Project Manual
Including Specifications for
the Construction of

SANTA FE COUNTY
CHIMAYÓ FIRE STATION ADDITION
Chimayó, New Mexico 87522

OWNER:

SANTA FE COUNTY
Public Works Department
424 NM Hwy 599 Frontage Road
Santa Fe, New Mexico 87507

ARCHITECT

MOLZEN CORBIN
2701 Miles Rd SE
Albuquerque, New Mexico 87106

ARCHITECT'S PROJECT NUMBER

SFC222-11

August 2023

MOLZENCORBIN
ENGINEERS | ARCHITECTS | PLANNERS

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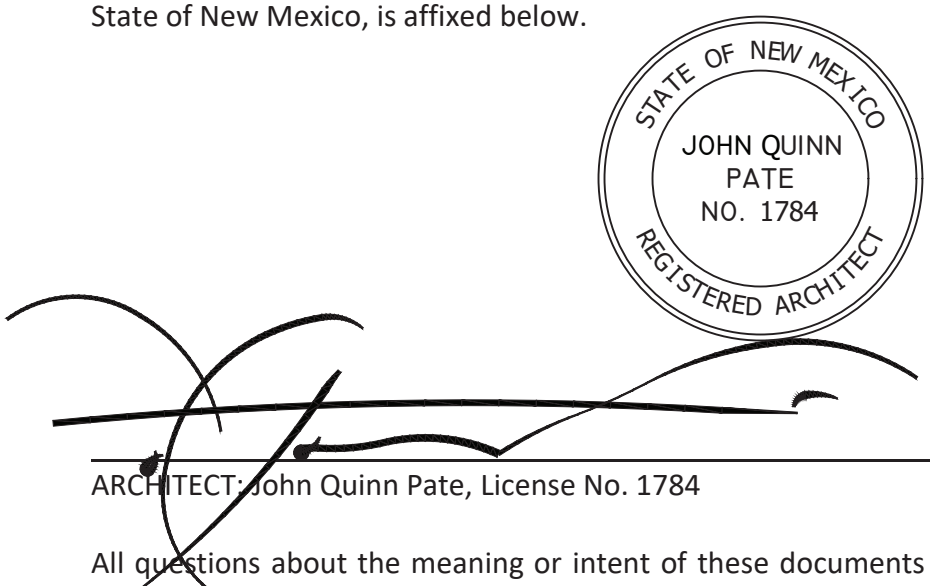
The technical material and data contained in the specifications under the supervision and direction of the undersigned, whose seal as a Professional Architect, licensed to practice in the State of New Mexico, is affixed below.



8/18/2023

ARCHITECT: John Quinn Pate, License No. 1784 DATE

All questions about the meaning or intent of these documents shall be submitted only to the Architect/Engineer (A/E) of Record, stated above, in writing. Refer to Paragraph 3.2 of the Instructions to Bidders as to interpretations.

TECHNICAL SPECIFICATIONS

DIVISIONS 27 – 30 (NOT USED)

DIVISION 31 – EARTHWORK

DIVISION 32 – EXTERIOR IMPROVEMENTS

DIVISION 33 – UTILITIES

DIVISIONS 34 – 48 (NOT USED)

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 49-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 "Chimayó Fire Station Addition" is located in Santa Fe County at 226 Juan Medina Road, Chimayó, New Mexico 87522.

C. Work consists of approximately 1600 sq ft addition to the existing fire station building and modifications to the existing site. Project work to be incorporated:

1. Selective Demolition, Cast-In-Place Concrete, Masonry, Rough Carpentry; Damp Proofing, Insulation, EIF Systems, Weather Barriers, TPO Roofing, Sheet Metal Roofing, Flashing and Trim, Elastomeric Sealants, Overhead Door, Metal Doors and Frames, Aluminum Storefronts, Door Hardware, Glazing, Gypsum Board Assemblies, Resilient Base, Painting, Room Signage, Dimensional Letter Signage, Wall Protection, Plumbing, HVAC, Electrical Power, Lighting and Special System; Earthwork, Concrete Sidewalks, Asphalt Paving, Utility Trenching, Piping and Connecting to Existing Utilities and Septic System.

CI. Bid Items include:

1. One (1) Base Bid Item: The base Bid includes all elements of construction

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. Secure and pay for permits, 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 required notices.

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 any noted deficiencies, and obtain certifications of satisfactory inspection. Deliver certificates to Owner in accordance with the Closeout Submittals Section.

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

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.	Relocation of Underground Utilities:	Allow the amount of $ 15,000.00 .
2.	Electric Service:	Allow the amount of $ 20,000.00 .
3.	Gas Service:	Allow the amount of $ 10,000.00 .
4.	Water Service:	Allow the amount of $ 10,000.00 .
5.	Pre-Authorized Construction Changes	Allow the amount of $ 25,000.00 .

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Substitution Requests:
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.
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

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Change procedures.

B. Proposal requests.

C. Effect of change on schedule.

D. 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. AIA Form G701.
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 change to A/E, describing proposed change and its full effect on the Work.
1. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors as described in previous paragraph.
2. Document requested substitutions in accordance with Section 01 25 00 – Substitution Procedures.

C. Proposal Format:
1. Within 10 days, Contractor will 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.

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

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 seven (7) 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 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.

C. 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.

D. Submit updated construction schedule with each Application for Payment.

E. Payment Period: Submit at intervals stipulated in the Agreement.

F. Submit with transmittal letter as specified for Submittals in Section 01 33 00 - Submittal Procedures.

G. 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.

H. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

I. 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.

J. Application for Payment at Substantial Completion:
   1. Submit an Application for Payment showing 100% 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.

K. 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

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 RFIs 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 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 Contact 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 for review by A/E three (3) copies of preliminary Progress Schedule within 20 days of date of Agreement between Owner and Contractor but no later than submission of first payment application.
   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

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. Quality Assurance/Quality Control 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

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 Jurisdication
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 Institiute
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 and 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

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 résumé 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 5 years of 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 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 5 years of 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

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 all 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. Contractor shall select a testing laboratory subject to the approval of the Owner.

D. Special Inspection Services: In addition to the inspections provided by CID, the New Mexico Building Code mandates that the Owner or the Engineer or Architect acting on behalf of the owner employ one or more special inspectors who shall provide inspections during construction on elements that are critical to the safety of the structure. It is important to note that these special inspectors are not on the project in lieu of the regular CID building inspector, but rather they are on the project in addition to the regular CID building inspector.
1. Where the New Mexico Building Code mandates that the Owner employ Special Inspectors, Special Inspection Agency shall be paid by the Contractor.
2. For special inspection type and frequency refer to Structural Drawings Quality Insurance Plan for Schedule.
3. The Special Inspection Agency shall be an agency approved by the Owner as being qualified by knowledge and experience to perform the Special Inspection for the category of work being constructed.
4. More than one Special Inspector may be required to provide the varied knowledge and experience necessary to adequately inspect all the categories of work requiring Special Inspection.
5. 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:
         1) In addition to the inspections provided by the Code Authority having Jurisdiction, the New Mexico Building Code mandates that the Owner or the Engineer or Architect acting on behalf of the Owner employ one or more Special Inspectors who shall provide inspections during construction on elements that are critical to the

safety of the structure. It is important to note that these Special Inspectors are not on the project in lieu of the regular AHJ building inspector, but rather they are on the project in addition to the regular building inspector.

c. Seismic Inspections.
d. Structural Observations.

B. Qualifications of testing agency or laboratory: The testing agency or laboratory will be qualified to the Owner's approval 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 Contractor 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 Contractor.

B. When there is work which the Owner requires tested and inspected in addition to specified and required tests, the Contractor will pay for the tests if the work does not comply with required standard and specifications. The Owner will pay for the tests if the work does comply with the required standards 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

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 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 ft^2, uniformly distributed, for general lighting, or equivalent illumination.
c. Provide one 100-W incandescent lamp every 50′ 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.
2. 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 ft^2 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″, 0.148″ thick, galvanized steel, chain-link fabric fencing; minimum 6′ high with galvanized steel pipe posts; minimum 2-3/8″ OD line posts and 2-7/8″ 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 "General 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 "eNOIsystem" to prepare andsubmit 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 "eNOIsystem" 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″ thick exterior grade plywood.
   d. Supports: Two, 4″ x 4″ x 8′ supports, sign bolted to supports.
   e. Artwork: Graphic file will be supplied by Owner.
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 Section 01 77 00 – 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 – General Requirements.

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 or manufacturer shall be considered to be the "Basis of Design." 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.
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. Manufacturers may submit their equivalent product, but only if product complies with or is superior to specified requirements, functional design, and warranty. Product must also meet aesthetic characteristics of specified product wherever appearance is critical in the opinion of the Architect.
   c. Products that obviously differ in appearance and quality from "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

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 that is shown on Drawings.

D. Verify setbacks 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.

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″ 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 offsite.

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″ 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

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 startup of various equipment and systems.

B. Notify Owner seven days prior to startup 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 startup 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

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, 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

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 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 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″, 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 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 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 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″ 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:
      a. Subject matter included in manual.
      b. Name and address of Project.
      c. Name and address of Owner.
      d. Date of submittal.
      e. Name, address, and telephone number of Contractor.
      f. Name and address of A/E.

2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
8. 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″ 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 not 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

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 be 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 one 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 startup, operation, control, adjustment, troubleshooting, 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

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 reconnection.

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 Owner's operation in adjoining spaces.

B. 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 sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full 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 SALVAGE 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 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and 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 A/E.

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. Protect materials and equipment remaining.

B. Demolish materials, equipment and construction as shown on the Drawings.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 – General Requirements 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 – General Requirements Sections.

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.

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.

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.

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

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.

H. Minutes of pre-installation conference.

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*.

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.

D. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Section 01 31 00 – Project Management and 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 2 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″ to the plane of the exposed concrete surface.
1. Provide ties that, when removed, will leave holes not larger than 1″ 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% 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″ 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″ 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/yd^2, 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/m^2 when applied at 200 ft^2/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. Epoxtite Binder 2390, A.C. Horn, Inc.
    f. Epabond, L&M Construction Chemicals, Inc.
    g. Concresive 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% 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″.
    2. Reinforced foundation systems: Not less than 1 inch and not more than 3″.

3. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8″ after adding admixture to site-verified 2″ - 3″ slump concrete.
4. Other concrete: Not more than 4″.

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°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 ±1-1/2% within the following limits:
1. Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:
   a. 4.5% (moderate exposure); 5.5% (severe exposure) for 1-1/2″ maximum aggregate.
   b. 4.5% (moderate exposure); 6.0% (severe exposure) for 1″ maximum aggregate.
   c. 5.0% (moderate exposure); 6.0% (severe exposure) for 3/4″ maximum aggregate.
   d. 5.5% (moderate exposure); 7.0% (severe exposure) for 1/2″ maximum aggregate.
2. Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2% to 4% 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°F and 90°F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°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″ 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″ 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 Section 07 92 00 – Elastomeric 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″ wide by one-fourth of slab depth or inserts 1/4″ 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′ 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 Section 07 92 00 – 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″ 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″ 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°F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F and not more than 80°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°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″ 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″ 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″ 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°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% 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″ 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″. 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″ 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″ 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″ 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°F and below, when 80°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 yd^3 plus additional sets for each 50 yd^3 more than the first 25 yd^3 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 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
3. When total quantity of a given class of concrete is less than 50 yd^3, Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
4. When strength of field-cured cylinders is less than 85% 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 – General Requirements 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 Section 03 30 00 – Cast-in-Place Concrete.

C. Allowances: Furnish the following under the allowances indicated, as specified in Section 01 21 00 – Allowances.
1. Source and field quality-control testing under the Inspection and Testing Laboratory Services 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 (31.1 MPa).

1.04 SUBMITTALS

A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 – General Requirements 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 C 270.
   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 C 1093, 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″ 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″ 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°F to 32°F (4°C to 0°C): Heat mixing water or sand to produce mortar temperatures between 40°F and 120°F (4°C and 49°C).
      b. 32°F to 25°F (0°C to −4°C): Heat mixing water and sand to produce mortar temperatures between 40°F and 120°F (4°C and 49°C). Heat grout materials to produce grout temperatures between 40°F and 120°F (4°C and 49°C). Maintain mortar and grout above freezing until used in masonry.
      c. 25°F to 20°F (−4°C to −7°C): Heat mixing water and sand to produce mortar temperatures between 40°F and 120°F (4°C and 49°C). Heat grout materials to produce grout temperatures between 40°F and 120°F (4°C and 49°C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40°F (4°C) if grouting. Use heat on both sides of walls under construction.
      d. 20°F (−7°C) and Below: Heat mixing water and sand to produce mortar temperatures between 40°F and 120°F (4°C and 49°C). Heat grout

materials to produce grout temperatures between 40°F and 120°F (4°C and 49°C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40°F (4°C). Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32°F (0°C) within the enclosures.

2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
   a. 40°F to 25°F (4°C to −4°C): Cover masonry with a weather-resistant membrane for 48 hours after construction.
   b. 25°F to 20°F (−4°C to −7°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 mph (25 km/h).
   c. 20°F (−7°C) and Below: Provide enclosure and heat to maintain temperatures above 32°F (0°C) within the enclosure for 48 hours after construction.
3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40°F (4°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°F (38°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 (13.1 MPa).
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″ (150 mm) nominal: 5-5/8″ (139 mm) actual.
    b. 8″ (200 mm) nominal: 7-5/8″ (194 mm) actual.
    c. 12″ (300 mm) nominal: 11-5/8″ (296 mm) actual.

2.03 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, 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 C 91.

C. Mortar Cement: U.B.C. Standard No. 21-14.

D. Hydrated Lime: ASTM C 207, 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 C 207.

F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4″ (6.5 mm), use aggregate graded with 100% passing the No. 16 (1.18 mm) sieve.
   1. White-Mortar Aggregates: Natural white sand or ground white stone.

G. Aggregate for Grout: ASTM C 404.

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 Section, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

J. Epoxy Pointing Mortar: ASTM C 395, 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 C 494, 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 A 615.
      a. Grade 60.

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

C. Welded-Wire Fabric: ASTM A 185.

2.05 JOINT REINFORCEMENT

A. General: Provide joint reinforcement formed from the following:
1. Galvanized carbon-steel wire, coating class as follows:
a. ASTM A 641, Class 1, for interior walls; and ASTM A 153, Class B-2, for exterior walls.
b. ASTM A 153, 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″ oc.

C. For multiwythe masonry, provide type as follows:
1. Ladder design with perpendicular cross rods spaced not more than 16″ oc.

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 Section, unless otherwise indicated.

B. Wire: As follows:
1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
2. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for wire ties and anchors in exterior walls.
a. Wire Diameter: 0.1875″.

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″, galvanized steel sheet.

C. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, 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 D 1056, Type 2, Class A, Grade 1; compressible up to 35%; 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 D 2000, Designation M2AA-805.
   2. Polyvinyl Chloride: ASTM D 2287, General Purpose Grade, Type PVC-65406.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, 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 C 270, Proportion Specification, for types of mortar indicated below:
   1. Type: S. – above grade.

C. Grout for Unit Masonry: Comply with ASTM C 476. 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″ in horizontal dimension, unless otherwise indicated.
   2. Use coarse grout in grout spaces 2″ 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 C 140.

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″ in 10′, nor 3/8″ in 20′, nor 1/2″ in 40′ or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4″ in 20′, nor 1/2″ in 40′ or more. For vertical alignment of head joints, do not exceed ±1/4″ in 10′, nor 1/2″ 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″ in 20′, nor 1/2″ in 40′ or more. For top surface of bearing walls, do not exceed 1/8″ in 10′, nor 1/16″ 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″ in 20′, nor 3/4″ in 40′ or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4″ nor +1/2″.

E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8″, with a maximum thickness limited to 1/2″. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8″. Do not vary from head-joint thickness indicated by more than ±1/8″. Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8″. Do not vary from collar-joint thickness indicated by more than −1/4″ or +3/8″.

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″. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4″ 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″ 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″ 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″ 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″ on exterior side of walls, 1/2″ elsewhere. Lap reinforcing a minimum of 6″.
   1. Space reinforcement not more than 16″ (406 mm) oc.

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 1/2 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

1.1 SUMMARY

A. This Section includes structural steel and grout.

1.2 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 the American Institute of Steel Construction's (AISC) *Steel Construction Manual*.

1.3 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.

1.4 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. Preinstallation Conference: Conduct conference at Architect's Office.

PART 2 - PRODUCTS

2.1 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.

2.2 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.

2.3 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, nonasphaltic, rust-inhibiting primer.

2.4 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.

2.5 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.

2.6 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.

2.7 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″.
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.

2.8 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, Paragraph 3.3 "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

3.1 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."

3.2 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.

3.3 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 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 Standard 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: AWPA C9.
   1. Use treatment containing no arsenic or chromium.
   2. Kiln-dry plywood after treatment to a maximum moisture content of 15%.

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″ 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″.

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 17 33

WOOD I-JOISTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wood chord and plywood and particle board web joists for roof and floor framing; bridging, bracing and anchorage; framing for openings; and preservative treatment of wood.

B. Related Sections:
1. Section 06 10 00 – Rough Carpentry.

1.2 REFERENCES

A. APA-The Engineered Wood Association:
1. APA/EWA TB 200 – Fire Retardant Treated Plywood.

B. American Wood-Preservers' Association:
1. AWPA C1 – All Timber Products – Preservative Treatment by Pressure Process.

C. ASTM International:
1. ASTM D2559 – Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions.
2. ASTM D5055 – Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
3. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SYSTEM DESCRIPTION

A. Design Roof Live and Dead Load as indicated on the Drawings.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following: I-Joist Quality Assurance Agency.

B. Joist Structural Capacities: Determine in accordance with ASTM D5055.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Protect structural components from warping or other distortion by stacking in vertical position, braced to resist movement.

PART 2 PRODUCTS

2.1 PLYWOOD I JOISTS

A. Manufacturers:
   1. Georgia Pacific Corp.
   2. Louisiana-Pacific Corp.
   3. Trus Joist MacMillan
   4. Weyerhaeuser Engineered Stand Products

2.2 ACCESSORIES

A. Adhesive: ASTM D2559.

B. Wood Blocking in accordance with Section 06 10 00.

C. Fasteners and Anchors:
   1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and Staples: ASTM F1667.
   3. Anchors: Lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

D. Bearing Plates: Plain steel. 1/8″ min.

2.3 FABRICATION

A. Fabricate joists to achieve structural requirements specified.

B. Brace members for support during transit.

C. Fabricate bottom and top chord extensions as indicated on Drawings.

D. Fabricate to achieve minimum end bearing of:
   1. 2″ on wood.

E. Frame special sized openings in web as indicated on Drawings and per manufacturer.

2.4 SOURCE QUALITY CONTROL

A. When fabricator is approved by Authority Having Jurisdiction, submit Certificate of Compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
   1. Specified shop inspections are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

B. Verify supports and openings are ready to receive joists.

3.2 PREPARATION

A. Coordinate placement of bearing and support items.

3.3 ERECTION

A. Set structural members level and plumb, in correct position.

B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members beyond manufacturer’s recommendations without approval of A/E.

D. Place headers and supports to frame openings.

E. Frame openings between joists with lumber per Drawings.

F. Coordinate placement of decking with Work of this Section.

3.4 SCHEDULES

A. As indicated on the Drawings.

END OF SECTION

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. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 04 00 00 –Unit Masonry.
3. Division 7 – Insulation.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements: Provide material complying with the following requirements:
1. Nonflammable.
2. VOC Content:
   a. 0.25 lbs per gal (30 g/L) less water and exempt solvents.
3. Service Temperature Range:
   a. −40°F to 150°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 – Submittal Procedures.

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 damproofing.

1.04 QUALITY ASSURANCE

A. Comply with Section 01 43 00 – Quality Assurance.

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 – Product Requirements.

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°F or when temperatures are expected to fall to 40°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 – Product Requirements.

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 dampproofing 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 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 or 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

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 03 – Concrete.
   2. Section 04 00 00 – Unit Masonry.
   3. Section 07 11 13 – Dampproofing.

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 Polyisocynurate 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 cm^2 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%; 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.
      b. Wall Framing or Furring Thermal Batt Insulation: R-Value: As indicated on Drawings.

D. 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 (2″) in diameter.
      c. Impaling Pins: Steel pins with head not less than 50 mm (2″) 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 6″ apart.
8. Roof Rafter Insulation: Place mineral fiber blankets between framing to provide not less than a 2″ 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.

END OF SECTION

SECTION 07 24 00

EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Provide labor, materials, and equipment necessary to install exterior insulation and finish system(s), Class PB, Polymer Based.

B. Finish Systems Include:
1. System A – Continuous Insulation System installed over Structural Sheathing, Concrete and CMS Substrates including:
   a. Adhesive.
   b. Expanded Polystyrene Insulation (EPS) Board of thickness to provide a minimum continuous "R" value as noted on the Drawings.
   c. Weather Barrier.
   d. Acrylic Polymer Base Coat with embedded Standard Reinforcing Fabric Mesh.
   e. Primer (OPTIONAL).
   f. Acrylic Polymer Finish Coat.

C. Related Sections
1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 04 00 00 – Unit Masonry.
3. Section 06 16 00 – Sheathing.
4. Section 07 25 00 – Weather Barriers.
5. Section 07 62 00 – Sheet Metal Flashing and Trim.
6. Section 07 92 00 – Elastomeric Sealants.
7. Section 08 41 13 – Aluminum Storefront and Framing.
8. Section 09 22 00 – Gypsum Board Assemblies.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) International Standards:
1. ASTM C1481 – Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS).
2. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E2134 – Standard Test Method for Evaluating the Tensile-Adhesion Performance of an Exterior Insulation and Finish System (EIFS).
4. ASTM E2273 – Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies.
5. ASTM E2430 – Standard Specification for Expanded Polystyrene ("EPS") Thermal Insulation Boards for Use in Exterior Insulation and Finish Systems ("EIFS").

6. ASTM E2485 – Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings.
7. ASTM E2486 – Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS).
8. ASTM E2568 – Standard Specifications for Exterior Insulation and Finish Systems.

B. QUALITY ASSURANCE

C. 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.

D. 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.

E. Regulatory Requirements:
1. Insulation Board: Shall be produced and labeled under a third party quality program as required by applicable building code.

F. 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.

1.03 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′ by 4′ samples of the EIF System for each 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. System Warranty Documents.

E. System manufacturer's installation recommendations.

F. Installer's Certificate.

G. Maintenance kit.

1.04 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.

1.05 COORDINATION AND SCHEDULING:

A. Coordination: Coordinate water-resistive membrane and air barrier coating materials installation with other construction operations.

1.06 WARRANTY

A. Manufacturer shall provide a written warranty for EIFS Systems:
1. System A: Material and labor warranty for 10 years.

