pipe sizes not given in the table, refer to Uni-Bell Standard UNI-B-6.
- F. Mandrel Test:
1. Performed on all lines made from plastic resin.
 2. No sooner than 30 days after placement and compaction of backfill, but prior to placement of permanent surface materials.

3. Use a rigid mandrel with diameter of at least 92.5% of the pipe's specified average inside diameter and a length of the mandrel circular portion at least equal to the nominal pipe diameter.
4. Pull the mandrel through the pipe by hand.
5. All pipe exceeding the 7.5% deflection shall be relaid or replaced by the Contractor at no additional cost to the Owner.

G. Lamp Test:

1. Each section between manholes will be lamped by Engineer.
2. Contractor shall furnish suitable assistants to help Engineer.
3. A minimum of 50% of a true circle will be required in lamp test relative to horizontal alignment of pipe.
4. A minimum of 90% of a true circle will be required in lamp test relative to vertical alignment of pipe unless otherwise indicated on Drawings.
5. Repair any sections not passing the lamp test.

H. Grade Tolerances:

1. Free from noticeable depressions or humps.
2. Invert elevations shall not exceed plus or minus 0.2 feet from elevations shown on Drawings or which can be computed from Drawings.
3. Shall comply with the lesser of the following:
 - a. not more than 0.1% difference from grade shown on Drawings.
 - b. not more than 10% of grade shown on Drawings.

3.03 SCHEDULE

- A. As indicated on Drawings.

MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015 cf/min/sf of surface

Pipe Diameter (in)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942 L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352 L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618 L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:20	40	42.738 L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

Note: If there has been no leakage (zero psig drop) after one hour of testing, the test section shall be accepted and the test complete.
(See Section 7.5.)

END OF SECTION

SECTION 33 13 13

DISINFECTION OF DOMESTIC WATER SYSTEMS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide personnel, equipment, and supplies, disinfect and test all potable water systems, including water treatment systems, waterlines, water storage reservoirs, water wells, and new building system including flushing at completion of treatment.

1.02 RELATED REQUIREMENTS

- A. American Waterworks Association Standards:
 - 1. AWWA B100 – Granular Filter Material
 - 2. AWWA B300 - Hypochlorites
 - 3. AWWA C651 – Disinfection Water Mains
 - 4. AWWA C652 – Disinfection of Water Storage Facilities
 - 5. AWWA C654 – Disinfection of Wells
 - 6. AWWA C655 – Field Dechlorination

1.03 RELATED WORK

- A. National Sanitation Foundation International (NSF):
 - 1. NSF/ANSI 60 – Drinking Water Treatment Chemicals – Health Effects.

1.04 QUALITY ASSURANCE

- A. Regulatory Agency Requirements: Comply with applicable state requirements.

1.05 SUBMITTALS

- A. Disinfection Plan:
 - 1. Submittal Requirements:
 - a. Prior to filling water system with water, submit electronic file of Disinfection Plan to Engineer for review and comment. Flushing, disinfection and sampling procedures shall be in accordance with the referenced AWWA standards.
 - b. Address Engineer's comments and submit electronic file of Final Disinfection Plan to Engineer and NMED Drinking Water Bureau pursuant to NMAC 20.7.10.201 B.(3), NMAC 20.7.10.201 T.(2) and NMAC 20.7.10.400 F.
 - c. Do not fill system with water until NMED has approved the plan.
 - d. After disinfection has been completed, submit a signed and notarized affidavit to the Engineer and NMED Drinking Water Bureau confirming

that disinfection procedures have been completed according to the referenced AWWA standards.