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 MANUFACTURER

A. Basis of Design: Parex USA, Inc., 4125 E. La Palma Avenue, Suite 250, Anaheim, California 92807. Contact: Architectural Sales Phone (866.516.0061) or Technical Support Phone (800.226.2424).

B. 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.

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.

D. Alternate Approved Manufacturers:
1. Sto
2. Dryvit

2.02 MATERIALS

A. Provide products of grade to satisfy Warranty requirements stated above.

B. Adhesive suitable for substrate and compatible with base coat.

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′ by 4′.
4. Thickness: to provide the "R" value for Continuous Insulation noted as noted on the drawings, minimum after rasping.

D. Standard Reinforcing Mesh:
1. Impact Resistance, 25-49 in-lbs Impact Range.
2. Weight 4.5 oz per yd^2.
3. Coated for protection against alkali.

E. High Impact Reinforcing Mesh:
1. Impact Resistance, 90-150 in-lbs Impact Range.
2. Weight 15 oz per yd^2.
3. Rated for ASTM E2486 high impact strength.
4. Up to 6′-0″ above finish grade.

F. Base Coat: 100% acrylic polymer base, requiring the addition of Portland cement or ready to use, applied without the addition of cement.

G. Primer: 100% acrylic based coating to prepare surfaces for acrylic or elastomeric finishes.

H. Finish:
1. Factory blended, 100% acrylic polymer based finish with fade-resistant integral pigment system offering superior fade resistance.
2. Finish type, texture and color as selected by the A/E.

I. Water: Shall be clear, potable and free of all foreign matter.

J. Sealant System: Refer to Section 07 92 00 – Elastomeric Sealants.

K. Accessories: Portland cement, drainage strips, flashings, and sealants as required by manufacturer's details and recommendations.

2.03 SOURCE QUALITY CONTROL

A. Provide products specified herein from a single source.

PART 3 EXECUTION

3.01 INSPECTION

A. Examination of Substrate:
1. Prior to installation of the system, the substrate shall be examined as follows:
   a. The substrate surface shall be free of foreign materials such as oil, dust, dirt, form-release agents, paint, wax, glazing, water, moisture, frost, etc.
   b. The substrate shall be examined for soundness, such as tightness of connections, crumbling or looseness of surface, voids and projections, etc.
   c. The substrate shall be examined for dimensional correctness per this specification.
   d. 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. Insulation Board
1. Install back-wrap mesh or edge-wrap mesh at system terminations.
2. Apply CI adhesive to backs of insulation boards with a notched trowel, with ribbons of adhesive oriented in a vertical direction (parallel to the 2′ [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.
5. Treat the heads of all window, door and similar openings with back-wrap mesh to allow for drainage at these locations.

C. 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. Apply multiple layers of base coat and mesh where required for specified impact resistance classification.

D. Apply primer to base coat after drying. Primer may be omitted if it is not required by the manufacturer's product data sheets for the specified finish coat or otherwise specified for the project.

E. 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 CLEAN UP

A. Remove and legally dispose of EIFS materials from job site.

B. Clean work area and surfaces of foreign materials resulting from Work.

3.06 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 Project Designer/Owner.

3.07 SCHEDULE

A. Refer to Drawings.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Weather Barrier Membranes for:
   1. EIFS.
   2. Low Slope Metal Roof Underlayment.

B. Accessories:
   1. Seam Tape.
   2. Flexible Flashings.
   3. Fasteners.

C. Related Sections:
   1. Section 07 41 00 – Metal Roofing and Siding.
   2. Section 07 24 00 – Exterior Insulation and 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″ by 11″.

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 9 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 10 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, Delaware 19805; 1.800.44TYVEK (8-9835); 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. 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.
3. Performance Characteristics:
a. Air Penetration: 0.004 cfm/ft^2 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/yd^2, 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 – Elastomeric 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″ to 12″ 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″ 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″ to 18″ vertically on center along stud line, and 24″ on center, maximum horizontally.
   2. Attach weather barrier to masonry. Secure using weather barrier manufacturer recommended fasteners, space 12″ to 18″ inches vertically on center and 24″ maximum horizontally. Weather barrier may be temporarily attached to masonry using recommended adhesive, placed in vertical strips spaced 24″ 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 and 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″ 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″ 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″ 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 INSTALLATION ROOF UNDERLAYMENT

A. Install the membrane directly on a clean, dry, continuous structural deck. Remove dust, dirt. Protrusions from the deck area must be removed. Decks shall have no voids, damaged, or unsupported areas. Repair deck areas before installing the membrane.

B. Install in strict accordance with manufacturer's printed application procedures, precautions, and limitations.

3.05 CLEANING

A. Immediately remove release paper and scrap from work area and dispose of material.

3.06 PROTECTION

A. Protect installed weather barrier from damage.

END OF SECTION

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SECTION 07 41 00

METAL ROOFING AND SIDING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
1. Standing seam metal roof including panels with concealed fasteners and trim.
2. Flush seam metal soffits, including panels with concealed fasteners and trim.
3. Prefinished metal parapet coping, fascia, edge trim.
4. Prefinished Roof Drainage Systems: Gutters, scupper, conductors and downspouts.

B. Related Work included in this Section:
1. Roof insulation.
2. Roof and wall panel underlayments.

C. Related Sections included in other Sections:
1. Section 05 12 00 – Structural Steel for structural-steel framing.
2. Division 06 – Sheathing.
3. Section 07 20 00 – Insulation for rigid wall insulation.
4. Division 07 – Membrane Roofing.
5. Section 07 62 00 – Sheet Metal Flashing and Trim for metal flashing and trim not part of this Work.
6. Section 07 92 00 – Elastomeric Sealants for field-applied sealants.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. A653-00 – Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip process.
2. A792-99 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot Dip process.

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. *Architectural Sheet Metal Manual*, 5th Edition.

C. National Roofing Contractor Association (NRCA):
1. *Roofing and Waterproofing Manual*, 5th Edition.

D. Single Ply Roofing Institute (SPRI):
1. *Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems*, 1994 Edition.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured roof and wall panel assemblies complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water into the building interior.

B. Air Infiltration: Provide manufactured roof panel assemblies with permanent resistance to air leakage through assembly of not more than 0.09 cfm/ft^2 (.045 L/s/m^2) of fixed wall area when tested according to ASTM E 283 at a static-air pressure difference of 4.0 lb/ft^2 (192 Pa).

C. Water Penetration: Provide manufactured roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E331 at a minimum of differential pressure of 20% of inward acting, wind-load design pressure of not less than 6.24 lb/ft^2 (300 Pa) and not more than 12.0 lf/ft^2 (575 Pa).

D. Wind Uplift Resistance: Provide roof panel system assemblies including clips, meeting requirements of UL 580 for Class 90 wind-uplift resistance. The panel manufacturer must also subscribe to Underwriters Laboratories "Follow Up Service" assuring continuing compliance of the product with U.L. requirements.

E. Structural Performance: Provide manufactured roof and wall panel assemblies capable of withstanding design wind loads indicated under in-service conditions with deflection no greater than the following, based on testing manufacturer's standard units according to ASTM E1592 and ASTM E330 by a qualified independent testing and inspecting agency.
   1. Maximum Deflection: 1/180 of the span.

F. Coping System: Completed metal coping system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

1.04 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to material and finishes for each component and for total panel assemblies.

B. Shop Drawings: Details of edge and corner conditions, joints, panel profiles, supports, anchorage, trim, flashings, underlayment, closures, and special details. Distinguish between factory and field-assembled work.

C. For installed products indicated to comply with certain design loadings, include structural analysis data signed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: Manufacturer's color charts or chips showing the full range of colors available for roof and wall panels with factory-applied finishes.

E. Qualification Data: For firms and persons specified in the following Quality Assurance subsection 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. Product Test Reports: Indicate compliance of manufactured roof and wall panel assemblies and materials with performance and other requirements based on comprehensive testing of current products.

G. Maintenance Manual at Project Close-Out including Warranties.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have a minimum of 10 years' experience in manufacturing metal components for the roofing industry. Panels and accessories specified in this section shall be manufactured at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. If roll-forming on site is required to achieve panels that exceed 50′ in length, then the operation of the roll-forming equipment must be conducted by an employee of the manufacturer in order to maintain top quality control. Under no circumstances should this equipment be operated by the roofer, contractor, installer, erector, or anyone other than the manufacturer. No exceptions.

B. Installer Qualifications: Engage an experienced installer (minimum of 5 years' experience) who has completed metal roof, soffit, and wall panel projects similar in material, design, and extent to that indicated for this Project and with a record of success in service performance. Installation contractor must be an approved and certified applicator by the specified metal roof manufacturer a minimum of 10 days prior to bid date. Contractor must supply A/E with a copy of this certification.

C. Snow Retention System manufacturer shall obtain written verification from metal roofing manufacturer that snow retention system is compatible with roof system and will not alter conditions of Warranty for roof system.

D. Professional Engineer Qualifications: A Professional Engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated.

E. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to ASTM E699.

F. Fire-Test-Response Characteristics: Where fire-resistance-rated roof panel assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E108 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: As indicated by design designations in UL's "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

G. Coordination: Prior to ordering materials, a pre-roofing meeting will be held with the metal roof manufacturer, approved applicator, general contractor, Owner, and the A/E to discuss the specified roofing system and its proper application.
   1. Coordinate application of the roofing system with other trades in such a manner that the complete installation is weather-tight and in accordance with all approved details and warranty requirements.

H. Inspections: After the metal roof installation is complete, the manufacturer shall inspect the work and inform (by written report) the A/E, contractor, and the installer of defective/incomplete work to be remedied. Those areas indicated shall be corrected to the full satisfaction of the A/E, Owner, and manufacturer. The manufacturer shall submit written acceptance of the Project to the A/E prior to issuance of the weather-tightness warranty.
   1. Inspections shall be performed at each transition of roof detail encountered for each phase of roofing for the duration of the project. Each inspection must be conducted by an experienced, full-time employee of the manufacturer with experience in similar inspections over the past two years.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against damage during transportation or handling.

B. Handling: Exercise care in unloading, storing, and erecting wall panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with a tarpaulin or other suitable weather-tight and ventilated covering. Store panels to ensure dryness. Do not store panels in contact with other material that might cause staining, denting, or other surface damage.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish opening dimensions and proceed with fabricating roof, soffit, and wall panels without field measurements or allow for trimming panel units. Coordinate roof and wall construction to ensure actual locations of structural members and to ensure opening dimensions correspond to established dimensions.

1.08 WARRANTY

A. General Warranty: Special warranties specified in this article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract documents and shall be in addition to, and run concurrent with, other warranties made by the contractor under requirements of the Contract Documents.

B. Special Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal panels within the specified warranty period and agreeing to repair or replace roof and wall panels that show evidence of finish deterioration. Deterioration of finish includes but is not limited to color fade, chalking, cracking, peeling, and loss of integrity.

C. Finish Warranty Period: 20 years from date of Substantial Completion.

D. Special Roof Weather-Tight Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace metal roof panel assemblies that fail to remain weather-tight within the specified warranty period. A weather-tight warranty is only available on systems installed by approved applicators, certified by the manufacturer.

E. Roof Weather-Tight Warranty Period: 20 years from date of Substantial Completion.

F. Roofing Installer Warranty: Installer shall provide a written warranty for 5 years from date of final completion and acceptance, guaranteeing materials, workmanship, and weathertightness of the roof system, without any cost to the building owner or manufacturer.

G. Coping, Flashing and Trim:
1. The contractor shall provide the Owner with a notarized written Warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of 3 years from the date of final acceptance of the building.
2. Warranty shall include all materials and workmanship required to repair any leaks that develop.
3. Installing contractor shall be responsible for the installation of the coping system in general accordance with the membrane manufacturer's recommendations.
4. Installing contractor shall certify that the coping system has been installed per the manufacturer's printed details and specifications.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Roof panels, wall panels, soffits panels, roof trim, and parapet coping systems shall be fabricated by one manufacturer subject to compliance with requirements.

B. Basis of Design: Sun Metal, 2139 Columbia Drive SE., Albuquerque, New Mexico 87109, Phone: 505.247.2278, Fax: 505.243.3780.

C. Products by other manufacturer's may be accepted as a substitute under the following conditions:
1. Products must be equal or superior to specified product.
2. Products must be submitted and approved by the A/E in accordance with Section 01 60 00 – Product Requirements.

2.02 PANEL METALS AND FINISHES

A. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755 (ASTM A755M) and the following requirements.
   1. Steel Sheet: ASTM A653, Steel sheet, G-90 Zinc-coated (galvanized) by the hot dip process; structural quality.
   2. Thickness: 24 Gauge thick, unless otherwise indicated.
   3. Finish: Apply the following organic coating in thickness indicated. Furnish appropriate air-drying spray finish in matching color for touchup.
      a. Fluoropolymer 2-Coat Coating System: Manufacturer's standard second coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight with a total minimum dry film thickness of 0.9 mil (0.023 mm) and 30% reflective gloss when tested according to ASTM D523.
      b. Color: Rio Grande Bronze SR.

2.03 PANEL ASSEMBLIES

A. General: Fabricate panel face sheet to profile of configuration indicated and of the material, finish and thickness indicated. Design joints between panels to form weather tight seals.

B. Standing-Seam Roof Panels: Manufacturer's standard factory-formed, standing-seam roof panel assembly with factory-installed sealant in all standing seams. Designed for concealed mechanical attachment of panels through insulation to metal deck.
   1. Basis of Design: SunSeam Roof Panel.
   2. Mechanically seamed panel system.
   3. 1-1/2″ (38.1 mm) high, 16″ (406.4 mm) wide panel.
      a. Panels will be supplied without striations.
   4. Clips shall be a 3-part assembly consisting of:
      a. Two-piece floating clip minimum 24 gauge (0.024″), thick, galvanized steel.
      b. 3″ by 5″ 20 ga coated steel (yield strength to be 33,000 PSI) bearing plate as recommended by the roofing manufacturer for attachment over rigid insulation.
      c. Panel clips must be designed to meet negative-load requirements.
      d. Panel clips must be UL-90 rated.

C. Soffit Panels: Manufacturer's standard factory-formed soffit panel assembly designed for concealed mechanical attachment of panels to purlin or secondary framing.
   1. Basis of Design: SunSoffit: Flush Seam panel system. 1″ high, 15″ wide panel.
      a. Panels will be supplied with 2 stiffening beads.

D. Wall Shingle Panels:
   1. Basis of Design: SunBatten Shingle Wall Panel: Pan and Batten panel system. 1″ high, 15-3/4″ wide panel by 60″, with top and side seams
      a. Panels will be supplied without striations.
   2. Clips: Provide clips as recommended by the wall panel manufacturer for installation over rigid insulation and wall substrate.
   3. Panel Clips: Minimum 24 gauge (0.024″), (.65 mm) thick, galvanized steel as required.
   4. Installation: Staggered.

E. Horizontal Ribbed Wall Panels: Manufacturer's standard factory-formed wall panel assembly designed for concealed mechanical attachment of panels to secondary framing.
   1. Basis of Design: SunWall: Flush Seam panel system. 1″ high, 15″ wide panel.

2.04 MISCELLANEOUS MATERIALS

A. General: Provide materials and accessories required for a complete roof, wall and soffit panel assembly as recommended by panel manufacturer, unless otherwise indicated.

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.
   1. Use galvanized steel fasteners for exterior and interior applications.
   2. Provide exposed fasteners with heads matching color of panel by means of factory applied coating.
   3. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
   4. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

C. Accessories: Unless otherwise specified, provide components required for a complete panel assembly including trim, copings, fascia, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.
   1. Sealing Tape: Pressure-sensitive 100% solids, polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
   2. Joint Sealant: One-part elastomeric polyurethane or butyl sealant as recommended by panel manufacturer.

D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-paint 12, compounded for 15-mil (0.4 mm) dry film thickness per coat, unless otherwise indicated. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

E. Expansion Joint Sealant: For hook-type expansion joints that must be free to move, provide non-setting, non-hardening, non-migrating, heavy-bodied polyisobutylene sealant.

F. Primer: Rust-inhibitive primer recommended by panel manufacturer for finish coat.

2.05 ROOF DRAINAGE SYSTEMS

A. Downspouts: 24 Ga fluoropolymer coated galvanized steel.
1. Minimum 10′ sections.

B. Conductors/Scuppers: 24 Ga fluoropolymer coated galvanized steel.

C. Commercial Grade Gutters: 24 Ga fluoropolymer coated galvanized steel:
1. Support straps and hangers at 30″ oc.
2. Concealed cover joints.

D. Gutter and Down Spout Anchorage Devices: Material as specified for system.

2.06 PARAPET COPING

A. Sunlok Coping System: Metal coping cap with steel chair and concealed, hemmed splice plate at splices for capping parapet wall. The system shall be watertight and not require exposed fasteners.
1. Product Characteristics:
   a. Coping system shall lock to anchor chair by Snap-On installation.
   b. Coping shall expand and contract while mechanically locked in place.
   c. Coping sections shall be 10′ 0″ in length.
   d. Coping front side and rear side shall be 4″ nominal respectively.
2. Splice Plate: 6″ wide, concealed and hemmed to drain moisture.
3. Butyl Tape and one part polyurethane sealant must be applied to splice plate per manufacturer’s recommendation and details.
4. Anchor Chair: 20 gauge galvanized steel, 12″ wide at 5′ 0″ on center and mechanically fastened. Shim Plates must be installed on chair when splice plate is not required.
5. Corners, endcaps, transitions, etc., shall be fabricated by the product manufacturer.

B. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755 (ASTM A755M) and the following requirements.
1. Steel Sheet: ASTM A653, Steel sheet, G-90 Zinc-coated (galvanized) by the hot dip process; structural quality.
2. Thickness: 22 gauge.
3. Finish: Apply the following organic coating in thickness indicated. Furnish appropriate air-drying spray finish in matching color for touchup.
   a. Fluoropolymer Second-Coat Coating System: Manufacturer’s standard second-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70% polyvinylidene fluoride resin by weight with a total minimum dry

film thickness of 0.9 mil (0.023 mm) and 30% reflective gloss when tested according to ASTM D 523.

b. Color: To be selected.

2.07 TRIM

A. Fabricate trim/flashing and accessories to detailed profiles.
1. Fabricate trim/flashing from same material as panel.

B. Prefabricated Roof Jacks:
1. Pipe flashings shall be a one piece EPDM (ethylene propylene diene monomer) molded rubber boot having a serviceable temperature range of −65°F to 212°F (for standard applications) and shall be resistant to ozone and ultraviolet rays. Units shall have an aluminum flanged base ring. Do not install pipe flashings through any panel seams; install only in the flat portion of the panel.

2.08 THERMAL INSULATION

A. Rigid Boards of the Following Type:
1. Polyisocyanurate Board Insulation: Unfaced, preformed, rigid, cellular, polyisocyanurate thermal insulation, 4″ mm) thick, complying with ASTM C 591, Type 2, with aged thermal-resistance values for 1″ thickness of 6.2°F x h x ft^2/Btu at 75°F (1.1 K x m^2/W at 24°C).
2. Refer to Drawings for wall insulation and R-values.
3. Attachment: Mechanically fasten.

2.09 PANEL UNDERLAYMENT

A. Roof: Ice and Water Barrier recommended by the primary roofing manufacturer:
1. Manufacturer: Imetco's Drydek, basis of design.
a. Self-adhering.
b. Provides protection against freeze/thaw cycles, wind driven rain.
c. 100% SBS modified.
d. Polyester and fiberglass reinforced scrim engineered to tolerate extremely high temperatures (260°F) and withstand thermal expansion and contraction of deck.
e. Meet ASTM D 1970 Standards

B. Walls: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

2.10 FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. If roll-forming on site is required to achieve full length panels, then the operation of the roll-forming equipment must be conducted by an employee of the manufacturer in order to maintain top quality control. Under no circumstances should this equipment be operated by the roofer, contractor, installer, erector, or anyone other than the

manufacturer. No exceptions. Comply with indicated profiles and with dimensional and structural requirements.

B. Panels:
   1. Roll-formed in one continuous length.
   2. Fabricate roof panel joints with hot melt mastic to provide a tight seal.

C. Trim must be fabricated by manufacturer.

2.11 DECKING, PANEL SUPPORTS AND SECONDARY FRAMING

A. Panel Supports and Anchorage: Under work of Division 05, provide decking, furring channels, angles, plates, bracing, and other secondary framing members, complying with the Light Gauge Structural Institute's "Guide Specifications" Section 07410, "Manufactured Roof and Wall Panels."
   1. Eave Struts: Unequal flange C-shaped sections formed to provide adequate back-up for roof panels. Fabricate from shop-painted, roll-formed steel (gauge as determined by others). Brake formed eave struts will not be allowed.
   2. Flange and Sag Bracing: 1-5/8″ by 1-5/8″ (41-by-41 mm) angles, fabricated from shop-painted, roll-formed steel (gauge as determined by others). Brake forming will not be allowed.
   3. Base or Sill Angles: Fabricate from cold-formed galvanized steel sections (gauge as determined by others).
   4. Secondary structural members.
   5. Soffit framing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements indicated for conditions affecting performance of metal panels.

B. Panel Supports and Anchorage: Examine substrate to verify that decking, angles, and other secondary structural panel support members and anchorage have been installed to meet requirements of panel manufacturer.

C. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate metal roof and wall panels with all other work: including flashing, trim and construction of decks, parapets, wall, and other adjoining work to provide a leak proof, secure, and non-corrosive installation.

B. Promptly remove protective film, if any, from exposed surfaces of metal panels. Strip with care to avoid damage to finish.

3.03 INSULATION INSTALLATION

A. Install only as much insulation as can be covered with roofing membrane and completed before the end of the day's work or before the onset of inclement weather.

B. Install polyisocyanurate insulation board in 2″ layers mechanically attached. Install polyisocyanurate insulation in solvent free insulation adhesive.

C. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

3.04 PANEL INSTALLATION

A. General: comply with panel manufacturer's written 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 and structural movement.
   1. Field cutting exterior panels by torch is not permitted.
   2. Install panels with concealed fasteners. Panel clips to be spaced as required by the manufacturer.
   3. Over insulation, install one ply of roofing underlayment as recommended by the manufacturer.
   4. Roof panels must be face-fastened to the substrate at the top to control thermal expansion and contraction in one direction. Do not face-fasten at both ends.
   5. Roof panels must have first and last fastening clips located at least 3″ (72.2 mm) away from panel ends.
   6. When panels must be lapped, install panels in vertical sets (from eave to ridge), so that panels can be adjusted to align seams.
   7. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.

B. Install underlayment under metal panels, unless otherwise recommended by panel manufacturer. Use adhesive for temporary anchorage, where possible to minimize the use of mechanical fasteners under metal panels. Apply from eave to ridge in shingle fashion and lap joints a minimum of 2″ (50 mm).

C. Accessories: Install components required for a complete panel assembly including trim, copings, fascia, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, mullions, sills, corner strips, and similar items.

D. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized-asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel assemblies. Provide types of gaskets, fillers and sealants indicated or, if not otherwise indicated, types recommended by panel manufacturer.

1. Install weather-seal under ridge cap and where required to prevent air and moisture penetration. Flash and seal panels at ends and intersections with other materials with closures to exclude weather.
2. Seal panel end laps with a bead of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
3. Prepare joints and apply sealants to comply with requirements of Section 07 92 00 – Elastomeric Sealants.

F. Standing Seam Roof Panel Assembly: Fasten panels to supports with concealed clips according to panel manufacturer's written instructions.
1. Install clips at spacing required by roof manufacturer with self-drilling/self-tapping fasteners.
2. At end laps, install tape sealant between panels.
3. Complete seaming of panel joints by operating portable power-driven equipment of type recommended by panel manufacturer to provide a weather-tight joint.

G. Soffit Panel/Wall Shingle Panel Assembly: Fasten panels to supports with concealed fasteners according to panel manufacturer's written instructions.
1. Align panels. Fasten panels, flashing and trim with blind rivets or self-tapping screws.
2. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

H. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4″ in 20′ (6 mm in 6 m) on level, plumb and location lines as indicated and within 1/8″ (3 mm) offset of adjoining faces and of alignment of matching profiles.

3.05 COPING AND ACCESSORY PREPERATION

A. Coping shall be secured to wood nailers with an anchor chair 12″ wide, 5′ 0″ on center. Fastening of metal to walls and wood blocking shall comply with SMACNA *Architectural Sheet Metal Manual*, Factory Mutual I-60 wind uplift specifications and/or manufacturer's recommendations, whichever is the highest standard. Installer shall furnish mechanical fasteners suitable for parapet substrates.

B. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied. Manufacturer shall provide all factory-fabricated accessories including, but not limited to, coping transitions, miters, scuppers, joint covers, etc.

3.06 COPING INSTALLATION

A. Installing Contractor shall be responsible for determining if the coping system is in general conformance with metal and roof manufacturer's recommendations.

B. Allow sufficient clearances for expansion and contraction of linear metal components. Secure metal using fasteners as required by the system. No exposed face fastening shall be accepted.

C. Install manufactured fascia and coping cap systems in strict accordance with manufacturer's printed instructions.

D. Installer must use a high-grade sealant under splices to make installation watertight. Install anchor chair every 5′ 0″ on center.

E. Install Miters First:
1. Position base flashing of roofing membrane over the wall edge covering nailers completely, fastening 8″ on center. Install membrane and cap sheet with proper material and procedure according to manufacturer's recommendations.
2. Install minimum 12″ wide anchor chair at 5′ 0″ on center.
3. Install 6″ wide splice plate by centering over 12″ wide anchor chair.
4. Apply two beads of sealant approximately 2″ in from the coping cap joint and one strip of butyl tape at each side of hem. Shim plate is installed on chair when splice plate is not required.
5. Install Coping Cap by hooking outside hem of coping on outside face of anchor chair. Press downward on inside edge of coping until "snap" occurs and hem is engaged on the entire chair.
6. Crimp coping hem at rear chair.
7. Remove protective plastic film immediately after installation and touch up scraped or damaged paint with factory supplied paint in matching color.

3.07 CLEANING AND PROTECTING

A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.

3.08 MAINTENANCE BY INSTALLER BEFORE LEAVING JOBSITE

A. Remove metal filings from panels and flashings at the end of each day. Filings from drilling, grinding, and cutting can start to rust overnight. At end of project, make final check for any filings. If rust spots have already appeared, they can be removed with a non-abrasive cleaner. Do not use abrasive cleaners.

B. Touch-up paint should be used on scratches but should be used sparingly and applied with a small artist's brush. If scratches penetrate the zinc coating on galvanized material, a zinc rich primer should be applied in the scratch before the touchup paint is applied.

C. Clean or power wash panels as necessary after completion of Project. This includes removing excess unsightly caulking. Caulking can be removed with mineral spirits. Rinse residue with clean water.

D. Remove debris and crating material from the site.

3.09 MAINTENANCE AND MAINTENACE MANUAL

A. Provide binder for owner including routine maintenance for metal panels. Include instructions to:

1. File job records, including project plans, specifications, shop drawings, warranties, if any, etc., pertaining to roofing and wall paneling for future reference.
2. Set up maintenance inspection schedule.
3. Use caution: Steep metal roofs can be slippery. A qualified metal roofing contractor may be required for roof inspections.
4. Keep gutters and downspouts clear of debris that can impede water flow.
5. Immediately remove any vegetation or debris that contacts metal panels. This includes tree branches, leaves, weeds, grass, etc.
6. Eliminate any conditions that are causing water to pond and accumulate on panels.
7. Reseal curbs, gutters, flashings, closures, penetrations, etc. as necessary to maintain the weathertightness of the system. Typically, a one-part polyurethane sealant (such as Sikaflex 201) is best for such repairs. The Owner may wish to hire a qualified, experienced metal contractor for these repairs.
8. Panel cleaning instructions.
9. Repair instruction for damage that may have occurred to panels with caulking, touchup paint, etc.

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 to install the following fully adhered roof systems including wall terminations, curb and wall flashings, corners, roof edges/parapets, and penetrations on 8 buildings:
   1. TPO Roof System D: TPO membrane, coverboard, and insulation over wood deck.

1.02 RELATED WORK

A. Section 06 10 00 – Rough Carpentry: Wood nailers.

B. Section 07 20 00 – Insulation: Batt insulation.

C. Section 07 62 00 – Sheet Metal Flashing and Trim: Metal scuppers and downspouts.

1.03 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.

1.04 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 “Terminology Relating to Roofing and Waterproofing”; glossary of NRCA’s *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*.

1.05 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.

1.06 SUBMITTALS

A. Submittals Package – General:
1. Submit the Shop Drawings, Product Data, and 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: One each type.
      b. Insulation: One each type.
      c. Coverboard: One each type.
      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.

1.07 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 5 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 and 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 5 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 10 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 5 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).
   1. In continuous operation of installing such roofing systems for 2 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.

1.08 DELIVERY, STORAGE, HANDLING, AND DISPOSAL

A. Delivery: Deliver roofing materials to the site in the manufacturer's unbroken containers bearing the manufacturer's printed labels.

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.

1.09 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.

1.10 WARRANTY

A. 30-year Red Shield Platinum Warranty shall provide material and labor and comprehensive, no-dollar limit, edge-to-edge system coverage, including membrane, insulation, and metal. Warranty shall include coverage from:
1. Incidental punctures.
2. Hail damage.
3. Wind damage from wind speeds up to 100 mph gusts.

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 2 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Firestone Ultraply TPO Platinum with 30-year Red Shield Platinum Warranty.
   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.
   1. Only Firestone brand products are covered in a Red Shield Warranty.

B. Thermal Layer:
   1. Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
   2. Thickness: To achieve a minimum long-term thermal resistance factor of 20.

C. Coverboard:
   1. 1/2″ thick Isogard high-density core closed cell polyisocyanurate core with coated fiberglass facer.
   2. Coverboard Attachment: Fastened or adhered, per substrate.

D. Membrane Layer: UltraPly Platinum TPO, 0.080″:
   1. Color: Tan.
   2. Membrane Layer Attachment: Adhesive.

E. Vapor Barrier: V-Force 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.

F. 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.

G. TPO Walk Pad: UltraPly Walkway Pads:
   1. At all access points (ladders, hatches) to roof.
   2. As walkway on roof around rooftop equipment, as shown on the Drawings.

H. Roof Edging System: Of types detailed on the Drawings.

I. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.

J. Bonding Adhesive: Manufacturer's standard, water-based.

K. Metal Termination Bars: Manufacturer's standard, pre-drilled stainless-steel or aluminum bars, approximately 1″ by 1/8″ thick; with anchors.

L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1″ wide by 0.05″ thick, pre-punched.

M. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with FM Approvals 4470, designed for fastening membrane to substrate.

N. 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. Concrete Decks, except Insulating Concrete:
1. Test concrete decks for moisture prior to application of roofing materials. Test for capillary moisture by plastic sheet method according to ASTM D4263.
2. Prime concrete decks, including precast units, with primer as specified. Keep primer back 4″ from joints in precast units.
3. Allow primer to dry before application of adhesive.

G. 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°F.

F. Do not apply materials to substrate having temperature of 40°F or less.

3.05 WOOD NAILER LOCATION AND INSTALLATION

A. Firestone Building Products no longer requires the use of treated wood nailers. This is due to the new EPA requirements that have caused treated lumber to have more corrosive properties than the previous generation of wood treatments. Where details require the use of treated wood nailers, the following requirements apply:
   1. Refer to the appropriate Firestone Design Guide for the appropriate Firestone fastener to be used for securing membrane into 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 Firestone Details and the EPDM System 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″ by 4″ nominal and exceed the width of any metal flange attached to it by a minimum of 1/2″.

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 a vapor retarder where specified and scheduled.

3.07 INSTALLATION OF TPO ROOFING

A. Do not allow the membrane to come in contact with surfaces contaminated with asphalt, coal tar, oil, grease, or other substances which are not compatible with TPO.

B. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.

C. Commence installation at the low point of the roof and work towards the high point. Lap the sheets so the flow of water is not against the edges of the sheet.

D. Position the membrane so it is free of buckles and wrinkles.

E. Roll sheet out on deck; inspect for defects as being rolled out and remove defective areas. Allow for relaxing before proceeding.
1. Lap edges and ends of sheets 2″ or more as recommended by the manufacturer.
2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434.
3. Check seams to ensure continuous adhesion and correct defects.
4. Finish edges of laps with a continuous beveled bead of sealant to sheet edges to provide smooth transition.
5. Finish seams as the membrane is being installed (same day).
6. Anchor perimeter to deck or wall as specified.

F. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.

G. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 4″ beyond cut.

H. Membrane Perimeter Anchorage:
1. Install metal fastening strip at the perimeter of each roof level, curb flashing, expansion joints and similar penetrations as indicated and in accordance with membrane manufacturer's instructions on top of roof membrane to deck or wall.
2. Mechanically Fastened Metal Fastening Strip:
   a. Set top of mechanical fastener set flush with top surface of the metal fastening strip. Space mechanical fasteners a maximum 12″ on center starting 1″ from the end of the nailing strip.
   b. When strips are cut round corners and eliminate sharp corners.
   c. After mechanically fastening strip cover and seal strip with a 6″ wide roof membrane strip; heat weld to roof membrane and seal edges.
   d. At roof edge metal, turn the membrane down over the front edge of the blocking or the nailer to below blocking. Secure the membrane to the vertical portion of the nailer; or, if required by the membrane manufacturer with fasteners spaced not over 12″ on centers.
   e. At parapet walls, intersecting building walls and curbs, secure the membrane to the structural deck with fasteners 300 mm (12″) on centers or as shown on NRCA manual.

I. Adhered System:
1. Apply adhesive in quantities required by roof membrane manufacturer.
2. Fold sheet back on itself after rolling out and coat the bottom side of the membrane and the top of the deck with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's application instruction, roll the membrane into the adhesive in a manner that minimizes voids and wrinkles.
4. Repeat for other half of sheet. Cut voids and wrinkles to lay flat and clean for repair patch over cut area.

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 8″ above roof surfaces and 4″ 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 4″.
   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 8″ on centers. Use fastening strip on ducts. Use pipe clamps on pipes or other round penetrations.
3. Apply sealant to top edge of flashing.

C. Installing Building Expansion Joints:
1. Install base flashing on curbs as specified.
2. Coordinate installation with metal expansion joint cover or roof expansion joint system.
3. Install flexible tubing 1-1/2 times width of joint over joint. Cover tubing with TPO flashing strip adhered to base flashing and lapping base flashing 4″. Finish edges of laps with sealants as specified.

D. Repairs To Membrane and Flashings:
1. Remove sections of TPO sheet roofing or flashing that is creased wrinkled or fishmouthed.
2. Cover removed areas, cuts, and damaged areas with a patch extending 4″ beyond damaged, cut, or removed area. Heat-weld to roof membrane or flashing. Finish edge of lap with sealant as specified.

3.09 WALKWAY PADS

A. Use reinforced sheet not less than 3′ wide.

B. Heat weld walkway sheet to roof sheet at edges. Weld area 2″ wide by the entire length of the walkway sheet.

C. Finish edges of laps with sealants as specified.

3.10 FIELD QUALITY CONTROL

A. Roofing Inspector: Contractor shall engage a qualified roofing inspector to perform roof tests and inspections and to prepare start up, interim, and final reports.
1. Examine and probe seams in the membrane and flashing in the presence of Owner’s Representative and Membrane Manufacturer’s Inspector.
2. Probe edge of welded seams with a blunt tipped instrument. Use sufficient hand pressure to detect marginal welds, voids, skips, and fishmouths.

B. Final Roof Inspection: Arrange for roofing system manufacturer’s technical personnel to inspect roofing installation on completion.

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. Metal valleys.
   3. Flashing at roof penetrations.
   4. Edge flashing.
   5. Roof Drainage Systems: Conductors and downspouts.
   6. Exposed metal trim/fascia units.
   7. Parapet copings.
   8. 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 01 General Requirements Specifications, 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 07 – 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.

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. Downspouts:
1. 24 ga Kynar 500 coated galvanized steel.
2. 10′ 0″ sections, offset for concealed joints.
3. Include matching accessories.

C. Conductor Head/Scupper:
1. 24 ga Kynar 500 coated galvanized steel.

D. Commercial Grade Gutters:
1. 24 ga Kynar 500 coated galvanized steel.

2. Support straps and hangers at 30″ on center.
3. Concealed joint covers.

E. Parapet Copings:
1. 24 ga Kynar 500 coated galvanized steel.
2. Face height: Outside height 4″ minimum or greater if indicated on the Drawings; slope 1/2″ to 3/4″ down to inside.
3. Lengths: 12′ 0″ minimum.
4. Joints: Splice in accordance with manufacturer's product data.
5. Nailers: Not required for snap-lock coping designs, as per product manufacturer.
6. Provide splice plates, anchor plates, fasteners.

F. Reglets and Counterflashings: Fry Reglet Corporation, Type ST at stucco, Type MA at masonry, Type CO (galvanized steel) at concrete, or fabricated as indicated on Drawings.

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° angle. Extend wall edge not less

than 1″ above front edge. Solder joints for watertight 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′ 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″ by 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 03 Sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 04 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 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 Division 1 – General Requirements 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 Sealants.

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

G. FS (Federal Specification) TT-S-00227E (COM-NBS) – Interim Federal Specification for Sealing Compound: Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

H. FS (Federal Specification) TT-S-00230C – Interim Federal Specification for Sealing Compound: Elastomeric Type, Single Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

I. FS (Federal Specification) TT-S-001543 (COM-NBS) – Interim Federal Specification for Sealing Compound: Silicone Rubber Base (for Caulking, Sealing, and Glazing in Buildings and Other Structures).

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 A/E, 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 A/E from the range of manufacturer's standard colors.

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 3 years' experience in installing materials of types specified and shall have successfully completed at least 3 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°F to 70°F (16°C to 21°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 A/E 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. Sonneborn® Building Products, ChemRex, Inc.
2. General Electric.
3. Dow Corning.
4. Pecora.
5. Tremco, Inc.
6. A/E approved equal.

B. Compatibility:
1. Provide joint sealants, joint fillers, and accessory joint materials that are compatible with one another and with joint substrates under project conditions.
2. Install joint sealants, joint fillers, and related joint materials that are non-staining to visible joint surfaces and surrounding substrate surfaces.

2.02 MATERIALS

A. Sealant Type A: Low-modulus, non-sag sealant; comply with ASTM C920, TT-S-00230C, Grade NS, Class 25. Acceptable sealants:
1. Single Component Urethane Type S, comply with TT-S-00230C:
   a. Sonolastic® NP 1.
   b. Vulkem 116, 911, 921, or 931.
   c. Tremflex 25.
   d. Pecora Dynatrol I XL.
   e. A/E approved equal.
2. Multi Component Urethane Type M, comply with TT-S-00227E:
   a. Sonolastic® NP 2.
   b. Dymeric 511.
   c. Vulkem 227 or 922.
   d. Pecora Dynatred.
   e. A/E approved equal.
3. Single-Component Silicones Type S, comply with TT-S-001543A:
   a. Spectrem 1, 2, or 3.
   b. Pecora 860.
   c. A/E approved equal.

B. Sealant Type B: Self-leveling sealant having a Shore A hardness of not less than 25 or more than 50 and ±25% 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 (NSF) 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 Type G: Gun grade sealant suitable for continuous water immersion, designed for use in swimming pools, fountains, cooling towers, wastewater treatment plants and plaza decks; conforms to ASTM C920, Type M, Grade NS, Class 25, Use NT, T, M, A and O. USDA approved, comply with TT-S-00227E. Acceptable sealants:
1. Multi Component Urethane:
   a. Vulkem 227.
   b. Pecora Dynatred.
   c. A/E approved equal.

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®-G.
3. 2-component Epoxy, pourable:
   a. Sonneborn®/Chem Rex Epolith®-P.

J. Sealant Type J: Comply with ASTM C920, Type S or M, Grade NS, Class 25, comply with EIMA 300.01. Acceptable products:
   1. Urethanes:
      a. Vulkem 922.
      b. Dymeric 511.
      c. Pecora Dynatrol II.
      d. A/E approved equal.
   2. Silicones:
      a. Spectrem 1 or 3.
      b. Pecora 890.
      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″ (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 A/E.
   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″ (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 backup material to prevent adhesion of sealant to backup 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 they are without contamination or damage at time of Substantial Completion.

3.04 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. Control and expansion joints in unit masonry.
   3. Control and expansion joints on exposed interior surfaces of exterior walls.
   4. Joints between different materials listed above.
   5. Perimeter joints between materials listed above and frames of exterior and interior doors, windows, storefronts, louvers, elevator entrances, and similar openings.
   6. Control and expansion joints in ceiling and overhead surfaces.
   7. Perimeter joints on exposed interior surfaces of exterior openings.
   8. 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. 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 and side wall 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 J: For exterior vertical joints in Exterior Insulation and Finish Systems.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish hollow metal doors and frames as specified and shown on Plans and schedules.

B. Metal Frames:
1. Fire-rated and non-rated door frames.
2. Glazed transom assemblies.
3. Glazed sidelight assemblies.
4. Glazed window assemblies.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

1.02 RELATED WORK

A. Division 07:
1. Section 07 20 00 – Insulation
2. Section 07 92 00 – Elastomeric Sealants

B. Division 08:
1. Finish Hardware

C. Division 09:
1. Section 09 22 00 – Gypsum Board Assemblies
2. Section 09 90 00 – Painting and Coating

1.03 REFERENCE STANDARDS

A. SDI Standards:
1. SDI-108-10(R14) – Recommended Selection and Usage Guide for Standard Steel Doors.
2. SDI -110-09 – Standard Steel Doors and Frames for Modular Masonry Construction.
3. SDI-111-09 – Recommended Details and Guidelines for Standard Steel Doors, Frames, Accessories, and Related Components.
4. SDI-112-08 – Zinc-Coated (Galvanized/Galvannealed) Steel Doors and Frames.
5. SDI-113-13 – Standard Practice for Determining the Steady-State Thermal Transmittance of Steel Door and Frame Assemblies.

6. SDI-117-13 – Manufacturing Tolerances for Standard Steel Doors and Frames.
7. SDI-118-12 – Basic Fire Door, Fire Door Frame, Transoms/Sidelight, and Window Frame Requirements.
8. SDI-122-15 – Installation Troubleshooting Guide for Standard Steel Doors and Frames.
9. SDI-124-16 – Maintenance of Standard Steel Doors and Frames.
10. SDI-128-16 – Guidelines for Acoustical Performance of Standard Steel Doors and Frames.

B. ANSI Standards:
1. ANSI/UL 10B-2009 – Fire Tests of Door Assemblies.
2. ANSI/UL 10C-2009 – Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/NFPA 80-2010 – Fire Doors and Fire Windows.
4. ANSI/NFPA 252-2012 – Fire Tests of Door Assemblies.
5. ANSI/SDI A250.3-2007 (R2011) – Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
6. ANSI/SDI A250.4-2011 – Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, and Frame Anchors.
7. ANSI/SDI A250.6-2003 (R2009) – Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
8. ANSI/SDI A250.7-1997 (R2007) – Nomenclature for Standard Steel Doors and Steel Frames.
9. ANSI/SDI A250.10-1998 (R2011) – Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
10. ANSI/SDI A250.11-2012 – Recommended Erection Instructions for Steel Frames (Formerly SDI-105).
11. A115 – Hardware Preparation in Steel Doors and Steel Frames.
12. A115.IG – Installation Guide for Doors and Hardware.

C. ASTM Standards:
1. ASTM A1008-2012 – Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
2. ASTM A568-2011 – Standard Specification for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
3. ASTM A1011-2012 – 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 A653-2011 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
5. ASTM A879-2012 – Standard Specification for Sheet Steel, Zinc Coated by the Electrolyte Process for Applications Requiring Designation of the Coating Mass on Each Surface.
6. ASTM A924-2010 – 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 Paragraph 2.01.

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 prior to manufacturing and/or delivery of product to the site.
1. Shop Drawings shall show elevations of each door design, door construction details, hardware locations, dimensions, and shapes of materials, anchorage and fastening methods, door frame types and details, and finish requirements. Submit for each frame type and door type:
2. Identify each unit with door and window marks and numbers.
3. Relate numbers to A/E's frame, door, and window schedules.

1.06 SIZES

A. Standard doors and frames shall be sized to fit openings as scheduled on the Drawings and may include:
1. Widths: 2′-0″, 2′-4″, 2′-6″, 2′-8″, 2′-10″, 3′-0″, 3′-4″, 3′-6″, 3′-8″, 3′-10″, and 4′-0″.
2. Sizes shown are for single doors only; equal pairs of doors use twice the width indicated. Pairs of doors can consist of two unequal door widths.
3. Heights: 6′-8″, 7′-0″, 7′-2″, 7′-10″ and 8′-0″.

B. Custom doors and 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 Architect's opening number on all doors, frames, and miscellaneous parts and cartons.

B. All doors and 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 A250.8-2017: The use of non-vented plastic or canvas shelters that can create a humidity chamber shall be avoided.

D. A 1/4″ space between the doors shall be provided to promote air circulation. If the wrapper on the door becomes wet, it must be removed immediately.

PART 2 PRODUCTS

2.01 MATERIALS

A. All steels used to manufacture doors, 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. When specified, 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."