2. Proposed Actions Described in Plan:
 - a. How pipes and tanks will be filled with source water. Coordinate availability of water with Owner.
 - b. Identify the sequence of filling system, chlorinating water, pressure testing and flushing system. Follow procedures specified in the referenced AWWA disinfection standards. Reference which AWWA method of chlorination will be followed.
 - c. If system will be disinfected, tested and flushed in segments, identify where and in what sequence the segments will be isolated and tested. Be aware that elevation differences may require breaking up a pipeline into segments with no more than approximately 50 psi (115 vertical feet) pressure difference within the segment.
 - d. Identify points in the system where water will be introduced, chlorine added (or swabbed), initial and residual chlorine concentrations measured, flushing water blown off, final chlorine residuals measured after flushing, and bacteriological sample points.
 - e. Identify method of measuring chlorine residual in the field.
 - f. Identify the bacteriological test lab that will be used, test method, and sampling, chain of custody, and transportation procedures.
 - g. Describe how highly chlorinated flush water will be properly disposed.
- B. Test Reports: Submit two (2) copies as follows:
1. Disinfection report, include:
 - a. Date issued
 - b. Project name and location
 - c. Treatment contractor's name, address, and phone number
 - d. Type and form of disinfectant used
 - e. Time and date of disinfectant injection start
 - f. Time and date of disinfectant injection completion
 - g. Test locations
 - h. Initial and 24-hour disinfectant residuals in ppm for each outlet tested
 - i. Time and date of flushing start
 - j. Time and date of flushing completion
 - k. Disinfectant residual after flushing in ppm for each outlet tested
 2. Bacteriological report, include:
 - a. Date issued
 - b. Project name and location
 - c. Laboratory's name, certification number, address, and phone number
 - d. Time and date of water sample collection
 - e. Name of person collecting samples
 - f. Test locations
 - g. Time and date of laboratory test start
 - h. Coliform bacteria test results for each outlet tested

- i. Certification that water conforms or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
- j. Microbiologist's signature

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect against damage and contamination.
- B. Maintain caution labels on hazardous materials.
- C. Maintain storage room dry and with temperatures as uniform as possible between 60 degrees F (15.6 degrees C) and 80 degrees F (26.7 degrees C).

1.07 PROTECTION

- A. Provide necessary signs, barricades, and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Disinfectant:
 - 1. Free chlorine; liquid, powder, tablet or gas: Per AWWA B300.
 - 2. Certified compliant with NSF/ANSI Standard 60.

PART 3 EXECUTION

3.01 INSPECTION

- A. Prior to starting Work verify that domestic water system is completed and cleaned.
- B. Do not start Work until conditions are satisfactory.

3.02 SYSTEM TREATMENT

- A. Water Distribution and Transmission System: Per AWWA C651. Including disinfecting existing systems after repair.
- B. Water Storage Reservoir: Per AWWA C652.
- C. Water Wells: Per AWWA A100 and AWWA C654.
- D. New Building Water System: Per local or State Plumbing Code.
- E. Granular Media Filters: Per AWWA, B100.
- F. Field Dechlorination: Per AWWA C655.

3.03 BACTERIOLOGICAL TEST

- A. Take samples where and when as required by referenced standards or codes.
- B. Analyze water samples in accordance with “Standard Methods for the Examination of Water and Wastewater”, latest edition, published by American Water Works Association.
- C. Analyze water samples as otherwise required or allowed by referenced standards or codes.
- D. Employ the services of an independent test laboratory certified by the New Mexico Environment Department Drinking Water Bureau to perform all bacteriological testing.
- E. Payment for bacteriological testing of water wells shall be as specified in Section 33 21 00 – Water Well.
- F. Payment for bacteriological testing for all other domestic water systems is considered incidental Work to the Contract Documents’ bid items.

3.04 DISPOSAL OF HEAVILY CHLORINATED WATER

- A. Test heavily chlorinated water for chlorine residual in accordance with Appendix A of the AWWA C651.
- B. Chlorine residual of water being disposed of, shall be neutralized in accordance with AWWA C655 – Field Dechlorination to meet residual acceptable for domestic use.
- C. Dispose of water flushed from water main, after neutralization to designated receiving drainage. Coordinate with Engineer.

3.05 FAILURE OF DISINFECTION AND/OR BACTERIOLOGICAL TESTS

- A. If test results do not comply with criteria required by referenced standards or codes, system shall undergo disinfection in accordance with Section 5.2 of the AWWA C651.