B. Thermal-Rated Insulating Assemblies: Provide at exterior locations and elsewhere as scheduled on Drawings, assembly with u-factor of 0.24 Btu/hr ft. 2°F or better.

C. Sound Rated Assemblies: Provide door and frame assemblies which have been fabricated as sound reducing type tested in accordance with ASTM E90 and provide sound ratings of STC33 or better.

2.02 FRAMES

A. Exterior frames shall be 16-gauge full profile welded type construction.

B. Interior frames shall be 16 gauge:
   1. Butted for existing drywall construction (with welded corners).
   2. Butted for masonry construction (with welded corners).

C. Finish: Factory primed, for field finishing.

D. Frames for Glazing:
   1. Mullions and transom bars shall be joined to adjacent members by welding or by rigid mechanical connection which maintains alignment of parts and assure performance when field assembled.
   2. Vertical mullions shall be supplied with floor anchors.
   3. Prepare frames for glass and glazing installed on the exterior rabbet of the frame assembly unless detailed otherwise on the drawings.
   4. Glazing beads shall be flush type formed channel, min 5/8″ height and accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

E. 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.

F. Slip-on drywall frame anchors shall be as provided by the manufacturer to assure performance.

G. 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.

H. Welding shall conform to ANSI/AWS-101-94:
   1. Welded joints shall be ground to a smooth uniform finish.

I. Butt joints of mullions, transom bars, center rails and sills shall be coped accurately and securely welded.

J. Fire labeled frame products shall be provided for those openings requiring fire protection ratings as indicated on the Drawings.

K. Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.03 DOORS

A. Doors shall be of types indicated on the Drawings.

B. Door Faces:
   1. Full Flush: Each door face shall be formed from a single sheet of steel with no visible seams on the surface to the faces. A full height vertical seam shall be permitted on the door edges.

C. Exterior Doors:
   1. Level 3, Extra Heavy Duty, 16 gauge, 1-3/4″ thick.
   2. Model 1, full flush design.
   3. Core: Core shall be insulated with KraftPaper honeycomb, polystyrene, polyurethane, mineral board at the discretion of the manufacturer in accordance with ANSI/SDI A250.8, “SDI-100 – Recommended Specifications for Standard Steel Doors and Frames”, Section 2.3.2.

D. Interior Doors:
   1. Level 2, Heavy Duty, 18 gauge, 1-3/4″ thick.
   2. Model 1, full flush design.

E. Door construction per ANSI/SDI A250.8-200319E.

F. End closure: The top and bottom of the doors shall be closed with either flush or inverted channel closures. The channels or closures shall have a minimum material thickness of 0.042″.

G. Door edge design: Shall be in accordance with ANSI/SDI A250.8, "SDI-100 – Recommended Specifications for Standard Steel Doors and Frames", Section 2.3.1.3.

2.04 FIRE-RATED DOORS AND RELATED FRAMES

A. Fire Rated Doors and Frames shall be successfully tested in accordance with: ANSI/UL 10B Fire Tests of Door Assemblies, ANSI/ UL 10C Positive Pressure Fire Tests of Door Assemblies, or ANSI/NFPA 252 Fire Tests of Door Assemblies.
   1. The assembly shall be identified by labels and/or approved identification marking of an agency accepted by the authority having jurisdiction. The door label shall indicate the applicable fire test rating for the door construction furnished.
   2. Attach fire rating label to each fire-rated unit.

B. Smoke Control Doors:
   1. When specified, manufacturers shall provide the type of fire door and frame assembly that has been investigated and/or successfully tested in accordance with the latest revision of ANSI/UL 1784 – Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives.
   2. See SDI-118, Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements for additional information.

C. Steel Astragals on Fire Doors:
   1. Where required by a manufacturer's listing or ANSI/NFPA 80, Standard for Fire Doors and Other Opening Protectives, a steel overlapping astragal shall be provided.

D. Louvers for Fire Doors:
   1. When specified, fire doors shall be provided with fire labeled louvers. See SDI-118, Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements for acceptable labeling methods.

2.05 HARDWARE PREPARATION

A. Mortise, reinforce drill and tap doors and frames as required for mortised hardware furnished under Division 08 Sections, Finish Hardware and under Division 28 Sections, Electronic Safety and Security in accordance with a final approved hardware schedule and templates provided by the hardware supplier and security supplier, including a minimum 1/2″ raceway for electrical hardware, electric hinges and power transfers, door position switches, and other electrified hardware.

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. Provide metal mortar guards for mortised cutouts for frames in masonry walls.

E. Obtain templates from hardware and security suppliers.

F. Interior frames shall be prepared for single stud door silencers, 3 per frame.

G. Drilling and tapping for surface door closers, door closer brackets, and adjusters shall be done in the field by the installer.

H. Astragals for Double Doors: Specified in Section 08 71 00 – Door Hardware.
1. Exterior Doors: Steel, Z-shaped.
2. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

2.06 FINISH

A. Doors and frames shall be leveled and ground smooth.

B. Apply mineral filler to eliminate weld scars and other blemishes.

C. Prime Finish:
1. Doors and frames shall be thoroughly cleaned and chemically treated to insure maximum paint adhesion.
2. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer, either air-dried or baked-on.
3. The 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."

2.07 DESIGN CLEARANCES

A. The clearance between the door and frame head and jambs shall be 1/8″ in the case of both single swing and pairs of doors.

B. The clearance between the meeting edges of pairs of doors shall be 1/8″ to 1/4″ for fire rated doors 1/8″ ± 1/16″.

C. The clearance at the bottom shall be 3/4″.

D. The clearance between the face of the door and door stop shall be 1/16″ to 1/8″.

E. All clearances shall be, unless otherwise specified, subject to a tolerance of ± 1/32″.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify that rough openings are no less than 3/16″ larger on all three 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. All 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 doors and frames in accordance with NFPA 80 shall be installed and fastened to maintain alignment with frames to achieve maximum operational effectiveness and appearance.

F. Doors shall be adjusted to maintain perimeter clearances as specified. Shimming shall be performed by the installer as needed to assure the proper clearances are achieved.

G. 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.

H. Contractor shall seal/caulk around frames in place.

3.02 PRIME COAT TOUCH-UP

A. Immediately after erection, areas where prime coat has been damaged shall be sanded smooth and touched up with same primer as applied at shop.

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 CLEAN

A. Complete painting prior to glass installation.

B. Clean surface promptly after installation of windows, exercising care to avoid damage to finish. Remove excess glazing and sealant compounds, dirt, and other substances.

3.04 PROTECTION

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

3.05 SCHEDULE

A. As indicated on Drawings.

END OF SECTION

SECTION 08 36 13

SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazed Sectional Doors: Insulated, steel sectional Overhead model 592 door, tracks, and support.

B. Electric Operators and Controls - Trolley-type continuous-duty door operators for standard lift sectional doors.

C. Related Sections
1. Section 04 00 00: Unit Masonry: Prepared opening in masonry. Execution requirements for placement of anchors in masonry wall construction.
2. Division 05: Metal Fabrications: Steel frame and supports.
3. Division 06: Wood Blocking and Curbing: Rough wood framing and blocking for door opening.
4. Division 07: Joint Sealers: Perimeter sealant and backup materials.
5. Division 09: Field Painting.
6. Division 26: Raceway and Boxes: Empty conduit from control station to door operator.
7. Division 26: Wiring Connections: Electrical service to door operator.

1.02 REFERENCES

A. ANSI/DASMA 102 – American National Standard Specifications for Sectional Overhead Type Doors.

B. ASTM A 653/A 653M – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A 924/A 924M – Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 209/209M – Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B 221/221M – Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 – Industrial Control and Systems: Enclosures.

1.03 DESIGN / PERFORMANCE REQUIREMENTS

A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
   1. Design pressure shall be as shown on the structural Design Criteria Drawing.
   2. Safety Factor: 1.5 times design wind load.

B. Wiring Connections: Requirements for electrical characteristics.
   1. 115V, single phase, 60 Hz.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

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: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish specified, two samples, minimum size 6″ (150 mm) square, representing actual product, color, and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

F. Operation and Maintenance Data.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 10 years' documented experience.

B. Installer Qualifications: Authorized representative of the manufacturer with minimum 5 years' documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.06 WARRANTY

A. Operator: Manufacturer's standard limited 2-year warranty against material and manufacturing defects.

B. Door Finish: Manufacturer's standard limited 5-year warranty against material and manufacturing defects.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

1.08 PROJECT CONDITIONS

A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

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. Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, Texas 75067.
2. Clopay Building Products Company, 8585 Duke Blvd., Mason, Ohio 45040.
3. Wayne Dalton, 2501 S. State Hwy. 121, Suite 200, Lewisville, Texas 75067.

B. Operators:
1. LiftMaster, 845 Larch Avenue, Elmhurst, Illinois 60126.

2.02 SECTIONAL OVERHEAD DOORS

A. Insulated Sectional Overhead Steel Doors
1. Door Assembly: Metal/foam/metal sandwich panel construction, with PVC thermal break and weather-tight ship-lap design meeting joints.
   a. Panel Thickness: 2″ (51 mm).
   b. Exterior Surface: Flush, textured.
   c. Exterior Steel: 20 gauge, galvanized.
   d. End Stiles: 16 gauge with thermal break.
   e. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.
   High cycle spring: 25,000 cycles.

2. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.
3. Thermal Values: R-value of 17.40; U-value of 0.057.
4. Air Infiltration: 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.
5. Sound Transmission: Class 26.
6. Glazing: 1/2″ Low E Insulated glazing.

B. Finish and Color:
1. Powder Coating Finish: Color as selected by Architect from manufacturer's standard colors.

C. Windload Design: Provide to meet the Design/Performance requirements specified.

D. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
1. Lock: No Lock.
2. Weatherstripping: Provide complete perimeter seals. Provide flexible top seal, flexible jamb seal and U shaped bottom seal.
3. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
   a. Size: 3″ (76 mm).
   b. Lift Type: As shown on the Drawings.
4. Spring Counterbalance: Torsion spring counterbalance mechanism sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of die cast aluminum with high strength galvanized aircraft cable with minimum 7 to 1 safety factor.
   a. High Cycle Spring: 100,000 cycles.

2.03 TROLLEY-TYPE DOOR OPERATORS

A. Heavy Industrial-Duty Operator: LiftMaster GT Heavy Industrial-Duty Trolley Operator, continuous-duty, high-starting torque motor with overload protection and emergency disconnect for manual door operation.

B. Electric Operator: Heavy industrial-duty assembly, UL listed and UL labeled, complete with electric motor and factory-prewired motor controls, wormgear reduction unit, electric solenoid-actuated brake, 3-button open/close/stop control station along with conduit-encased wiring from control circuit to motor, and accessories required for proper operation; operator shall be capable of driving door at a speed of approximately 11″ to 12″ (279 to 304 mm) per second.
1. Primary Drive Reduction: Wormgear-in-oil-bath gear reducer with synthetic "All Climate" oil with 20:1 speed reduction; adjustable torque limiter and quick- disconnect door arm to facilitate manual operation; permanently lubricated ball bearings on output shaft and output and door driven sprockets.
2. Brake: Electric solenoid-actuated brake that is capable of stopping and holding a door at any position.
3. Limit Switches: Fully adjustable, linear-driven limit mechanism synchronizing operator with door; low-friction nylon limit nuts fitted on treaded steel shaft that rotates on oil-tight self-lubricating bronze bushings; motor shall be removable without affecting limit switch settings.

4. Electric Motor: High-starting torque, continuous-duty, industrial-type protected against overload by current sensing and thermal overload devices. For single-phase applications, incoming voltage field-selectable between 115V and 230V, 60 Hz by properly positioning connector. For 3-phase applications, incoming voltage field-selectable between 208V, 230V and 460V, 60 Hz by properly positioning connector.

C. Motor Specification: Provide UL listed electric operator, as recommended by manufacturer to move door in either direction at not less than 2/3′ nor more than 1′ per second.
1. 115/230V 60 Hz, single phase.

D. Motor Control and Enclosure: LiftMaster Logic 5.0 motor control shall be UL-approved microprocessor solid-state type and shall include:
1. Radio Receiver: LiftMaster Logic 5.0 on-board, 3-channel receiver with standard external antenna; equipped to accept Security+ 2.0 rolling code technology remote controls and trinary DIP switch remote controls, with memory up to (30) 3-button remote controls (or 90 single-button remote controls) plus 30 wireless keypads, or an unlimited number of trinary DIP switch remote controls. Tri-band frequency (310/315/390 MHz) sends multiple radio signals to bypass radio interference.
2. Internet Connectivity: MyQ technology.
3. 902 to 928 MHz.
4. 50-channel FHSS (Frequency Hopping Spread Spectrum).
5. LiftMaster 828LM Internet Gateway enables monitoring and control of door operators and lighting controls via Internet-enabled smartphone, tablet or computer.
6. Provides two-way communication between commercial door operator and MyQ accessories to enable remote open, close and monitoring of commercial door.

E. 3-Button Control Station: 3-button station providing open/close/stop functionality shall be NEMA Type 1 with maintenance alert indicator to signal intervals for routine door and operator maintenance.

F. Door Drive: Full #41 roller chain with emergency disconnect for manual door operation.

G. Track: Heavy-duty, double-angle, 11-gauge galvanized steel.
1. Trolley Assembly: 2″ H x 2″ W (51 mm H x 51 mm W) galvanized steel angle rails with cast aluminum trolley including plated steel rail spacers with nylon chain-guide assembly.

H. Primary Entrapment Protection Devices:
1. NEMA 4 Monitored Photo Sensors: LiftMaster CPS-UN4 Monitored Photo Eyes (industrial thru-beam) fully monitored, non-contact, photo beam reversing photo sensor system with NEMA 4 watertight enclosure shall reverse, in conjunction with the LiftMaster Logic 5.0 operator, a closing door to the full open position when an obstruction is sensed; photo sensors shall be mounted no higher than 6″ (152 mm) maximum above the floor.

2. Monitored Sensing Edge Interface:
    a. LiftMaster CPS-MEI Monitored Sensing Edge shall provide a means to attach a 2-wire monitored sensing edge to a LiftMaster Logic 5.0 operator for continuous monitoring purposes; the edge, in conjunction with the LiftMaster Logic 5.0 operators, shall reverse a closing door to the full open position when an obstruction is sensed; sensing edge ordered separately and can be field-cut to required length.

I. Trolley Track: 2″ H x 2″ W (51 mm H x 51 mm W) galvanized steel angle rails with automatic reconnecting trolley and shall include plated steel rail spacers with nylon chain-guide assembly; nylon inserts will be provided on trolley mechanism and rail spacers to reduce vibration and chain noise.

J. Accessories:
1. Open-Only Push Button: LiftMaster 02-401M Mushroom Button Control Station.
2. Door-Position Indicator: LiftMaster RGL24LY Red/Green Traffic Light.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until openings have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If 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 overhead doors and track in accordance with approved Shop Drawings and the manufacturer’s printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

G. Install operator in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained. Demonstrate operation to owner's personnel.

3.04 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.

B. Clean doors, frames, and glass.

C. Remove temporary labels and visible markings.

3.05 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of Project.

C. Touch-up damaged coatings and finishes and repair minor damage before Substantial Completion.

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 Manufactures 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 form 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 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.

2.04 STOREFRONT FRAMING SYSTEMS:

A. Thermal Framing System:
1. 2″ by 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″ by 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.

2.05 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.

2.06 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.

2.07 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.

2.08 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.

2.09 SOURCE QUALITY CONTROL

A. Provide aluminum entrances and storefront framing specified herein from a single source.

B. Provide Curtainwall specified in Division 08 from the same manufacturer as products of this Section.

C. Provide Sun Control Devices specified in Division 10 from the same manufacturer as this Section and compatible with the Curtainwall system.

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 Painting: 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 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. Section 061000 – Rough Carpentry.
2. Division 8: Aluminum Doors and Frames.
3. Section 08 11 13 – 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 – General Requirements for allowance amount and procedures.

F. Alternates

1. Refer to Division 1 – General Requirements for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1 – General Requirements.

1.3 SUBMITTALS:

A. Comply with Division 1 – General Requirements.

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 Paragraph 2.2 – Materials.

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 – General Requirements 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 110V.
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 – General Requirements.

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’ experience 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 – General Requirements.

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: 5 Years.
3. Mechanical Locksets and 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 Section 01 78 00 – Closeout Submittals.

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 – General Requirements.

Item:	Manufacturer:	Approved:
Hinges	Stanley	Bommer, McKinney
Continuous Hinges	Stanley	Select, ABH
Locksets	Stanley	Dorma
Cylinders	Match Existing	
Exit Devices	Stanley	Dorma
Closers	Stanley	Dorma
Push Button Locks	Kaba	No Substitution
Push/Pull Plates	Trimco	Don-Jo, Hager
Push/Pull Bars	Trimco	Don-Jo, Hager
Protection Plates	Trimco	Don-Jo, Hager
Overhead Stops	ABH	Rixson, Glynn Johnson
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° swing of door.
11. Furnish 5 knuckles with flush ball bearings.
12. Provide hinge type as listed in Schedule.
13. Furnish 3 hinges per leaf to 7′ 6″ height. Add one for each additional 30″ 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°.

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″ (70mm) backset, or 2-3/8″ backset as needed.
5. 1/2″ (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. Cylinders:

1. Provide the necessary cylinder housings, collars, rings, and springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related Sections.

F. 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 1-1/2″ 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.

G. 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.

H. 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.

I. Kickplates: Provide with four beveled edges ANSI J102, 10″ high by width less 2″ on single doors and 1″ on pairs of doors. Furnish oval-head countersunk screws to match finish.

J. Mop plates: Provide with four beveled edges ANSI J103, 4″ high by width less 1″ on single doors and 1″ on pairs of doors. Furnish oval-head countersunk screws to match finish.

K. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

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 1/2″ 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 Paragraph 3.5 – Schedule of Finish Hardware, 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. Cylinders-match building standard.

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 Architectural Hardware for Standard Steel Doors and Frames* by the Door and Hardware Institute (DHI).

2. *Recommended Locations for Architectural Hardware for Flush Wood Doors* by DHI.

3. Window and Door Manufacturers Association’s 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°, 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

Code	Name
AB	ABH Manufacturing Inc.
KA	KABA/ILCO
NA	National Guard
SH	Stanley Commercial Hardware
ST	Stanley
TR	Trimco

Finish List

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

Option List

Code	Description
CSK	Counter Sunk Screw Holes
B4E	Beveled 4 Edges

Hardware Sets

SET #1

Doors: 201

3	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Keypad Lockset	E-Plex 2000	626	KA
1	Door Closer	QDC119	689	SH
1	Kick Plate	KO050 10″ x 2″ LDW B4E CSK	630	TR
1	Weatherstrip	160SA Head & Jambs		NA
1	Door Sweep	200 NA		NA
1	Handicap Threshold	513A	AL	NA

NOTE: Match existing keyway.

SET #2

Doors: 202, 203

3	Hinges	FBB179 4 1/2 X 4 1/2 NRP	US26D	ST
1	Lockset	QCL270 E	626	SH
1	Overhead Stop	4420 Series	US32D	AB
1	Gasketing	5050B Head & Jambs		NA

NOTE: Match existing keyway.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Aluminum Storefronts

B. Section includes glazing materials and glazing installation requirements for other sections listing Glazing section as a Related Section.

1.02 REFERENCES

A. ANSI Z 97.1 - Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

B. American Society for Testing and Materials (ASTM)
   1. ASTM C 1036 – Standard Specification for Flat Glass.
   2. ASTM C 1048 – Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   3. ASTM C 1172 – Standard Specification for Laminated Architectural Flat Glass.
   4. ASTM C 1376 – Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
   5. ASTM E 773 – Standard Test Method for Accelerated Weathering of Sealed Insulating Glass Units.
   6. ASTM E 774 – Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
   7. ASTM E 2188 – Standard Test Method for Insulating Glass Unit Performance.
   8. ASTM E 2189 – Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
   9. ASTM E 2190 – Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.

C. CPSC 16CFR-1201 – Safety Standard for Architectural Glazing Materials.

D. Glass Association of North America (GANA) *Glazing Manual*.

1.03 DEFINITIONS

A. Sealed Insulating Glass Unit Surfaces:
   1. Surface No. 1: Exterior surface of outer lite.
   2. Surface No. 2: Interior surface of outer lite.
   3. Surface No. 3: Exterior surface of inner lite.
   4. Surface No. 4: Interior surface of inner lite.

B. Interspace or Airspace: Space between lites of an insulating glass unit that contains dehydrated air or other inert specified gas.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glass capable of withstanding thermal movement and wind and impact loads (where applicable) as specified in the following paragraph.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat-treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Design Wind Loads: Determine design wind loads applicable to the Project according to ASCE 7, Minimum.
      b. Design Loads for Buildings and Other Structures: Section 6.5, Method 2 – Analytical Procedure, based on mean roof heights above grade indicated on Drawings. Refer to Structural Building Criteria indicated on the Drawings for:
         1) Basic Wind Speed: mph.
         2) Importance Factor.
         3) Exposure Category.
   2. Specified Design Snow Loads: As indicated on Drawings, but not less than snow loads applicable to Project as required by ASCE 7, Minimum Design Loads for Buildings and Other Structures: Section 7.0, Snow Loads.
   3. Probability of Breakage for Vertical Glazing: lites per 1000 for lites set vertically or not more than 15° off vertical.
      a. Wind Load Duration: Short duration, as defined in ASTM E 1300 or 3 seconds or less.
   4. Maximum Lateral Deflection: For insulating glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure 1″.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from ambient and surface temperatures changes acting on glass framing members and glazing components.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 1/4″ (6.0 mm) thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including performance characteristics and installation instructions.

B. Shop Drawings: Submit manufacturer's or fabricator's shop drawings, including plans, elevations, sections, and details, indicating glass dimensions, tolerances, types, thicknesses, and coatings.
   1. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

C. Samples: Submit manufacturer's samples of each type, thickness, and coating.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that fabricator of coated glass is certified by coating manufacturer.

E. Fabricator's Certification: Submit fabricator's certification by manufacturer.

F. Cleaning Instructions: Submit manufacturer's cleaning instructions.

G. Warranty: Submit manufacturer's standard warranty for sealed insulating glass units.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Minimum of 5 years' experience manufacturing solar control coated glass.

B. Fabricator's Qualifications:
   1. Minimum of 5 years experience manufacturing sealed insulating glass units meeting ASTM E 2190, Class CBA.
   2. Certified by manufacturer.

C. 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. GANA Publications: *Laminated Glazing Reference Manual* and *Glazing Manual*.
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

D. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, Insulating Glass Manufacturers Alliance ANSI Z97.1

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to Authorities having Jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles:
    a. For glazing lites more than 9 ft^2 in area, provide glazing products that comply with Category II materials.
    b. For lites 9 ft^2 or less in area, provide glazing products that comply with Category I or II materials.

E. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of Authorities having Jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Deliver glass to site in accordance with manufacturer's instructions.
2. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:
1. Store glass in accordance with manufacturer's instructions.
2. Store glass in clean, dry area indoors.
3. Protect from exposure to direct sunlight and freezing temperatures.
4. Apply temporary coverings loosely to allow adequate ventilation.
5. Protect from contact with corrosive chemicals.
6. Avoid placement of glass edge on concrete, metal, and other hard objects.
7. Rest glass on clean, cushioned pads at 1/4-points.

C. Handling:
1. Handle glass in accordance with manufacturer's instructions.
2. Protect glass from damage during handling and installation.
3. Do not slide 1 lite of glass against another.
4. Do not use sharp objects near unprotected glass.

1.08 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 conformances 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 MANUFACTURERS

A. PPG.

B. Guardian.

C. Pilkington.

D. Vitro.

2.02 PRODUCT SELECTION

A. Source of Supply
   1. Glass: Obtain from single source from single manufacturer for each glass type.
   2. Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.03 GLASS PRODUCTS

A. Annealed Float Glass, ASTM C1036 Type I transparent flat.
   1. Class 1: Transparent flat glass.
      a. Quality: q3 - Clear.

2.04 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 Caoting (#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

2.05 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

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. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Glazing Tape: Provide type as recommended by the manufacturer.
   1. Butyl-based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for specified installation, complying with ASTM C 1281 and AAMA 800 for application.
   2. Closed cell polyvinyl chloride foam, maximum water absorption by volume 2%, designed for 25% compression percent for air barrier and vapor retarder seal, black color, coiled on release paper over adhesive on two sides; widths required for specified installation, and complying with AAMA 800.

D. Glazing Gaskets:
   1. Dense Compression Gaskets: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone or thermoplastic polyolefin rubber, as recommended by glazing product manufacturer for application, molded or extruded shape to fit glazing channel retaining slot; black color.
   2. Soft Compression Gaskets: ASTM C 509, Type II, black, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal.

E. Setting Blocks: ASTM C 864, neoprene, 80 to 90 Shore A durometer hardness; length 4″, width of glazing rabbet space less 1/16″, height required for glazing method, pane weight, and pane area.

F. Spacer Shims: ASTM C 864, neoprene, 50 to 60 Shore A durometer hardness; length 3″, one half height of glazing stop, thickness required for application, one face self-adhesive.

G. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

H. Glazing Sealants: When glazing channels are required - ASTM C 920, type recommended by glazing product manufacturer for application indicated, complying with requirements of Section 07 92 00 – Elastomeric Sealants, color as selected by Architect.

I. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

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 areas to receive glass. Notify Architect of conditions that would adversely affect installation. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Verify glazing openings are correct size and within tolerance.

B. Verify glazing channels, recesses, and weeps are clean and free of obstructions.

3.03 FIELD QUALITY CONTROL

A. Coated glass, when viewed from minimum of 10′, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.

B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity.

3.04 INSTALLATION

A. Perform installation in accordance with GANA *Glazing Manual*.
   1. Glazing Sealants: Comply with ASTM C1193.
   2. Fire Rated Openings: Comply with NFPA 80.

B. General: Install glass and glazing materials in accordance with instructions of manufacturers and requirements of GANA *Glazing Manual*.
   1. Install setting blocks of size and in location required by glass manufacturer. Set blocks in bed of approved sealant.
   2. Provide spacers for glass lites as recommended, based upon size of glass unit.
   3. Comply with glass manufacturer's limits on edge pressures.
   4. Ensure that glazing units are set with proper and consistent orientation of glass units toward interior and exterior.
   5. Provide edge blocking where recommended.
   6. Install sealants in accordance with requirements of Section 07 92 00 – Elastomeric Sealants.

C. Use glazing method or methods below that are applicable to project.
   1. Tape Glazing: Place tapes on fixed stops positioned to be flush or protrude slightly when compressed by glass. Install tapes continuously. Form butt joints at corners and where required, and seal tape joints with approved sealant.
      a. Apply heel bead of glazing sealant along intersection of permanent stop and frame for continuity of air and vapor seal.
      b. Set glass lites centered in openings on setting blocks.
      c. Install removable stops, and insert dense compression gaskets at corners, working toward centers of lites, compressing glass against tape on fixed stops.
      d. Apply cap bead of elastomeric sealant over exposed edge of tape or gasket on exterior of glass unit.
   2. Sealant Glazing: Install continuous spacers between glass lites and glazing stops. Install cylindrical sealant backing where recommended, in width and depth recommended to provide proper depth and width of sealant bead. Ensure sealant cannot block weep system.
      a. Install sealant under pressure to completely fill glazing channel without voids, with full bond to glass and channel surfaces.
      b. Tool sealant bead to proper profile providing wash away from glass.
   3. Sealant Glazing for Butt Glazing:
      a. Brace glass in position for duration of glazing process.
      b. Mask edges of glass at adjoining glass edges and between glass edges and framing members.
      c. Secure small diameter non-adhering foamed rod on back side of joint.
      d. Apply sealant to open side of joint in continuous operation; completely fill joint without displacing foam rod; tool sealant surface smooth to concave profile.
      e. Allow sealant to cure, then remove foam backer rod.
      f. Apply sealant to opposite side; tool sealant smooth to concave profile.
      g. Remove masking tape.

4. Gasket Glazing: Fabricate gaskets to fit openings exactly. Allow for stretching of gaskets during installation.
    a. Set soft compression gasket against fixed stop or frame, secure, with bonded miter cut joints at corners.
    b. Set glass lites centered in openings on setting blocks.
    c. Install removable stops, and insert dense compression gaskets at corners, working toward centers of lites, compressing glass against soft compression gaskets and to produce a weathertight seal. Seal joints in gaskets. Allow gaskets to protrude past face of glazing stops.

3.05 CLEANING

A. Clean glass promptly after installation in accordance with manufacturer's instructions.

B. Remove labels from glass surface.

C. Do not use harsh cleaning materials or methods that would damage glass.

3.06 PROTECTION

A. Protect installed glass from damage during construction.

B. Protect installed glass from contact with contaminating substances resulting from construction operations.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

3.07 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: Gypsum Board Wall and Ceiling Systems.
1. Interior gypsum board and joint treatment.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backer board non-structural wall framing as noted on the Architectural Drawings.
4. Metal channel ceiling framing.
5. Metal suspension systems framing members for gypsum board assemblies.
6. Main tees, cross tees, perimeter angles, perimeter channels, hanger wire, and accessories.
7. Trim accessories, joint compound, control joints, fasteners, and sealants.
8. Textured finish.

B. Related Sections:
1. Division 05 – Structural Metal Studs and Track noted on Structural Drawing.
2. Section 06 10 00 – Rough Carpentry.
3. Section 07 20 00 – Insulation.
4. Section 09 90 00 – Painting and Coating.
5. Division 10 – Wall Protection.

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 A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
3. ASTM B 633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
4. ASTM C1396 – Standard Specification for Gypsum Board.
5. ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
6. ASTM C514 – Standard Specification for Nails for the Application of Gypsum Board.

7. ASTM C557 – Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
8. ASTM B 633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
9. ASTM C635 – Standard Specifications for Metal Suspension Systems.
10. ASTM C636 – Recommended Practice for Installation of Metal Suspension Systems.
11. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
12. ASTM C645 – Standard Specification for Nonstructural Steel Framing Members.
13. ASTM C665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
14. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
15. ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board.
16. ASTM C1002 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
17. ASTM C 1658 – Standard Specification for Glass Mat Gypsum Panels.
18. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
19. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
20. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

D. Gypsum Association:
1. GA-201 – Gypsum Board for Walls and Ceiling.
2. GA 214 – Recommended Levels of Gypsum Board Finish.
3. GA 216 – Application and Finishing of Gypsum Board.
4. GA-226 – Application of Gypsum Board to Curved Surfaces.
5. GA-235 – Gypsum Board Typical Mechanical and Physical Properties.
6. GA-236 – Joint Treatment under Extreme Weather Conditions.
7. GA-238 – Guidelines for Prevention of Mold Growth on Gypsum Board.
8. GA 600 – Fire Resistance Design Manual Sound Control.

E. Ceilings and Interior Systems Construction Association (CISCA) *Ceiling Systems Handbook.*

F. Wall and Ceiling Bureau, wallandceilingbureau.org.
1. UL 723 – Tests for Surface Burning Characteristics of Building Materials.

G. Product Data: Submit manufacturer's product specifications and installation instructions for systems shown.
1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

2. Local/Regional Materials:
a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

H. VOC data: Submit manufacturer's product data for joint compounds. Indicate VOC limits of the product. Submit SDS highlighting VOC limits.

I. 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).

J. All components of an assembly shall be classified by the same agency. Only complete tested assemblies shall be accepted

1.03 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.

1.04 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.

1.05 PROJECT CONDITIONS

A. Temperature, Ventilation, and Moisture: Conform to GA - 216 and manufacturer's instructions. Maintain temporary controls to regulate heating, ventilating, moisture, and humidity levels. Do not begin taping and finishing until following conditions are achieved.
   1. Building: Fully enclosed and free of standing water. Watertight roofing and wall envelope systems in place, except where Architect accepts water and mold resistant gypsum board.
   2. Temperature: Between 50°F and 95°F for minimum 48 hours.
   3. Gypsum Board Moisture Content: 0.4% on gypsum scale (12% on wood scale).
   4. Lighting: Sufficient temporary lighting to perform work to achieve specified finishes.

1.06 ALTERNATE CONSTRUCTION WASTE DISPOSAL

A. Reuse:
   1. Separate clean waste drywall pieces from contaminants for landfilling or recycling. Do not include vinyl faced, mold-resistant, or asphalt impregnated gypsum boards. Pulverize and apply to site soil in accordance to landscape specifications. Protect scrapes and pulverized material from moisture and contamination. Alternate to on-site soil amendment, work to supply local farming granular material for their use.

B. Recycle:
   1. Separate clean waste drywall pieces from contaminants for landfilling or reuse. Working with local waste hauler and local drywall manufacturer, provide proper storage of waste for pickup and return. Protect scrapes material from moisture and contamination.

PART 2 PRODUCTS

2.01 NON-STRUCTURAL METAL STUD FRAMING SYSTEMS

A. Steel framing shall be designed in accordance with the American Iron and Steel Institute (AISI) publication *North American Specification for the Design of Cold-Formed Steel Structural Members*.

B. Design framing systems to withstand design loads without deflections greater than the following:
   1. Interior non-load bearing walls: Lateral deflection of L/240, typical.

C. Design framing system to accommodate deflection of primary building structure and construction tolerances.

D. Framing Members, General: Comply with ASTM C645 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
   2. Protective Coating: Comply with ASTM C645; ASTM A 653/A 653M G40 (Z120), Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120) or DiamondPlus coating; roll-formed from steel meeting mechanical and chemical requirements of ASTM A 1003 with a zinc-based coating. A40 galvannealed products are not acceptable.
      a. Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authority having jurisdiction.

E. Steel Studs and Runners: ASTM C645.
   1. Non-Structural Studs.
   2. Cold-formed galvanized steel C-studs.
   3. Flange Size: 1-1/4″.
   4. Web Depth: As specified on Drawings.
   5. 25 ga equivalent drywall stud.
      a. 50 ksi.
      b. Minimum Base-Steel Thickness: 0.0150″.
      c. Minimum Design Thickness: 0.0158″.
   6. 20 ga equivalent drywall stud.
      a. 65 ksi.
      b. Minimum Base-Steel Thickness: 0.019″.
      c. Minimum Design Thickness: 0.020″.

F. Non-Structural Track: Cold-formed galvanized steel runner tracks in conformance with ASTM C 645 for conditions indicated below:
   1. Flange Size: 1-1/4″.
   2. Web Depth: Track web to match stud web size.
   3. Minimum Base-Steel Thickness: Track thickness to match wall stud thickness or as per design.

G. Slotted Deflection Track: Cold-formed galvanized steel in conformance with AISI's *North American Specifications for Design of Cold-Formed Steel Structural Members*.
   1. Designation and size as indicated on the Drawings.

H. Furring Channel: Cold-formed galvanized steel in conformance with AISI's *North American Specifications for Design of Cold-Formed Steel Structural Members*.
   1. Designation and size as indicated on the Drawings.

I. Bridging, bracing and backing:
   1. Pre-notched steel bridging bars.
   2. Galvanized steel flat straps.
   3. Fire-retardant treated wood blocking and bracing.

J. Fasteners
   1. Gypsum Board Screws: Comply with ASTM C646. Screws conforming to ASTM C1002. Bugle or pan head, and lengths as required for securing materials in place.
   2. Wood Framing and Backing: Type W.
   3. Light Gauge Metal Framing: Type S.
   4. 18 Gauge or Heavier Metal Framing: Type S-12.
   5. Pneumatic Fasteners:
      a. Minimum 0.100″ diameter.
      b. Length to penetrate minimum 1/4″ beyond steel stud framing.
      c. Aericote 1000 corrosion-resistant coating.

2.02 GYPSUM BOARD MANUFACTURERS

A. Celotex Building Products.

B. Certainteed.

C. Georgia Pacific.

D. National Gypsum Co.

E. United States Gypsum Co.

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 Gypsum Board:
1. ASTM C931/C931M.
2. Fire rated type 5/8″ thick, maximum available length.
3. Ends square cut, tapered edges.
4. Sag- and warp-resistant.
5. Gypsum board core w/water repellant face and back paper.

2.04 TILE BACKER BOARD OPTIONS

A. 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.

B. Cement Board 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″.
4. Width: 4′.
5. Length: 4′.
6. Edges: Tapered.
7. Compressive Strength: Not less than 2250 psi 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.

2.05 FASTENERS

A. Nails: 1-1/2″ long, hot dipped galvanized, and in accordance with FS FF-N-105B, Type 2, Style 20.

B. Self-Piercing Screws: Hi-Lo thread screws (No. 8) wafer head, corrosion-resistant, 1-1/4″ or 1-5/8″ long, complying with ASTM C 1002.

C. Gypsum Board Screws: Comply with ASTM C646.

2.06 TRIM ACCESSORIES

A. General: Provide manufacturer’s standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for

concealment of flanges in joint compound. Provide corner beads, L-type edge trim beads, U-type edge trim beads, special L-kerf-type edge trim beads, and one-piece control joint beads.

B. JOINT TREATMENT MATERIALS

C. General: ASTM C475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
1. Control Joints per ASTM C840-08 or GA-216.

D. Joint Tape:
1. Paper reinforcing tape for gypsum board.
2. 2″ wide 10x10 glass mesh tape for glass backer board.
3. Joint Treatment: Tape: Alkali-resistant fiberglass mesh tape intended for use with cement board.

E. 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.

F. 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.

2.07 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. Reinforcing Tape:
1. Toxicity/IEQ: Sheetrock Joint Tape. Paper; fiberglass joint tape not permitted.

C. Joint-Treatment Materials:
1. Toxicity/IEQ: Lime compound. All-purpose joint and texturing compound containing inert fillers and natural binders. Pre-mixed compounds shall be free of antifreeze, vinyl adhesives, preservatives, biocides, and other slow releasing compounds.

D. Wall Texture: Unagreggated texture coating designed for application over properly prepared interior surfaces.

2.08 CEILING SUSPENSION SYSTEMS

A. Commercial quality, cold-rolled steel, hot dipped galvanized finish.

B. Main Tees: Fire-Rated Heavy Duty classification 1.617″ high x 144″ long, integral reversible splice with knurled face.

C. Cross Members: Fire-Rated members with knurled face.

D. Cross Tees: Cross tee 1-1/2″ high x 48″ long with 1-1/2″ wide face.
1. Quick release cross tee ends for positive locking and removability without tools.
2. Accessory Cross Tees: Cross tees must have knurled faces and quick release cross tee ends for positive locking and removability without tools.

E. Wall Moldings: Single web with knurled face.

F. Accessories
1. Splice clips.
2. Transition clips.
3. Wall Attachment clips.
4. Splice plates.
5. Wire: Hanger wire 12 ga, galvanized or as noted on Drawings.

G. Wall-to-Wall Suspension Systems: Commercial quality, cold-rolled steel, hot dipped galvanized finish for use in corridors and short span applications.
1. Main Tees: Fire-Rated Heavy Duty classification 1.617″ high x length required, integral reversible splice with 1-1/2″ knurled face.
2. Wall Moldings: Single web with knurled face, 1-1/2″ x 1″ x 12′ long.
3. Wall Channel: Single web with knurled face, 1-5/8″ x 1″ x 12′ long.
4. Locking Wall Channel: Single web with knurled face, 1-3/4″ x 1″ x 12′ long.

PART 3 EXECUTION

3.01 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality:
1. Temporary ventilation: Provide temporary ventilation for work of this Section.
2. Multi-layer gypsum board: Screw attach. Adhesive attachment will not be permitted.

B. Select panel sizes and layout panels to minimize waste; reuse cutoffs to the greatest extent possible.
1. Scrap gypsum: Coordinate with Section 32 90 00 (02900) – Planting to identify requirements for gypsum soil amendment and to prepare scrap gypsum board for use as soil amendment. Do not use products containing glass fiber.

3.02 COORDINATION WITH OTHER WORK

A. General: Coordinate with other work including mechanical and electrical work and partition systems. Installation of conduit and ductwork above suspension system shall be complete before installation of suspension system.

3.03 ERECTION TOLERANCES

A. Maximum Variation from Indicated Position: 1/8″ in 10′.

B. Maximum Variation from Plumb: 1/8″ in 10′.

3.04 METAL PARTITION FRAMING INSTALLATION

A. Install cold-formed framing in accordance with requirements of ASTM C 754.

B. Align all partitions accurately according to the partition layout. Attach floor and ceiling runners 24′ oc to concrete slabs with concrete stub nails or power driven anchors.

C. Framing Installation:
1. Erect framing and panels plumb, level, and square in strict accordance with approved Drawings.
2. Handle and lift prefabricated panels in a manner to not cause distortion in any member.
3. Anchor runner track securely to the supporting structure. Install concrete anchors only after full compressive strength has been achieved.
4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or splice them together.
5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks.
6. Attach wall stud bridging when required in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.
7. Provided temporary bracing until erection is completed.
8. Where indicated in the Drawings, provide for structural vertical movement using means in accordance with manufacturer's recommendations.
9. Cut all framing components square for attachment to perpendicular members or as required for an angular fit against abutting members.
10. Anchor studs located adjacent to doors and window frames, partition intersections and corners to runner flanges by positive screw engagement with 3/8″ Type S, pan head screws through each stud flange and runner flanges. Stud splicing not permissible.
11. Fabricate corners using minimum of 3 studs.

3.05 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 United States Gypsum Company's *Gypsum Construction Handbook.*

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″ oc unless otherwise indicated.

F. Frame opening other than door openings to comply with details.

3.06 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.

3.07 INSTALLATION OF CEILING SUPPORT SYSTEMS

A. Standard Reference: Install grid members in accordance with ASTM C636, CISCA installation standards, and other applicable references.

B. Manufacturer's Reference: Install in accordance with manufacturer's current printed recommendations.

C. Drawing Reference: Install in accordance with approved Shop Drawings and locate ceiling in accordance with main tee dimensions relative to elevations.

D. Install in accordance with reference standards and manufacturer's instructions and as required to comply with seismic requirements.

E. In ceilings, spacing of hangers and channels is designed to support only the dead load. Independently support heavy concentrated load.

3.08 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 ft^2 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.

3.09 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.

3.10 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 curved or radius outside corner bead.
   2. Install L-type trim where work is tightly abutted to other work.

3.11 CONTROL JOINTS INSTALLATION

A. Place control joints consistent with lines of building spaces and per ASTM C840-08 or GA-216.
   1. Control joints shall be installed where indicated on the Drawings. Full height door frames shall be considered equivalent to a control joint.
   2. A control joint shall be installed where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the base building structure.
   3. Control joints shall be installed where a wall or partition runs in a uninterrupted straight plane exceeding 30 LF.
   4. Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50′ and total area between control joints does not exceed 2500 ft^2.
   5. Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30′ and total area between control joints does not exceed 900 ft^2.
   6. Control joints in exterior ceilings and soffits shall be installed so that linear dimensions between control joints do not exceed 30′ and total area between control joints does not exceed 900 ft^2.
   7. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
   8. Control joints shall be installed where specified by the Architect or Designer as a design accent or architectural feature.
   9. Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8″ type X gypsum board, mineral fiber, or other tested equivalent.

3.12 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.

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.

3.13 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:
1. For new construction, texture shall be an orange peel finish. Texture shall be to match existing contiguous construction.
2. Remove any texture droppings or overspray from door frames, windows, and other adjoining work.

3.14 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.

3.15 SCHEDULE

A. Refer to Drawings: Wall Type Schedule.

B. Provide a tile backer board option at walls scheduled on the Drawings for tiling.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Resilient wall base.
2. Resilient transitions and adaptors.

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 5 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 2 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°F air temperature at flooring installation area for minimum 2 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°F or more than 85°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/cm^2 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″ height coved base unless noted otherwise on the Drawings
9. Length: Coil 120′.
10. Gauge: 1/8″.
11. Color to be selected by A/E from manufacturer’s full range of colors.

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

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.
   1. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

B. Extent of painting work is indicated on Drawings and Schedules, and as herein specified.

C. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout Project, except as otherwise indicated.

D. 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.

E. 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.
   4. 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. 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.

G. 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. ASTM International:
1. ASTM D16 – Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
2. ASTM D4442 – Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
1. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Painting and Decorating Contractors of America:
1. *Architectural Painting Specification Manual*.

D. The Society for Protective Coatings (SSPC):
1. *Steel Structures Painting Manual*.

E. Underwriters Laboratories Inc.:
1. UL 723 – Tests for Surface Burning Characteristics of Building Materials.

F. National Association of Corrosion Engineers – NACE International (NACE).

1.03 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples:
1. For initial color selection.
2. For each color and sheen after selection of colors is made.

C. Coating Maintenance Manual: Upon completion of Project, furnish coating maintenance manual. Basis of Design: Sherwin Williams' *Custodian Project Color and Product Informatio*n report or equal.
1. Manual shall include an Area Summary with finish schedule, Area Detailing designating where each product/color/finish was used, product data pages, SDS

Sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.

1.04 QUALITY ASSURANCE

A. 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.

B. 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.

1.05 PRE-INSTALLATION MEETING

A. Schedule pre-installation meeting with Owner and A/E one week minimum prior to commencing work of this Section.

1.06 DELIVERY AND STORAGE

A. Delivery: Deliver materials to job site in original, new, and unopened packages and containers bearing manufacturer’s name and label and following information:
1. Name or title of material.
2. Fed. Spec. number, if applicable.
3. Manufacturer’s stock number and date of manufacture.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Cleaning instructions.
9. Color name and number.