END OF SECTION

**CERTIFICATION OF DISINFECTION
OF WATER FACILITIES**

I, _____, hereby certify that the facilities constructed under the project _____ were disinfected in accordance with the Disinfection Plan submitted under Specification Section 33 13 13 – Disinfection of Domestic Water Systems and with the following American Water Works Association (AWWA) standards:

C651 – AWWA Standard for Disinfecting Water Mains

C652 – AWWA Standard for Disinfection of Water-Storage Facilities

C653 – AWWA Standard for Disinfection of Water Treatment Plants

C654 – AWWA Standard for Disinfection of Wells

Contractor: _____

Signature: _____

Printed Name: _____

Title: _____

Date: _____

Notary Certification:

State of _____

(County) of _____

Signed or attested before me on _____ by _____

SEAL

Notary Public

My Commission Expires: _____

SECTION 33 41 14

STORM SEWER PIPE INSTALLATIONS

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The construction items specified in this Section are common to storm sewer pipe installation and pipe type culverts.

1.02 RELATED WORK

- A. Section 31 23 33 – Trenching and Backfilling
- B. Section 33 31 01 – Sanitary Sewerage Systems

1.03 REFERENCES

- A. American Society for Testing and Materials International (ASTM):
 - 1. ASTM C33 – Concrete Aggregates.
 - 2. ASTM C76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 3. ASTM C289 – Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
 - 4. ASTM C361 – Reinforced Concrete Low-Head Pressure Pipe.
 - 5. ASTM C425 – Compression Joints for Vitrified Clay Pipe and Fittings.
 - 6. ASTM C443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - 7. ASTM D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 8. ASTM D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 9. ASTM D3350 – Polyethylene Plastics Pipe and Fittings Materials.
 - 10. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 11. ASTM F2306 – 12 to 60 inch Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
 - 12. ASTM F2648 – 2 to 60 inch Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M 36 – Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.
 - 2. AASHTO M 218 – Steel Sheet, Zinc Coated (Galvanized), for Corrugated Steel Pipe.
 - 3. AASHTO M 274 – Steel Sheet, Aluminum Coated (Type 2), for Corrugated Steel Pipe.

- C. American Concrete Pipe Association (ACPA):
 - 1. ACPA Concrete Pipe Design Manual.

1.04 SUBMITTALS

- A. Section 01 33 23 – Shop Drawings, Product Data, and Samples:
 - 1. Product data.
 - 2. Certification of conformance to referenced standards.
 - 3. Installation instructions.

PART 2 PRODUCTS

2.01 CERTIFICATION

- A. A certification from the manufacturer shall be furnished to the Engineer attesting compliance with appropriate ASTMs. Only pipe manufactured in the United States of America is acceptable.

2.02 CORRUGATED POLYETHYLENE PIPE

- A. Description: Annular corrugated profile wall polyethylene pipe and fittings for gravity drainage applications, smooth inside wall.
- B. Conformance: ASTM F2648.
- C. Fittings: ASTM F2306.
- D. Joints: Gasketed bell and spigot in accordance with ASTM D3212, and meeting watertightness requirements of ASTM F2306.
- E. Gaskets: Polyisoprene in accordance with ASTM F477.
- F. Pipe Material: Engineered blend of virgin and recycled high-density polyethylene in accordance with ASTM D3350, except carbon black content shall not exceed 4%.
 - 1. Cell Classification for 4" to 10" Pipe: 424420C, ((ESCR test condition B).
 - 2. Cell Classification for 12" to 60" Pipe: 435400C, ((ESCR test condition B).
- G. Installation: ASTM D2321 and manufacturer's published guidelines.
- H. Acceptable Manufacturers and Models: Advanced Drainage Systems (ADS), Hilliard, OH, ADS N-12 WT IB Pipe per ASTM F2648, or Engineer reviewed equivalent.

2.03 METALLIC-COATED CORRUGATED STEEL PIPE

- A. Materials and Construction: AASHTO M 36.
 - 1. Galvanized Steel: AASHTO M 218.
 - 2. Aluminized, Type 2: AASHTO M 274.