B. Storage:
1. Store materials not in actual use in tightly covered containers.
2. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
3. Protect from freezing where necessary.
4. Keep storage area neat and orderly.
5. Remove oily rags and waste daily.
6. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50°F (10°C) and 90°F (32°C), unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F (7°C) and 95°F (35°C), unless otherwise permitted by paint manufacturer's printed instructions.

C. Do not paint in snow, rain, fog, or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.

D. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sherwin Williams Paints (Listed in Schedule).

B. Products by the following manufacturers may be substituted for scheduled products when equivalent in performance:
1. Dunn Edwards Paint Company.
2. Benjamin Moore.
3. Kwal-Howells.
4. ICI Paints.

2.02 COMPONENTS

A. Coatings: Ready-mixed, except field catalyzed coatings. Prepare coatings:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

2.03 MATERIALS

A. Material Quality:
1. Provide best quality grade of various types of coatings regularly manufactured by listed manufacturers.
2. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Color Pigments: Pure, no-fading, applicable types to suit substrates and service indicated.

PART 3 EXECUTION

3.01 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of Work.

B. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

C. Starting of painting work will be construed as Applicator’s acceptance of surfaces and conditions within any particular area.

D. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 GENERAL PREPARATION

A. Product label directions must be read and followed.

B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition. Clean surfaces before applying paint or surface treatments.
1. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

C. When using a commercially available solvent or cleaner, observe recommended precautions:
1. Follow all manufacturers' specifications for product use and preparation.
2. Test cleaning materials on an isolated or hidden area to determine that the desired result is achieved and that no damage or discoloration occurs as a result of the product's use.
3. Do not mix chemical compounds. Some cleaners may react with other solutions, creating toxic or poisonous vapors.
4. Remove cleaners thoroughly.
5. When working with toxic or caustic substances, wear protective clothing and gear as recommended by the substance manufacturer.
6. Use the proper tools for the cleaning job at hand, and use these tools in a safe and proper manner.

D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

E. Surfaces must be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint, or other contamination to ensure good adhesion.
   1. Provide barrier coats over incompatible primers or remove and reprime as required. Notify A/E in writing of any anticipated problems in using specified coating systems with substrates primed by others.

F. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply the solution and scrub the mildewed area. Allow the solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow the surface to dry 48 hours before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing, and follow all precautions as listed on the cleaning product label. Quickly wash off any of the mixture that comes in contact with skin. Do not add detergents or ammonia to the bleach/water solution.

G. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place that are not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Following completion of painting of each space or area, reinstall removed items.

3.03 SUBSTRATE PREPARATION

A. Follow the required preparation method identified in the manufacturer's product data sheet and the recommended SSPC surface preparation method.

B. Aluminum: Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP1 – Solvent Cleaning.

C. Asbestos Siding: Remove all dust and dirt. If siding has weathered and become porous, treat with masonry conditioner.

D. CMU: 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. Cure concrete and mortar at least 30 days at 75°F. The pH of the surface should be between 6 and 9. On tilt-up and poured-in-place concrete, commercial detergents and abrasive blasting may be necessary to prepare the surface. Fill bug holes, air pockets, and other voids with a cement-patching compound.

E. Brick: Must be free of dirt, loose and excess mortar, and foreign material. Allow brick to weather for at least one year, followed by wire brushing to remove efflorescence. Treat the bare brick with one coat of Loxon Exterior Acrylic Masonry Primer.

F. 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. 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. 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.

G. Cement Composition Siding/Panels: Remove all surface contamination by washing with an appropriate cleaner, rinse thoroughly and allow to dry. Scrape and sand existing peeled or checked paint to a sound surface. Pressure-clean, if needed, with a minimum of 2100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow the surface to dry thoroughly. If the surface is new, test it for pH; many times the pH may be 10 or higher.

H. Copper: Remove all oil, grease, dirt, oxide, and other foreign material by cleaning per SSPC-SP2 – Hand Tool Cleaning.

I. Drywall—Interior and Exterior: Must be clean and dry. Set and spackle nail heads. Tape and cover joints with a joint compound. Sand spackled nail heads and tape joints smooth, and remove dust prior to painting. Spackle exterior surfaces with exterior grade compounds.

J. Exterior Composition Board (Hardboard): Some composition boards may exude a waxy material that must be removed with a solvent prior to coating. Whether factory primed or unprimed, exterior composition board siding (hardboard), clean thoroughly and prime with an alkyd primer.

K. Galvanized Metal: First, Solvent Clean per SSPC-SP1 and 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.

L. Plaster: Allow to dry thoroughly for at least 30 days before painting. Ventilate rooms while drying; heat rooms in cold, damp weather. Repair damaged areas with an appropriate patching material. Allow bare plaster to cure and harden. Treat textured, soft, porous, or powdery plaster with a solution of 1-pint household vinegar to 1 gallon of water. Repeat until the surface is hard; rinse with clear water and allow to dry.

M. Previously Coated Surfaces: Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting; however, remove all surface contamination such as oil, grease, loose paint, mill scale dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers to assure sound bonding to the tightly adhering old paint. Clean and dull glossy surfaces of old paint films before repainting. Fill and sand surface irregularities smooth. Thoroughly wash with an

abrasive cleanser to clean and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 ft^2. Allow to dry one week before testing adhesion per ASTM D3359. If the coating system is incompatible, complete removal is required (per ASTM 4259, see Concrete).

N. Steel—Structural, Plate, etc.: Clean by one or more of the nine surface preparations described below. These methods were originally established by the Steel Structures Council in 1952 and are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Steel Structures Painting Council, SSPC-VIS 1-89. 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. Provide ventilation as recommended by the Solvent manufacturer.
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 this process remove adherent mill scale, rust, and paint. 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 this process remove adherent mill scale, rust, and paint. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP 1.
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, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1 or other method proposed by the installer and agreed upon by the A/E.
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% 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, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP 1 or other method proposed by the installer and agreed upon by the A/E.
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, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP 1 or other method proposed by the installer and agreed upon by the A/E.

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 method proposed by the installer and agreed upon by the A/E.
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% 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, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1 or other method proposed by the installer and agreed upon by the A/E.
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.

O. Water Blasting, NACE Standard RP-01-72: Remove 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.

P. Stucco: Clean and remove loose stucco. If recommended procedures for applying stucco are followed and normal drying conditions prevail, the surface may be painted in 30 days. The pH of the surface should be between 6 and 9.

Q. Wood—Exterior: Must be clean and dry. Prime and paint as soon as possible. Scrape, sand, and spot-prime knots and pitch streaks before full priming coat is applied. Patch all nail holes and imperfections with a wood filler or putty and sand smooth. Apply caulk after priming.

R. Wood—Interior: Store finishing lumber and flooring in dry, warm rooms to prevent absorption of moisture, shrinkage, and roughening of the wood. Sand surfaces smooth with the grain, never across it. Correct surface blemishes and clean area of dust before coating.

S. Vinyl Siding: Clean vinyl siding thoroughly by scrubbing with a warm, soapy water solution. Rinse thoroughly.

3.04 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application.
1. Do not stir surface film into material.
2. Remove film and, if necessary, strain material before using.

3.05 APPLICATION

A. General:
1. Apply paint in accordance with manufacturer's directions.
2. Use applicators and techniques best suited for substrate and type of material being applied.
3. Provide finish coats which are compatible with prime paints used.
4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance.
    a. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Do not paint surfaces behind permanently-fixed equipment or furniture.
6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, not-specular black paint.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges same as exterior faces, unless otherwise indicated.
9. Sand lightly between each succeeding enamel or varnish coat.
10. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:
1. Apply first-coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness:
1. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

D. Prime Coats:
1. Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Pigmented (Opaque) Finishes:
1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

F. Transparent (Clear) Finish:
1. Use multiple coats to produce glass-smooth surface film of even luster.
2. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
3. Provide satin finish for final coats.

G. Completed Work:
1. Match approved samples for color, texture, and coverage.
2. Remove, refinish, or repaint work not in compliance with specified requirements.

3.06 CLEANUP AND PROTECTION

A. Cleanup:
1. During progress of Work, remove from site discarded paint materials, rubbish, cans, and rags at end of each work day.
2. Upon completion of painting work, clean window glass and other paint-spattered surfaces.
   a. Remove spattered paint by proper methods of washing and scraping.
   b. Use care not to scratch or otherwise damage finished surfaces.

B. Protection:
1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work.

2. Correct any damage by cleaning, repairing, or replacing, and repainting, as acceptable to A/E.
3. Provide “Wet Paint” signs as required to protect newly painted finishes.
4. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
5. At completion of Work of other trades, touch-up and restore all damaged or defaced painted surfaces.

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 PAINT SCHEDULE

A. Concrete - Concrete Slabs, Patios, Porches, Steps and Platforms:
1. First Coat:
   a. Okon Seal and Finish, Horizontal Concrete and Masonry Sealer.
2. Second Coat:
   a. Okon Seal and Finish, Horizontal Concrete and Masonry Sealer.

B. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
   1. Prime Coat:
      a. Primer, water-based, anti-corrosive for metal: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry or shop primer specified in Section where substrate is specified.
   2. Intermediate Coat:
      a. Light industrial coating, exterior, water based, matching topcoat.
   3. Topcoat:
      a. Light industrial coating, exterior, water based, semi-gloss: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

C. Wood Substrates:
   1. Prime Coat:
      a. Primer, latex for exterior wood.
   2. Intermediate Coat:
      a. Latex, exterior, matching topcoat.
   3. Topcoat: Latex, Exterior, Semi-Gloss:
      a. S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

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, Colorado 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, alkalis, 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-plus-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. Provide signs for all rooms.

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-E84for 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. Construction Specialties, Inc., Muncy, Pa..

B. Alternate manufacturers when submitted in accordance with Section 01 60 00 – Substitution Procedures.

2.02 MATERIALS

A. Vinyl/Acrylic: Extruded material should be high impact Acrovyn with pebblette grain texture, nominal .078" thickness. Chemical and stain resistance should be per ASTM D-1308 standards as established by the manufacturer. Colors to be indicated in the finish schedule from one of manufacturer's standard color range.

B. Aluminum Retainers: Extruded aluminum retainers should be 6063-T6 alloy, nominal .094" thickness. Minimum strength and durability properties as specified in ASTM B221.

C. 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, 90° Rounded Corner: 1.5″ by 1.5″ legs with tapered wings, 4′ tall, adhered corner guard. Install above 4″ rubber base, then install 6″ AFF. Provide 4 at Gypsum board outside corners in apparatus bay.

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 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′ 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. Globe valves.
7. Ball valves.
8. Butterfly valves.
9. Check valves.
10. Pipe hangers and supports.
11. Pressure gages.
12. Pressure gage taps.
13. Thermometers.
14. Flow control valves.
15. Relief valves.
16. Strainers.
17. Recessed valve box.
18. Underground pipe markers.
19. 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 3 years' experience and with service facilities within 500 miles of Project.

C. Installer: Company specializing in performing Work of this Section with 3 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% lead in solder and solder flux, and no more than 8% 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′ 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°F to 1480°F.
   3. Protective pipe covering must be factory- or field-applied according to manufacturer's written instructions.
      a. 2-1/2″ 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 1″ overlap required.
      b. 2″ and Smaller: Products must be 27 MIL plastic sleeve-protector. LSP® Products Group, Plasti-Sleeve or equivalent.

B. PVC Pipe: ASTM D1785, Schedule 80 or ASTM D2241, SDR-26 for 160 psig pressure rating.
   1. Fittings: ASTM D2467, Schedule 80, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

C. PVC Pipe: AWWA C900 Class 100.
   1. Fittings: AWWA C110, ductile iron, standard thickness.
   2. Joints: ASTM D3139 compression gasket ring.

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. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.
   1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
   2. Joints: Threaded for pipe 2″ and smaller; flanged for pipe 2-1/2″ and larger.

B. 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.

C. 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.

D. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.04 UNIONS, FLANGES and REDUCERS

A. Unions for Pipe 2″ 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″ 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″ 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 2 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″ 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. 2-1/2″ 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 GLOBE VALVES

A. 2″ and Smaller: Class 125, screwed ends, bronze body, inside screw, screw-in bonnet, renewable seat and disc. NIBCO T-211 or equivalent.

B. 2-1/2″ and Larger: Class 125, iron body conforming to ASTM A126 Class B, bronze trim, flanged ends, bolted bonnet, bronze disc, replaceable seats. NIBCO F-718-B or equivalent.

2.07 BALL VALVES

A. 2″ 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. 2-1/2″ to 3″: 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″ 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.

2.08 BUTTERFLY VALVES

A. 2-1/2″ through 6″: 200 psi working pressure, ductile iron body, aluminum / bronze disc, stainless steel shaft, resilient seat, O-ring seals, lug type for dead-end service, lever operator. NIBCO LD2000 series.

B. 8″ and Larger: 150 or 200 working pressure, ductile iron body, aluminum / bronze disc, stainless steel shaft, resilient seat, O-ring seals, lug type for dead-end service, gear operator. NIBCO LD1000 or LD2000 series dependent on the application.

2.09 CHECK VALVES

A. 2″ 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. 2-1/2″ 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″ and Smaller: Class 125, threaded ends, bronze body, spring actuated, inline vertical lift type, TFE seat ring. NIBCO T-480-Y or equivalent.

2.10 PIPE HANGERS AND SUPPORTS

A. See Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

2.11 PRESSURE GAGES

A. Gage: ASME B40.1, UL 404 with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
1. Case: Steel.
2. Bourdon Tube: Brass.
3. Dial Size: 4-1/2″ diameter.
4. Mid-Scale Accuracy: 1%.
5. Scale: Psi.
6. Model 1220 as manufactured by Ashcroft or equivalent.

2.12 PRESSURE GAGE TAPS

A. Needle Valve: 1″ and Smaller: Rated at 600 psi and 300°F, positive shut-off for gauges, brass. Weiss Instruments 25 Needle Valve Brass or equivalent.

B. Ball Valve: Brass 1/8″ NPT or 1/4″ NPT for 250 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4″ NPT connections.

2.13 STEM TYPE THERMOMETERS

A. Thermometer: ASTM E1, red-appearing mercury, lens front tube, cast aluminum case with enamel finish.
1. Size: 7″ scale.
2. Window: Clear glass.
3. Stem: Brass, 3/4″ NPT, 3-1/2″ long.
4. Accuracy: 2%.
5. Calibration: Degrees F.
6. Model EL by Ashcroft or equivalent.

B. Thermometer: ASTM E1, adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.
1. Size: 7″ scale.
2. Window: Clear glass.

3. Stem: Brass, 3/4″ NPT, 3-1/2″ long.
4. Accuracy: 2%.
5. Calibration: Degrees F.

2.14 FLOW CONTROL VALVES

A. Construction: Class 125 Brass or bronze body with union on inlet temperature and pressure test plug on inlet.

B. Calibration: Control flow within 5% of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

2.15 RELIEF VALVES

A. Pressure Relief:
1. ANSI Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
2. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi UL listed for fuel oil, capacities ASME certified and labeled.

B. Temperature and Pressure Relief:
1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210°F capacity ASME certified and labeled.

2.16 STRAINERS

A. 2″ and Smaller: Threaded ends, cast bronze body with screwed cap, and 20-mesh 304 stainless steel screen for water service. Watts series 777S.

B. 2-1/2″ and Larger: Flanged ends, cast iron body and bolted cap, 20-mesh stainless steel screen for water service. Watts series 77-DI-125.

2.17 RECESSED VALVE BOX

A. Washing Machine: Plastic preformed rough-in box with brass valves with single-lever handle, socket for 2″ waste, slip-in finishing cover.

B. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle slip in finishing cover.

2.18 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6″ wide by 4 mil thick, manufactured for direct burial service.

2.19 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 31 23 33 – Excavation and Fill for Site Work.

B. Cover: Fill Type as specified in Section 31 23 33.

C. Soil Backfill from Above Pipe to Finish Grade: Soil 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. Thermometers and Gages:
1. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
2. Install gage taps in piping.
3. Install pressure gages with pulsation dampers. Provide needle valve to isolate each gage.
4. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2″ for installation of thermometer sockets. Allow clearance from insulation.
5. Provide instruments with scale ranges selected according to service with largest appropriate scale.
6. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45° off vertical.
7. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

B. Hangers and Supports:
1. Install hangers and supports according to Section 22 05 29 – Hangers and Supports.

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 1′ 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″ compacted depth; compact to 95% 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 shutoff valves at locations indicated on Drawings according to this Section.
11. Install plastic ribbon tape continuous buried 6″ below finish grade, above pipeline; coordinate with Section 31 23 33. Refer to Section 22 05 53 – Identification for Plumbing Piping and Equipment.
12. Pipe Cover and Backfilling:
13. Backfill trench according to Section 31 23 33.
14. Maintain optimum moisture content of fill material to attain required compaction density.
15. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6″ compacted layers to 6″ minimum cover over top of jacket. Compact to 95% maximum density.
16. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
17. 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 – Plumbing Insulation.
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 – Painting and Coating.
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 – Hangers and Supports for Plumbing Piping and Equipment.
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. Install globe valves for throttling, bypass, or manual flow control services.
19. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
20. Provide spring-loaded check valves on discharge of water pumps.
21. Provide flow controls in water circulating systems as indicated on Drawings.
22. 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.
23. Pipe relief from valves, back-flow preventers and drains to nearest floor drain or as shown on Drawings.
24. Test backflow preventers according to CSA B64.4or CSA B64.4.1 OR as directed by facility maintenance.
25. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping as shown on Drawings.
26. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4″ minimum, and minimum 18″ long.
27. 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.
28. 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 at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
2. Install long-radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For

close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4″ and over.

3. Install pumps on vibration isolators.
4. Install flexible connectors at or near pumps.
5. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4″ and larger.
6. Provide air cock and drain connection on horizontal pump casings.
7. Provide drains for bases and seals.
8. Check, align, and certify alignment of base mounted pumps prior to startup.
9. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 30 00 – Cast-in-Place Concrete.
10. Lubricate pumps before startup.

F. Service Connections:

1. Provide new water service complete with approved reduced pressure back-flow preventer.
2. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
3. Provide 18 gage galvanized sheet metal sleeve around service main to 6″ above floor and 6″ minimum below grade. Size for minimum of 2″ of loose batt insulation stuffing.

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 2-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% 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% 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 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, and
11. Equipment bases and supports.

1.02 SYSTEM DESCRIPTION

A. Firestopping Materials: To achieve fire ratings as noted on Drawings for adjacent construction, but not less than one 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.

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: Manufacturers catalog data including load capacity.

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 3 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°F.

B. Maintain this minimum temperature before, during, and for minimum 3 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 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″: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2″ 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″ and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4″ 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/ft^2 sheet lead.
2. Soundproofing: 1 lb/ft^2 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″ 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″ 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″ space between finished covering and adjacent Work.
4. Place hangers within 12″ of each horizontal elbow.
5. Use hangers with 1-1/2″ 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.
13. Refer to manufacturer’s recommendations for grooved end piping systems.

C. Equipment Bases and Supports:
1. Provide housekeeping pads of concrete, minimum 4″ thick and extending 6″ 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″ minimum high above roofing surface. Flash and counterflash 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″ 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.

3.04 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE (Inches)	COPPER TUBING MAXIMUM HANGER SPACING (Feet)	STEEL PIPE MAXIMUM HANGER SPACING (Feet)	COPPER TUBING HANGER ROD DIAMETER (Inches)	STEEL PIPE HANGER ROD DIAMETERS (Inches)
1/2	6	6	3/8	3/8
3/4	6	8	3/8	3/8
1	6	8	3/8	3/8
1-1/4	6	10	3/8	3/8
1-1/2	6	10	3/8	3/8
2	10	10	3/8	3/8
2-1/2	10	10	1/2	1/2
3	10	10	1/2	1/2
4	10	10	5/8	5/8
5	10	10	5/8	5/8
6	10	10	3/4	3/4
8	10	10	7/8	7/8
10	10	10	7/8	7/8
12	10	10	7/8	7/8
14	10	10	1	1
16	10	10	1	1
18	10	10	1-1/4	1-1/4
20	10	10	1-1/4	1-1/4
24	10	10	1-1/4	1-1/4

B. Plastic Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING (Feet)	HANGER ROD DIAMETER (Inches)
CPVC 1″ OR SMALLER (Note 1)	3	3/8
CPVC 1-1/4″ OR LARGER (Note 1)	4	3/8 up to 4 1/2 5 through 8 5/8 10 through 12
FRP (All Sizes) (Note 1)	4	3/8 up to 4 1/2 5 through 8 5/8 10 through 12
PVC (All Sizes) (Note 1)	4	3/8 up to 4 1/2 5 through 8 5/8 10 through 12

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. Include reduced-scale Drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.03 QUALITY ASSURANCE

A. Testing, Adjusting, Balancing (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, 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 ±5% of design for supply systems and ±10% of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust to within ±10% 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% 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. Measure building static pressure and adjust supply, return, and exhaust air systems to airflows indicated on Drawings.

K. Adjust air quantities for multi-zone units with mixing dampers set first for cooling, then heating, then modulating.

L. 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.

M. On fan-powered VAV boxes, adjust airflow switches for proper operation.

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 11 23

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Polyethylene piping below grade,
2. Anodeless riser,
3. Transition fitting,
4. Natural gas piping above grade,
5. Regulator vent piping,
6. Unions and flanges,
7. Ball valves,
8. Plug valves,
9. Pipe hangers and supports,
10. Natural gas pressure regulators,
11. Gas meters,
12. Appliance connectors,
13. Underground pipe markers, and
14. 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, fittings, and accessories. Submit manufacturers catalog information.
2. Valves: Manufacturers catalog information with valve data and ratings for each service.

1.04 QUALITY ASSURANCE

A. Perform Natural 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 3 years' experience.

F. Installer: Company specializing in performing work of this Section with 3 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 NATURAL 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 D2513, 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″ and less, Grade B for 2″ 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 (Drisopipe 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″ and less, Grade B for 2″ and larger. The mechanical joint shall be provided with a tamper proof, gas tight connection, and seal per ASTM D2513, Category 1.

2.04 NATURAL 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″ and Smaller:
      a. Class 150, banded malleable iron, screwed, ASME B16.3. Galvanized fittings shall be hot dipped in accordance ASTM A153.
   2. Fittings: 2-1/2″ and Larger:
      a. Class 150, Schedule 40 wrought steel butt-weld fittings, ASME B16.9.
   3. Joints: Threaded for pipe 2″ and smaller; welded for pipe 2-1/2″ 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″ and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.