PART 3 EXECUTION

3.01 GENERAL

- A. Pipe and appurtenances shall be new and unused. The type of pipe to be installed shall be as approved by these Specifications or unless otherwise shown on the Drawings. Pipe and appurtenances shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken to prevent damage to any pipe coating.
- B. The interior of the pipe shall be thoroughly cleaned of foreign material before being lowered into the trench and shall be kept clean during construction operations. When work is not in progress, the open ends of pipe shall be securely closed so that no foreign materials will enter the pipe. Any section of pipe found to be defective before or after laying shall be replaced with sound pipe, or repaired in a manner satisfactory to the Engineer, without additional expense to the Owner.
- C. Pipe shall be laid to line and grade as shown on the plans and as staked in the field. The bottom of the trench shall be graded and prepared to provide a firm and uniform bearing throughout the entire length of the pipe barrel. Suitable excavation shall be made to receive the bell of the pipe, and the joint shall not bear upon the bottom of the trench. All adjustment to the line and grade shall be made by scraping away or filling in with pipe zone material under the body of the pipe, and not by wedging or blocking. When connections are to be made to any existing manhole, pipe, or other improvement, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate as necessary to expose and locate such potentially conflicting underground improvements prior to laying the new pipe. Any adjustment in line or grade which may be necessary to accomplish the intent of the plans will be made.
- D. Contractor shall submit to the Engineer the proposed method for making connections to existing manholes. Connection methods will be dependent upon manhole size and pipe sizes. Unnecessary damage to the existing manhole shall be avoided.
- E. Pipe shall be laid upgrade in a continuous operation from structure to structure, with the socket or collar ends of the pipe upgrade unless otherwise permitted by the Engineer. Concrete pipe with elliptical reinforcement shall be laid with the minor axis of the reinforcement cage in a vertical position. Corrugated metal pipe shall be laid with the external laps of the circumferential seams toward the inlet end.

3.02 JOINTS FOR PIPE

- A. Joints for Concrete Pipe:
 - 1. The type of joint to be used shall be O-ring rubber gasket joints conforming to ASTM C361 and C443.

2. Gasketed Type of Joints for Reinforced Concrete Pipe:
 - a. General: The ends of the pipe shall be so formed that when the pipes are laid together and joined, they shall make a continuous and uniform line of pipe with a smooth and regular surface.
 - b. Rubber gaskets for making compression-type joints for concrete pipe shall be factory fabricated in accordance with ASTM C443; pipes 12 inches in diameter and larger shall be O-ring and shall be handled, primed, installed, etc. in strict accordance with the manufacturer's recommendations.
 - c. The Contractor's attention is particularly called to ASTM C443, regarding storage of gaskets.
 - d. The Contractor shall furnish the Engineer complete information concerning the type and make of all joint material which he intends to use under the contract, including certification that the joint material meets the requirements of the Specifications.

B. Joints for Corrugated Metal Pipe:

1. The seams of the pipe are to be placed at the sides, not on the bottom. The inside circumferential seams should be placed pointing downstream. Care should be taken to insure that dirt or other particles do not get between the outside of the pipe and the pipe coupling. Paved inverts should be placed and centered on the bottom of the trench. Any damage to the protective lining and coating shall be repaired prior to the backfilling around the pipe.
2. If waterproof joints are called for on the plans or specified in the Specifications, the caulking compound or other waterproofing material used shall be subject to the approval of the Engineer.

3.03 TESTING FOR LEAKAGE

- A. Normally storm sewer lines need not be tested, but if in the opinion of the Engineer, the workmanship or materials do not appear to be satisfactory, the Engineer may require that a section of the storm sewer line be tested in accordance with Section 33 31 01 – Sanitary Sewerage Systems.

3.04 CLEANING AND INSPECTION

- A. Cleaning: No pipe spalls, rocks, dirt, joint compounds, cement mortar, and other trash or obstructions shall be left in a sewer pipe of any size or type. During flushing operations the manhole outlet shall be bagged or plugged so that the debris will not be carried in to an existing active line.
- B. Inspection: Before lines become operational or final acceptance of the installation, small size lines will be inspected by lamping, or Owner may inspect by television camera. Larger size lines will be inspected by walking through the line.

3.05 SCHEDULE

- A. As indicated on Drawings.
- B. Corrugated Polyethylene Pipe.

END OF SECTION