B. Flanges for Pipe 2-1/2″ 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″ 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″-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″ 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, 2-1/2″ 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, 2-1/2″ 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″: Malleable iron Carbon steel, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2″ 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″ 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/ft^2 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 lbs 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 NATURAL GAS REGULATOR

A. Natural gas regulator shall be furnished and installed with the gas meter. Coordinate with local gas company and conform to their requirements. Set for the required gas leaving pressure shown on the Drawings.

2.11 GAS METERS

A. Natural gas meters shall be furnished and installed by the natural gas utility company. All required permits and fees shall be secured and paid for by the Contractor. Gas meter shall be the type and capacity required for the application and shall be located as indicated on the Drawings and in accordance with utility company requirements.

B. All-natural gas meters shall be preceded by a main gas supply shut-off valve serviceable and accessible outside the building.

2.12 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.

2.13 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Brightly colored, continuously printed, minimum 6″ wide by 4 mil thick, manufactured for direct burial service.

2.14 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Section 31 23 33 – Trenching and Backfilling.

B. Cover: Fill Type as specified in Section 31 23 33 – Trenching and Backfilling. 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″ 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 natural 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′ 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 – Trenching and Backfilling. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4″ compacted depth; compact to 95% 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 – Trenching and Backfilling.
    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″ compacted layers to 24″ minimum cover over top of jacket. Compact to 95% 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 natural 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 Plumbing 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 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 and 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″.

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 allow conductors.

B. Conductor: Aluminum.

C. NEC Type: XHHW-2.

D. Wire Size: #6 to 1000 kcmil.

2.03 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.

2.04 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. 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, M394l-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 4 by 4 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.

3.05 GROUNDING CONDUCTORS

A. Grounding Electrodes/Grounding Electrode Conductors: Bare copper.

B. Equipment Grounding Conductors: Insulated as required in Paragraph 2.01, or as part of a cable. Bare copper where shown thus on the Drawings.

3.06 SCHEDULE (NOT USED)

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″ 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″.
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 12″ diameter by 10″ 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 10″ diameter by 12″ 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 12″ diameter by 10″ 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 1/2″ 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″ below finished grade.
   2. Where access box is not installed, drive rod so top is 24″ 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 1/2″ 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 1″ high letters.

C. Where an access box is surrounded by asphalt, pour a 20″ by 6″ by 12″ deep concrete marker in a nearby non-traffic area with the legend "GND BOX ?? FT" and an arrow pointing to the box, minimum 1″ high characters.

D. Where an access box is surrounded by dirt, pour a 6″ by 6″ by 12″ deep concrete marker adjacent to it. Stamp the legend "GND" into the concrete, minimum 1″ 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.

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 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°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.

2.03 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.

2.04 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.

2.05 LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

A. Meet NEC 350.

B. Listed/labeled under UL 360 for use in ambient temperatures from –30°C to +80°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.

2.06 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°C, dry; +60°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.

2.07 OTHER CONDUITS

A. Meet requirements of appropriate NEC article and applicable UL standard.

B. Use only after specific written approval of the Engineer.

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.

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. 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.

P. Requirements where conduits enter/exit a structure/building below grade:
1. Do not run conduits in/through footings.
2. Bury conduits larger than 2″ trade size minimum 12″ below the bottom of the footing.
3. Fewer than 5 conduits of 2″ 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″ 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.

Q. Expansion Joints: Where conduit spans building expansion joints or in long duct runs, use expansion fittings and bonding jumpers.

3.03 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. 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″ or greater. Elbows may be RTRC or PVC RMC.

C. EMT:
1. Use only where shown in the matrix of conduit usage.

D. 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″ except:
    a. For connection of lay-in luminaries.
    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 luminaries.
6. Use FMC for connections to adjustable equipment and devices in air ducts or plenums.

E. 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.

F. 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′ 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.

3.04 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″.
3. HID pole lighting circuits: 1″.
4. 120/208/240V receptacle circuits:
5. Last receptacle in run: 1/2″.
6. Other runs: 3/4″.
7. 120/208/240V branch circuits to a single load: 1/2″.
8. 208/240V feeders: 3/4″.
9. 480V circuits: 3/4″.
10. 120VAC control circuits: 1/2″ minimum: 3/4″ for 10 to 20 #14; 1″ minimum for more than 20 #14, then by NEC.
11. Shielded or coaxial cable: 3/4″.
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″.

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 400 Amps or greater.
   h. Equipment greater than 600V.
   i. Equipment with interrupt rating greater than 22kAIC.
2. 3/8″ 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 400 Amps.
   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: 1/4″ 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 following paragraphs.

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″ for:
   a. 100 amp, single phase, flush mounted.
   b. 100 amp, 208Y/120 volt, three phase, flush mounted.
2. 20″ 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/120V and 120/240V single phase panelboards: Provide 100% neutral bar with a screw for each pole unless shown otherwise on the Drawings or Schedules.
2. 480Y/277V panelboards which are used as service equipment: Provide 100% neutral bar.
3. 480Y/277V panelboards which power 277V loads, such as site lighting and UV systems, and elsewhere required on the Drawings: Provide 100% neutral bar with a screw for each pole.
4. 480V panelboards which power no 277V 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/120V and 120/240V 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/120V and 120/240V single phase panelboards rated greater than 100A and all flush mounted 480V 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% 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″ centerline above finished floor unless shown otherwise on the Drawings.

B. Indoors: Mount duplex receptacles at 18″ centerline above finished floor, unless shown otherwise on the Drawings.

C. Outdoors and In Areas Considered Wet Location: Mount duplex receptacles at 30″ 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″ 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″ 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°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% 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% 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′ 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′ 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.

Voltage	Type	L-N	L-G	N-G	L-L	In	SCCR	MCOV
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″. 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° 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 – General Requirements 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 – General Requirements 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 barrow 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 Section 01 31 00 – Project Management and 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″ 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% passing a 1-1/2″ sieve and not more than 8% passing a No. 200 sieve.

F. Engineered Fill: Subbase or base materials.

G. Bedding Material: Subbase or base materials with 100% passing a 1″ sieve and not more than 8% 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% passing a 1-1/2″ sieve and not more than 5% passing a No. 8 sieve.

I. Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100% passing a 1-1/2″ sieve and 0% to 5% 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″ 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″ 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″ 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 lbs.
b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.
c. Permeability (ASTM D 4491): 150 gal/minute/ft^2.

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 ±1.2″. 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 8″ 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″ higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12″ 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″ 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″ or larger in nominal diameter, shape bottom of trench to support bottom 90° of pipe circumference. Fill depressions with tamped sand backfill.

3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6″ 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″ of footings. Place concrete to level of bottom of footings.

C. Provide 4″ thick concrete base slab support for piping or conduit less than 30″ below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4″ 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″, to a height of 12″ 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″ below finished grade, except 6″ 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% 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″ in loose depth for material compacted by heavy compaction equipment, and not more than 4″ 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″ below subgrade and each layer of backfill or fill material at 95% maximum dry density.
2. Under walkways, compact the top 6″ below subgrade and each layer of backfill or fill material at 95% maximum dry density.
3. Under lawn or unpaved areas, and non-structural areas compact the top 6″ below subgrade and each layer of backfill or fill material at 90% 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: ±1.2″.
2. Walks: ±1.2″.
3. Pavements: ±1/2″.

C. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2″ when tested with a 10′ 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% 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″ or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6″, place materials in equal layers, with no layer more than 6″ thick or less than 3″ thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12″ 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 ft^2. 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′ 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′ 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. Protection of existing trees.
   2. Removal of trees and other vegetation.
   3. Topsoil stripping.
   4. Clearing and grubbing.
   5. Removing above-grade improvements.
   6. 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. Protection of Existing Trees and Vegetation:
   1. Protect existing trees and other vegetation indicated to remain in place against unnecessary:
      a. Cutting.
      b. Breaking or skinning of roots.
      c. Skinning and bruising of bark.
      d. Smothering by stockpiling construction materials or excavated materials within drip line.
      e. Excess foot or vehicular traffic.
      f. Parking of vehicles within drip line.
   2. Provide temporary guards to protect trees and vegetation to be left standing.

3. Water trees and other vegetation to remain within limits of construction area as required to maintain plant health during the course of the construction operations.
4. Provide protection for roots over 1-1/2″ diameter cut during construction operations. Coat cut faces with emulsified asphalt or other acceptable coating formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
5. Repair or replace trees and vegetation indicated to remain which have been damaged by construction operations, in a manner acceptable to the A/E. Employ a licensed arborist to repair damaged trees and shrubs.
6. Replace trees which cannot be repaired and restored to full-growth status as determined by arborist.

D. Improvements on Adjoining Property: Authority for performing removal and alteration work on property adjoining Owner's property will be obtained by the Owner prior to award of the contract.
1. Extent of work on adjacent property is indicated on the Drawings.

E. 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″ 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 22 00

GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. This work shall consist of shaping roadbeds and side ditches to subgrade preparation to the depths indicated on the Drawings.

1.02 REFERENCE STANDARDS

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/ft^3 (2,700 kN-m/m^3)).
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 will provide material testing for quality control during earthwork operations.

1.04 JOB CONDITIONS

A. Do not construct embankments when atmospheric temperature is below 35^{o}F.

PART 2 PRODUCTS

2.01 BORROW

A. Borrow shall consist of materials obtained from approved borrow areas designated by the Engineer for the construction of embankments.

B. Provide free of vegetation.

2.02 WASTE

A. Disposal of excess excavation shall be the responsibility of the Contractor. Excess material to be placed in location reviewed by Engineer.

2.03 EXCAVATION

A. Includes excavation, removal, backfill, and satisfactory disposal of all materials encountered in the work.

2.04 EMBANKMENT

A. Embankment construction shall consist of the formation of embankments with suitable material from on-site excavation.

PART 3 EXECUTION

3.01 GENERAL

A. Excavation and embankments for the roads shall be finished to the contours, shapes, dimensions, and elevations shown on the Drawings.

B. No materials shall be wasted without permission from the Engineer.

C. Perform clearing operations prior to beginning excavation, grading, and embankment operations.

3.02 SUBGRADE PREPARATION

A. See Section 31 23 13 – Subgrade Preparation.

3.03 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 1/2″ as measured by a 10′ straightedge.

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 excavations promptly.

3.04 EMBANKMENT

A. Embankments shall meet the compaction requirements specified in Paragraph 3.05.

B. No frozen material, brush, sod, or unsuitable material shall be placed in the embankments.

C. In the distribution of embankment material, avoid lenses differing substantially from the surrounding material.

D. Deliver materials to the embankment in such a manner as to result in a well and uniformly compacted embankment.

3.05 EMBANKMENT AND BACKFILL COMPACTION

A. General:
1. Compact in 8″ loose horizontal layers.
2. Use moistened material when necessary.
3. Layers shall be uniformly compacted before a succeeding layer is placed.
4. Add water in sufficient quantity to obtain the specified compaction.
5. Do not allow free water to stand on an embankment surface.
6. Compaction shall be accomplished by approved methods and equipment.

B. Degree of Compaction:
1. Optimum density will be determined in accordance with ASTM D1557.
2. Perform compaction as follows:

Description	Percent of Maximum Dry Density to Be Not Less Than	Variation of Optimum Moisture
Embankment and backfill under roads, lift station, or where otherwise scheduled.	95	+2
General area grading not included in the above.	90	+2

3.06 FIELD QUALITY CONTROL

A. Field control of density of in-place material will be determined in accordance with any of the following methods:
1. Nuclear Method, ASTM D6938.
2. Rubber-Balloon Method, ASTM D2167.
3. Sand-Cone Method, ASTM D1556.

B. Field control of moisture content will be determined in accordance with either of the following methods:
1. Nuclear Method, ASTM D6938.
2. Laboratory Determination, ASTM D2216.

C. In-place density and moisture tests to be taken at intervals to be determined by the Engineer.

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. Precast Utility Structure Excavation, Filling, and Backfilling.

C. Compaction of Fill and Backfill.

D. Finish Grading.

1.02 RELATED WORK

A. Section 31 23 00 – Excavation, Backfill, and Compaction 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/ft^3 (2,700 kN-m/m^3)).

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

Area	Type of Material	Degree of Compaction
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/ft^3 (2,700 kN-m/m^3)).
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 A/E 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 A/E.

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 ±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 1/2″ as measured by a 10′ 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′.
2. At locations designated by the A/E.

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/ft^3 (2,700 kN-m/m^3)).

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 00 – Submittal Procedures:
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″ 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: see Section 03 30 00 – Cast-in-Place Concrete.

B. Initial Backfill Materials:
1. Initial backfill material is that material placed above the bedding material, around and over the pipe to 12″ 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″ 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:
1. Haul and dispose of all debris, rubbish, vegetation, broken concrete, broken asphaltic concrete, rocks, and other material to be removed.
2. Properly dispose of material in accordance with applicable state and federal regulations.
3. Burning of debris and rubbish will not be permitted on the project site.

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:

Pipe Size	Minimum Trench Width	Minimum Clearance	Maximum Trench Width at Top of Pipe
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% 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% ASTM D1557 compaction.
2. Top 12″ below subgrade, 95% ASTM D1557 compaction.

G. Unpaved Traveled Areas and Treatment Plant/Pump Station Sites:
1. 90% ASTM D1557 compaction.

H. Untraveled Areas: Compacted to at least undisturbed natural density but not less than 85% 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 LF of trench in traveled areas.

D. Minimum of one field density test for each compacted layer of trench backfill for each 500 LF 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:

Pipe Diameter	Trench Depth To Top of Pipe	Bedding Class
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.

3.13 PIPE MARKING SCHEDULE

A. Identification Tape: Potable Water, Power, Sanitary, Communication, and Gas.

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 00 – Submittal Procedures:
   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% as determined by AASHTO T 96.
3. Soundness loss of not more than 21%, as determined by AASHTO T 104.
4. Freeze thaw loss of not more than 10% 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 following Table.
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″, with securing pins inserted through both layers at no greater than 2′ 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″ 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″ per foot of depth. When the required riprap is 20″ 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/yd^2 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′ straightedge, shall not contain irregularities in excess of 1/4″.

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% passing a 1-1/2″ sieve and not more than 8% 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 yd^2, 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 yd^2 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 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. 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 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 17 23.13

PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Painted pavement striping and marking.

1.02 REFERENCES

A. Federal Specifications:
1. FS TT-P-1952, Paint, Traffic, and Airfield Marking, Waterborne.

1.03 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures:
1. Paint: Product data, performance characteristics, application procedures, and MSDS data.

PART 2 PRODUCTS

2.01 MATERIALS

A. Striping Paint – for asphalt less than one year old, or concrete free of sealers and efflorescence:
1. Composition Type: One component, water-based acrylic latex polymer.
2. VOC, ASTM D3960, excluding water: 0.79 lbs/gallon.
3. Total Solids: 70% solids by weight minimum.
4. Colors Available: White and lead-free yellow.
5. No Pickup Dry Time, ASTM D711: 45 minutes at 50% RH.
6. Reflective Option: Glass beads can be dropped on surface while paint is still wet.
7. Recommended Spreading Rate at 7.5 mils DFT: Approximately 320 LF of 4″ stripe per gallon.
8. Manufacturer: Sherwin-Williams Setfast® Acrylic Latex Traffic Marking Paint, TM2160/TM2161, or Engineer reviewed equivalent.

B. Striping Paint – for asphalt at least several months old, asphalt with emulsified coal tar type sealers, or concrete free of sealers and efflorescence:
1. Composition Type: One component, water based 100% acrylic emulsion polymer latex.
2. Conformance: Federal Specification TT-P-1952, Type 1.
3. VOC, ASTM D3960 excluding water: 0.75 lbs/gallon.
4. Total Solids: 73% solids by weight minimum.
5. Colors Available: White and lead free yellow, in conformance with U.S. Bureau of Public Roads.
6. No Pickup Dry Time, ASTM D711: 45 minutes at 50% RH.

7. Reflective Option: Glass beads can be dropped on surface while paint is still wet.
8. Recommended Spreading Rate at 8.5 mils DFT: Approximately 320 LF of 4″ stripe per gallon.
9. Manufacturer: Sherwin-Williams Setfast® Acrylic Waterborne Traffic Marking Paint, TM226/TM227, or Engineer reviewed equivalent.

C. Marking Paint – Red, blue, and black colored markings for asphalt at least several months old, or concrete free of sealers and efflorescence:
1. Composition Type: One component, water based latex.
2. VOC, EPA Method 24: 0.83 lbs/gallon.
3. Total Solids: 68% solids by weight minimum.
4. Colors Available: Red, blue, black.
5. No Pickup Dry Time, ASTM D711: 45 minutes at 50% RH.
6. Reflective Option: Glass beads can be dropped on surface while paint is still wet.
7. Recommended Spreading Rate at 8.3 mils DFT: Approximately 320 LF of 4″ stripe per gallon.
8. Manufacturer: Sherwin-Williams Setfast® Latex Traffic Marking Paint, TM2132/TM2133/TM2135, or Engineer reviewed equivalent.

PART 3 EXECUTION

3.01 TRAFFIC LANE AND PARKING STALL MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust. Remove sealers and efflorescence from concrete surfaces.

B. Application: Apply paint with mechanical equipment to produce uniform straight edges. Apply in one or two coats at manufacturer's recommended rates.

C. Handicapped Symbols: Apply paint as above, in approved pattern, using clean-cut stencil.

D. Add reflective glass beads where scheduled.

3.02 SCHEDULE

A. Paint markings on pavement as indicated on Drawings.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 – General Requirements Sections apply to work of this Section.

B. The Contractor shall provide all labor, materials, and appurtenances for the complete installation of hot-dipped galvanized chain link fence system.

C. The extent of each type of chain link fencing is indicated on Drawings and by the provisions of this Section.

1.02 SUBMITTALS

A. Shop Drawings: Clearly indicate plan layout, grid, spacing of components, accessories, fittings, and anchorage.

B. Product Data: Submit manufacturer's product data, installation instructions, and general recommendations for each product specified.

1.03 QUALITY ASSURANCE

A. Completion of 10 equivalent installations.

PART 2 PRODUCTS

2.01 FABRIC

A. Zinc-coated fabric shall be galvanized before weaving (GBW) with a minimum 1.2 oz of zinc per square foot of surface area and conform to ASTM A-392, Class 1.
1. Wire Size: The finished wire size shall be 9 gauge.
2. Nominal diameter of coated wire to be 0.148″.

B. Height of fencing is indicated on the Drawings.

C. Fabric Schedule:

Usage	Size of Mesh	Selvage	
		Top	Bottom
Perimeter	2”	twisted	knuckled

2.02 FRAMEWORK

A. Posts, gate frames, braces, and horizontal rails shall be:
1. Industrial fence round pipe post, manufactured from high tensile steel pipe cold formed and welded per ASTM F1043, Group 1B, having a minimum yield strength of 50,000 psi.
2. The external zinc coating shall be Type B zinc (ASTM B6) with 0.9 oz/ft^2.
3. The internal coating shall be Type B zinc (ASTM B6) with 0.9 oz/ft^2 or Type D, 81% nominal zinc pigmented coating with 0.3 mils minimum thickness.

B. Framework Dimensions and Weights:

1. Use and Section	Nominal OD - Inches	Nominal Weight/Foot Lbs/Ft
End corner and pull posts fabric height		
6′0″ and less, round	2.375	3.12
Over 6′0″, round	2.875	4.64
Intermediate (Line) posts fabric height		
6′0″ and less, tubular	1.90	2.28
Over 6′0″, tubular	2.375	3.12
Gate posts, nominal width of gate, single or one leaf of double gate		
6′0″ or less, round	2.875	4.64
Over 6′0″ to 13′0″, round	4.00	6.56
Over 13′0″ to 18′0″, round	6.625	18.97
Over 18′0″, round	8.625	24.70
Gate frames		
6′0″ or less in height, 8′0″ or less in width, round	1.660	1.83
Over 6′0″ in height 8′0″ in width, round	1.90	2.28
Rails and post braces	1.66	1.83

2. Horizontal Railing:
   a. Top rail shall be supplied in 21′ lengths and joined by 6″ long sleeves and run continuously along the top of the fence through openings provided in the line post tops.
   b. Top rail shall be 1.66″ OD weighing 1.83 lbs/LF.
   c. Bottom rail, middle rail and bracing are optional and shall be the same as specified for top rail when required.

2.03 ACCESSORIES

A. Caps: Cast or pressed steel, or malleable iron, hot dip galvanized, sized to post dimension.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings, shall be of galvanized press steel, malleable or cast steel as specified in ASTM F626 and FS RR-F-191.

C. Top and Bottom Tension Wire: 7 gauge steel single strand, galvanized.

D. Extension Arms: To accommodate 3 strands of barbed wire, sloped 45° or razor ribbon coil.

E. Barbed Wire: 12-1/2 gauge wire, 3 strands, 4 point, Type Z, Class 3 (0.80 oz/ft^2, zinc-coated (galvanized),14 gauge round barbs on 5″ centers.

F. Gates: As indicated in the drawings, gates shall be swing or sliding as required, complete with latches, stops, keepers, hinges or rollers and roller tracks, and when required, with provision for three strands of barbed wire above the fabric.
1. Swing gates shall conform to ASTM F900 and FS RR-F-191.
2. Slide gates shall conform to ASTM F1184.
3. Gate Hardware:
   a. Gate center rest, 2 piece drop latch, chain gate holdback, gate hinge 180° male and female, fork latch and latch catch, drop bolt, hardware for padlock.
   b. Gate hardware shall be in accordance with ANSI 404.2.7 and be 34″ minimum to 48″ maximum above the ground.

2.04 CONCRETE

A. 3000 psi, 2″-3″ slump, Section 03 30 00 – Cast-in-Place Concrete.

PART 3 EXECUTION

3.01 INSTALLATION

A. The complete fence shall be plumb, both in line and transverse to the fence, straight and rigid with fabric tightly stretched and held in place firmly.
1. Set posts in concrete footings as specified in CLFMA standard.
2. Install chain link in accordance with Practice F567.

B. Post Setting:
1. Set fence posts at spacings of a maximum of 10′-0″ on center.
2. Space gate posts according to the gate openings shown on the Drawings.
3. Set end, gate and line posts in concrete footings.
4. Set post to within 6″ from bottom of concrete footing.
5. Top of footing shall be 2″ above grade and sloped to direct water away from posts.

C. Fabric:
1. Attach fabric to security side.
2. Pull fabric taut with bottom selvage 2″ above grade.
3. Fasten to end posts with tension bars threaded through mesh and secured with tension bands at maximum 15″ intervals.

4. Tie to line posts and top rails with tie wires spaced at maximum 12″ on posts and 24″ on rails.
5. Attach to bottom tension wire with top rings at maximum 24″ intervals.

D. Security Wire:
1. Install 3 strands of barbed wire on arms.
2. Anchor to end extension arms, pull taut and firmly install in slots of line post extension arms.
3. Extended line posts shall be installed when using coil security fence topping.
4. One strand of barbed wire shall be used to support coil fence topping.

E. Gates:
1. Install center and bottom brace rail on corner and gate leaves.
2. Provide 3 hinges per leaf, latch, catch, drop-bolt, retainer, and locking clamp.
3. Provide concrete center rest and drop-bolt retainers at center of double gate openings.
4. Gates shall swing easily and hang true and close into the plane of the fence.

3.02 SCHEDULE

A. As shown on Drawings.

B. Gates: Single and double leafs; width as noted on Drawings.

END OF SECTION

SECTION 32 32 01

GRAVITY RETAINING WALL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section covers the engineering, design and construction of gravity retaining walls as shown on the Drawings.

B. The types of Gravity Retaining Wall Systems covered include cast-in-place concrete gravity retaining walls, grouted boulder retaining walls, precast concrete retaining walls, segmental concrete unit masonry retaining walls, manufactured modular walls and gabion retaining walls. The requirements for each type of Gravity Retaining Wall are included in the appropriate Section of the Specifications.

C. Unless specified otherwise on the Plans, use only cast-in-place concrete gravity wall, precast concrete gravity retaining wall, or a stacked grouted boulder retaining wall. Gabion retraining walls are permitted only where specified on the Plans.

D. Scope of Work: The Work shall consist of furnishing materials, labor, equipment and supervision for the construction of a gravity retaining wall structure in accordance with the requirements of this Section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans. No geogrid reinforcing will be allowed for this type of wall system. This system will be designed purely as a gravity wall.

1.02 RELATED SECTIONS

A. The following is a list of Specifications which may be related to this section.
1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 31 22 00 – Grading.
3. Section 31 23 01 – Excavation and Fill for Site Work.

1.03 REFERENCES

A. The following is a list of standards which may be referenced in this section:
1. American Association of State Highway and Transportation Officials (AASHTO)
2. ASTM International (ASTM):
    a. ASTM G172 – Standard Guide for Statistical Analysis of Accelerated Service Life Data.

1.04 DEFINITIONS

A. Standards:
1. Working Drawings. Contractor-furnished documents including but not limited to such items as:
    a. Shop Drawings.

b. Design plans and related documents for Contractor-designed project elements such as cofferdams, bracing, false work, erection.
c. Such other similar data required for successful completion of the Work.

1.05 CRITERIA

A. Service Life:
1. Gravity Retaining Wall Systems, including all miscellaneous components, shall have a service life of at least 50 years in accordance with ASTM G172 and recommended practice for individual components of the system.

B. Design the Gravity Retaining Wall System as a stable structure in accordance with these specifications satisfying the following conditions:
1. The design must incorporate a factor of safety meeting the following criteria:

Retaining Wall Stability Criteria

Case No.	Loading Condition	Sliding Factor of Safety, FS	Overturning Criteria Minimum Base Area in Compression		Minimum Bearing Capacity Safety Factor
			Soil Foundation	Rock Foundation	
R1	Usual	1.5	100%	75%	3.0
R2	Unusual	1.33	75%	50%	2.0
R3	Earthquake	1.1	Resultant Within Base	Resultant Within Base	>1.0

Notes:

1. *R1, usual loading: backfill load, surcharge load (stability should be checked with and without the surcharge). Any existing lateral and uplift pressures due to water. Also includes usual loads possible during construction which are not considered short-duration loads.*
2. *R2, unusual loading: same as case R1 except the water table rises for a short duration or another type of loading of short duration; e.g. high wind loads, equipment surcharges during construction.*
3. *R3, earthquake loading: same as case R1 with the addition of earthquake induced lateral and vertical loads, if applicable. The uplift is the same as for case R1.*
4. *Less base area in compression than the minimum shown may be acceptable provided adequate safety against unacceptable differential settlement and bearing failure is obtained.*

2. All retaining walls shall be designed as gravity retaining walls without geosynthetic reinforcing or other types of reinforcement. The weight and configuration of the wall shall provide a stable wall system.
3. The design height shall be no less than the height shown on the Construction Drawings for each location appropriate.

C. Design Soil Parameters: All applicable soils parameters required for the retaining wall designs shall be obtained by a New Mexico Registered Professional Geotechnical Engineer hired by the Contractor. The design parameters shall be developed based on soils samples obtained at the various sites as required.

1.06 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures:
   1. Product Data:
      a. Manufacturer's product data for each component.
      b. Materials of construction, weights and capacities.
      c. Information indicating conformance with referenced design standards and criteria.
   2. Engineer of Record:
      a. Working Drawings and design calculations must be signed and sealed by a New Mexico registered Engineer.
   3. Working Drawings:
      a. Submit Working Drawings for each Gravity Retaining Wall system for each location for review by the Engineer at least 40 days before beginning construction at that location. No fabrication shall be done until approval has been given by the Engineer. Working Drawings shall include the following:
         1) Layout of the wall including plan and elevation views.
         2) Existing ground elevations field verified by the Contractor
         3) Geotechnical design parameters necessary for retaining wall design shall be obtained by the Contractor and included in the calculation package for review.
         4) Calculations supporting the design including assumptions, methodology, and all supporting materials for review.
         5) Complete details of elements and component parts required for the proper construction of the system.
         6) A complete listing of materials specifications.
         7) Earthwork, foundation, and dewatering requirements.
         8) Other information required by the Contract, necessary for complete review of the design or requested by the Owner's Representative.
   4. Engineer of Record for the Gravity Retaining Wall system shall be responsible for the following at no additional cost to the Owner.
      a. Any special inspection required.
      b. Review of material and other submittals related to construction of the wall.
      c. Record Drawings of the constructed wall.
      d. Final inspection and certification of final completion of the Gravity Retaining Wall system.
      e. Any Geotechnical Investigation that is necessary for wall design and construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 32 92 19.19

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. Hydraulically Applied Mulch
      c. Site Cleanup
      d. Maintenance and Guarantee

B. Related Work
   1. Site Grading
   2. Erosion and Sedimentation Control

1.02 REFERENCES

A. Definitions
   1. TOPSOIL: Stockpiled soil from on-site. If additional topsoil is required, amended native soil or soil furnished by Contractor shall consist of friable soil free from undesirable subsoil, refuse, or foreign materials. It shall be free from weed and weed seed, roots, brush, sticks, litter, and rocks larger than 1 inch in any dimension. It shall be free-draining and non-toxic, with no decomposed stone salts or alkali, and contain 5% Organic Matter.
   2. WEEDS: Includes *Taraxacum officinale* – Dandelion, *Datura stramonium* – Jimsonweed, *Elymys repens* – Quackgrass, *Equisetum hyemale* – Horsetail, *Ipomoea purpurea* – Morning Glory, *Juncus sp*. – Rush Grass, *Brassica sp.* – Mustard, *Chenopodium album* – Lambsquarter, *Stellaria media* – Chickweed, *Lepidium sp.* – Cress, *Digitaria sp.* – Crabgrass, *Cirsium arvense* – Canadian Thistle, *Cyperus rotundus* – Nutgrass/Nutsedge, *Toxicodendron diversilobum* – Poison Oak, *Rubus sp.* – Blackberry, *Jacobaea vulgaris* – Tansy Ragwart, *Cynodon dactylon* – Bermudagrass, *Sorghum halepense* – Johnson Grass, *Toxicodendron radicans* – Poison Ivy, *Muhlenbergia schreberi* – Nimble Will, *Convolvus arvenis* – Bindweed, *Agrostis stolonifera* – Bent Grass, *Allium ursinum* – Wild Garlic, *Rumex acetosa* – Perennial Sorrel, and *Carduus nutans* – Musk Thistle.

B. Reference Standards: The following are made a part of the Contract Documents by reference:
   1. Association of Official Seed Analysts (AOSA).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the Work of this Section with landscaping, grading, construction and utility operations.

B. Sequencing:
   1. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.
   2. Do not prepare or plant when soil is frozen.

C. Scheduling: Submit a work schedule for approval at least fifteen (15) days prior to start of work under this section.
   1. Do not schedule seeding before the middle of May
   2. Do not schedule seeding after the middle of September.

1.04 SUBMITTALS

A. Product Data: Manufacturer's Literature and/or Laboratory Analysis of products supplied.
   1. Fiber mulch.
   2. Tank mix fertilizer.
   3. Top dress fertilizer.
   4. Graphic illustrating areas disturbed by construction to be seeded.

B. Samples: Furnish samples of materials demonstrating conformity to this specification as requested by the Owner.

C. Certificates:
   1. Certification of seed and seed mixes from a certified testing laboratory.
   2. Certification for Seed Mix to be dated within 12 months of placement.
   3. Certification that the seed has been stored in appropriate conditions in the 12 months before arriving at the project.
   4. Certification for Seed Mix:
      a. Pure Live Seed Certification, labeled in accordance with the Federal Seed Laws and New Mexico Department of Agriculture labeling laws. Include:
         1) Variety
         2) Kind of Seed
         3) Lot number
         4) Purity
         5) Germination
         6) Percent crop
         7) Percent inert
         8) Percent weed (including noxious)
         9) Origin

10) Test data
11) Net weight

b. Federal seed laws require analysis shall be
1) No older than 5 months for seed shipped interstate
2) No older than 9 months for seed shipped intra-state

1.05 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.

1.06 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. Substitution of Seed: Substitution may be accepted if the specified seed or seed mix is not available at the time of installation.
1. 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 seed mix containing minimum 5 specimens from Grass List and 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 hymonoides – Indian Ricegrass, Bouteloua curtipendula – Sideoats Grama, Bouteloua gracilis – Blue Grama, Bromus marginatus – Mountain Brome, Hilaria jamesii – Galleta Grass, Nassela viridula – Green Needlegrass, Pascopyrum smithii – Western Wheatgrass, Schizachyrium scoparium – Little Bluestem, Sporobolus cryptandrus – Sand Dropseedacre
        1) Seed application rate per acre:
            a) Drill - 8 lbs.
            b) Broadcast - 16 lbs.
    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) Seed application rate per acre:
            a) Drill - 5 lbs.
            b) Broadcast - 10 lbs.
    c. Quick Cover: *Leptochloa dubia* – Green Sprangletop or Sterile *Triticale hybrid* – QuickGuard
        1) Seed application rate per acre:
            a) Drill - 5 lbs.
            b) Broadcast - 10 lbs.

G. Adjust rate of pure live seed using the following equation: P X G/100 = PLS where 90% or greater cannot be achieved. Use table to illustrate where >90% PLS 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 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

2.04 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 EXAMINATION

A. Verify that prepared soil base is ready to receive the Work of this Section

B. Beginning of installation means acceptance of site conditions.

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. 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. 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 1/4 - 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 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.

3.09 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.

3.10 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.

3.11 MAINTENANCE BY THE CONTRACTOR

A. The Contractor's Maintenance Period shall begin upon review and approval at Substantial Completion and shall be for the period of 60 days.

B. 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.

3.12 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.

3.13 GUARANTEE

A. Contractor shall guarantee growth and coverage of seed, hydraulically applied mulch and other mulches under this Contract to the effect that a minimum of 95% of the area planted will be covered with specified planting after 60 days with no bare spots greater than ten (10) square feet.

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.

3.14 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 seed establishment shall be as follows:
1. Uniform coverage of grass in excess of one (1") inch height. No single bare spot of greater than sixteen (16) square feet will be accepted.
2. The A/E and/or Owner shall judge that the previous conditions has been met.

C. Final Acceptance of grass seed establishment shall be as follows:
1. Satisfactory stand as specified under guarantee.

D. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

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

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 Fitrtings.
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, Metal Alloy 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 23 – 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.

B. Section 01 78 23 – Operation and Maintenance Data:
1. Operation and maintenance data for valves 4″ 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. 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.

B. 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. 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.
   b. Reclaimed Water Service:
      1) Color: Purple pigment.
      2) Marking: Continuous text, "Reclaimed Water – Do Not Drink".
   c. Non-Potable Water other than Reclaimed Water Service:
      1) Color: White pigment.
2. Pipe and Fittings:
   a. Pipe sizes 4″ through 60″:
      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″ and smaller:
1) Unless otherwise scheduled or shown on the Drawings.
a) ASTM D2241.
b) 1.5″ and smaller: SDR 21.
c) 2″ through 3.5″: 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.

B. Tapping Saddles and Service Lines:
1. Service Lines 3/4″ to 3″:
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, SIDR-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°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: Bonze 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.

5. Curb Stop Valves:
a. Material: Cast brass.
b. Style: Ball type, full port.
c. Rated Working Pressure: 300 psi.
d. Size: As indicated on Drawings.
e. Conformance: AWWA C800.
f. Connections: Compatible with service line material.
g. Ball: Fluorocarbon coated brass ball.
h. Seats: EPDM molded seats with stainless steel reinforcing rings, bi-directional flow.
i. Stem Seals: Two EPDM O-rings.
j. Tee-Head and Stem: Solid, one piece.
k. Tee-Head Rotation: Standard stops on body to permit quarter-turn only.
l. Non-Toxic: NSF/ANSI 61 certified.

m. Lead-Free: Certified by the Water Quality Association to comply with NSF/ANSI 372.
n. Curb Box: Cast iron box and lid with brass pentagon plug, arch style with foot piece, telescoping upper piece for grade adjustment.

C. High Density Polyethylene (HDPE) 3″ to 54″:
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. Fire Hydrants:
1. Latest revision of AWWA C502.
2. Mueller A-423 Super Centurion 250 or Engineer reviewed equivalent.
3. 1-1/2″ Pentagon Bronze Operating Nut equipped with elastomer weather seal between the top casting and the operating nut.
4. Sealed oil reservoir will incorporate a system of forced lubrication of the thrust collar area each time the hydrant is operated.
5. Two 2.5″ and one 4.5″ nozzles with National Standard fire hose threads mechanically connected into the barrel, “O”-ring sealed and standard nozzle caps.
6. Steel safety stem coupling with stainless steel fasteners, and two-piece break away safety flange.
7. Centerline of hose nozzle will be a minimum of 18″ above groundline.
8. 5-1/4″ diameter main valve opening.
9. Upper valve plate shall be all bronze.
10. All internal surfaces of the shoe, the lower valve plate, and cap nut shall be coated with a factory applied two-part, thermosetting epoxy coating with a minimum thickness of 4 mils.
11. The bronze valve seat shall be threaded into a bronze drain ring or shoe bushing. The drain channel shall be all bronze.
12. The hydrant shall have two drain outlets above the lower flange of the hydrant shoe assembly.
13. 250 psi working pressure, and be certified as such by the manufacturer.
14. Lower barrel to shoe connection shall have a minimum of 6 bolts made of stainless steel.
15. All hydrants furnished shall have a standard 10-year warranty certified by the manufacturer.
16. Painted chrome yellow.

B. Offset Fire Hydrant Connector Pipe:
   1. Joints: Fully restrained by means of split M J Glands.
   2. Length and Offset: To suit field conditions.
   3. Material: DIP, AWWA C153.
   4. Interior Lining: Cement mortar AWWA C104.

C. 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.

D. 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.

E. Butterfly Valves with Actuator (Buried Service):
1. Butterfly valve:
   a. Size as shown on Drawings.
   b. AWWA C504, Pressure Class 150 B 250 B.
   c. Pratt, Dresser, Val-Matic, or Engineer reviewed equivalent featuring ductile iron and offset disc and shaft.
2. Valve actuator:
   a. Manufactured by butterfly valve manufacturer.
   b. Traveling nut type.
   c. Withstand minimum 300 ft-lbs torque at full open or full closed position.
   d. Fully gasketed and sealed.
   e. Withstand 10 psi submergence without leaking.
   f. Minimum 16 turns full open to full closed position.
   g. 2″ AWWA nut.
3. Coating: AWWA C550 epoxy coating on all interior and exterior ferrous metal surfaces, 16 mils nominal thickness.
4. Threaded operator: Open left (counter clock-wise) unless scheduled otherwise.
5. Ends: Mechanical joint for buried service, unless indicated otherwise on Drawings.

F. 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° 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: 3/4″ NPT, no-lead brass.
3. Ford FTSS, Smith-Blair 663, or JCM 432.
4. Sizes as shown on Drawings.

G. 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″ AWWA nut.

H. Inserting Valves:
1. Sizes: As shown on Drawings.
2. Special Conditions: As noted on Drawings.
3. Minimum Working Pressure: 250 psi.
4. Fully restrain valve and host piping.

5. Acceptable Manufacturers:
    a. Advanced Valve Technologies EZ_2.
    b. Hydra-Stop IVP 250 Patriot Series Inserta-Valve.
    c. Team Industrial Services
    d. Or Engineer reviewed equivalent.

I. 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% 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 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 (PCV) 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. 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.

H. 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° or more.
      d. Plugs.
      e. Fittings in fills or unstable ground.
      f. Above grade or exposed piping.
   2. Concrete thrust blocking:
   3. Install so joints are accessible for repair.
   4. Install as shown on Drawings for buried pipe unless otherwise scheduled or reviewed by Engineer.
   5. Use bond breaker, such as 8 mil polyethylene sheets, between concrete and surfaces of all piping, fittings, and appurtenances.

I. Valves: Installed as shown on Drawings with valve boxes and blocking.

J. 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:

L = (N) (D) (P^0.5) / 133,200

Where:

L = allowable leakage in gallons per hour.
N = length of pipeline tested in feet.
D = nominal diameter of pipe in inches.
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 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 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 8 hours. If pipe must be pressurized again to test pressure, depressurize pipe first and allow it to relax for at least 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.
2. Ductile Iron Pipe (DIP):
a. 12″ and smaller: Pressure Class 350.
b. 14″ and larger: Pressure Class 250.

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 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 C653 – Disinfection of Water Treatment Plants.
   6. AWWA C654 – Disinfection of Wells.
   7. 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 and prior to placing components into service, submit Certification of Disinfection of Water Facilities in the form of a notarized affidavit to the Engineer and NMED Drinking Water Bureau confirming that disinfection of project components has been completed according to the referenced AWWA standards. Owner will withhold payment of the disinfection portion of the affected Work items until Contractor successfully submits Certification.
e. Do not place the system into service until NMED has accepted the Certification.

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 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°F (15.6°C) and 80°F (26.7°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 Treatment Reservoir: Per AWWA C652.

C. Water Storage Plants: Per AWWA C653.

D. Water Wells: Per AWWA A100 and AWWA C654.

E. New Building Water System: Per local or State Plumbing Code.

F. Granular Media Filters: Per AWWA, B100.

G. 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 redisinfection 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 31 01

SANITARY SEWERAGE SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage piping, non-pressure, non-surcharged, 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. 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 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 A536 – Ductile Iron Castings.
   2. ASTM A746 – Ductile Iron Gravity Sewer Pipe.

3. ASTM C76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 – Joints For Concrete Pipe And Manholes, Using Rubber Gaskets.
5. ASTM D395 – Rubber Property – Compaction Set.
6. ASTM D412 – Vulcanized Rubber and Thermoplastic Elastomer- Tension.
7. ASTM D882 – Tensile Properties of Thin Plastic Sheeting.
8. ASTM D1784 – Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
9. ASTM D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
10. ASTM D2412 – Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
11. ASTM D2564 – Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
12. ASTM D2665 – Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
13. ASTM D3034 – Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
15. ASTM D3311 – Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
16. ASTM D4976 – Polyethylene Plastics Molding and Extrusion Materials.
17. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
18. ASTM F679 – Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
19. ASTM F794 – Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe And Fittings Based On Controlled Inside Diameter.
20. ASTM F894 – Polyethylene (PE) Large Diameter Profile Wall Sewer And Drain Pipe.
21. ASTM F1417 – Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.
22. ASTM F1668 – Procedures for Buried Plastic Pipe.
23. ASTM F1803 – Poly (Vinyl Chloride)(PVC) Closed Profile Gravity Pipe And Fittings Based On Controlled Inside Diameter.
24. 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 C116/A21.16 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Flirtings.
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 C302 – Reinforced Concrete Pressure Pipe, Noncylinder Type.

9. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
10. 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 00 – Submittal Procedures:
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″ and Larger: Solid wall, ASTM F679, SDR 35 (Pipe Stiffness PS 46 psi in accordance with ASTM D2412).
b. 4″ to 15″: 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′ or 14′.
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.

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 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″ or less in diameter, where difference in elevation between inverts of adjacent manholes or structures is 10′ 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″ or less in diameter, where difference in elevation between inverts of adjacent manholes or structures is greater than 10′; air pressure test or water exfiltration test, or as approved.
3. Gravity pipelines greater than 24″ 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′ above the high point of the pipe or 5′ 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″ 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. Television Inspection:
1. Required for all gravity sewers unless scheduled otherwise.
2. Scheduling of Inspection: Perform inspection after sewer pipe has been cleaned, flushed, and all debris and plugs have been removed. Perform successful inspection as a condition of substantial completion.
3. Notification of Inspection: Notify Owner and Engineer 7 calendar days prior to performing the inspection and allow Owner and Engineer to be present to observe the inspection.
4. Television Equipment: Camera shall be color, equipped with rotating lens capable of 360-degree rotation with zoom focus and a wide-angle lens permitting spontaneous focal adjustments that allow viewing of service laterals connections, joints, pipe walls, and other installation anomalies.
5. Inspection Log: Maintain a television inspection report log during the inspection. Indicate project, general location, each manhole-to-manhole segment and stationing, pipe material and size, description of any trenchless rehabilitation repairs, stations and positions of all live taps and stub-outs, limits of any sags, and any abnormal or line defects within each segment. Submit completed logs and video files to the Owner and Engineer.
6. Perform television inspection of needed line repairs and re-inspections when the previous inspection is not satisfactory to the Owner and Engineer.
7. Submission: Submit completed logs and video recording files to the Owner and Engineer in a format acceptable to the Owner and Engineer.

H. Grade Tolerances:
1. Free from noticeable depressions or humps.
2. Invert elevations shall not exceed ±0.2′ 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 061000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

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 paragraphs 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 Standard Committee (ALSC) 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% maximum moisture content at time of dressing for 2″ 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: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

B. Kiln-dry material after treatment to a maximum moisture content of 19% for lumber and 15% for plywood.

C. Mark each treated item with treatment quality mark of an inspection agency approved by the ALSC 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″ 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 ALSC 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″ nominal thickness and 12″ nominal width for single-member use.

E. For concealed boards, provide lumber with 19% maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 2 grade; SPIB.
   2. Eastern softwoods, No. 2grade; 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″ 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% maximum moisture content of any species.

D. For concealed boards, provide lumber with 19% 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″ 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″ nominal thickness, compressible to 1/32″; 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 AWPA 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 American Forest & Paper Association's *Wood Frame Construction Manual*, 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″ overlap and 6″ end lap; fasten to sheathing with galvanized staples or roofing nails. Cover upstanding flashing with 4″ 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