TECHINICAL SPECIFICATIONS

FOR

City of Cleveland, Georgia

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Phone: (706) 865-2017

Wastewater Treatment Plant Expansion
Technical Specifications
Volume 1 of 2

CITY OF CLEVELAND, GEORGIA

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DOCUMENT 00 01 10

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1.02 CONTRACT DESCRIPTION

A. The work of this Contract is located in City of Cleveland, White County, Georgia at the existing Cleveland Wastewater Treatment Plant.

The project includes all material, labor, and related appurtenances for complete construction as indicated on the construction drawings and in these specifications. The Work consists of the upgrade and expansion of the existing City of Cleveland Wastewater Treatment Plant from 0.75 million gallons per day (MGD) to 1.5 MGD and includes the following:
The project includes upgrading the existing manual screen to an automated screen; upgrading existing pond aerators; duplex influent pumps and pump station with building; an oxidation ditch; two secondary clarifiers; flocculation tank; disc filters; UV disinfection; Parshall flume; plant drain pump station; WAS/RAS pumps; an aerobic digester with steel tank; dewatering/electrical building with rotary press; upgrades and expansion of existing control building; new chemical building; electrical work; yard piping; demolition of existing buildings, pond appurtenances, utilities, fences, and other areas as shown; SCADA system; and miscellaneous other work and improvements necessary to complete the work as described in the Contract Documents and Contract Drawings.

It shall be the responsibility of each bidder to field-verify the work, location, and related conditions. Opportunity for verification can be arranged through the City of Cleveland.

B. Perform Work of Contract under stipulated sum contract with Owner in accordance with Conditions of Contract.

1.03 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limit use of site and premises to allow Owner occupancy.

B. The existing wastewater treatment plant is currently operational and must remain in operation throughout the duration of the Work.

C. Time Restrictions for Performing Work: Monday to Friday, 7:00 am to 7:00 pm. Contractor must coordinate with Owner any work to be conducted beyond these hours.

D. Keep driveways and entrances clear and clean. Do not use these areas for parking and/or materials storage. Schedule deliveries to minimize on-site storage of materials and equipment.

E. Contractor shall assume full responsibility for security of all Contractor and sub-contractor materials and equipment stored on the site.

1.04 OWNER OCCUPANCY

A. The Owner will occupy the premises during the entire period of construction.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

D. The existing facility is currently and continuously receiving and treating wastewater. These functions shall not be impeded or interrupted during this contract except as specified herein. Any request to interrupt the standard operation of this plant must be approved by the Owner.

E. The Contractor and his subcontractors, suppliers, and vendors shall not operate any valves, gates, energize, or de-energize any existing equipment. The Owner shall undertake all such activities.

F. Unscheduled bypassing of untreated or partially treated sewage to surface waters or drainage courses is prohibited during construction. In the event of accidental bypassing by the Contractors operations, the Owner shall be entitled to immediately employ such means and methods the Owner deems necessary to stop the bypassing without giving the Contractor any written notice.

G. Penalties imposed on the Owner as a result of any bypass caused by the Contractor shall be borne in full by the Contractor, including legal fees and other expenses resulting directly or indirectly from the bypass.

H. The Contractor shall submit a detailed plan and time schedule for plant shut downs. The plan shall fully describe the means and methods for preventing bypassing of treatment units, the length of time required to complete the planned operation, and the necessary equipment required.

I. The Owner and Engineer shall be notified in writing at least fourteen (14) days in advance of any planned operation that requires a shut down.

J. Shut downs, when approved, shall be performed during daily low flow periods.

1.05 CONSTRAINTS

A. The Contractor is advised that the existing treatment facility must remain in service during construction of the new facility.

B. The Contractor shall include in the bid price, the cost of providing all temporary piping, piping re-routing, temporary storm drainage, modifications to any structures for temporary connections and bypass or temporary pumping as required during the entire construction period.

C. The sole access road to the facility is shared with a local school and experiences high traffic volumes during school drop-off and pick-up hours. Coordination of deliveries and construction traffic to avoid peak school hours should be done. Anticipated hours that traffic is expected are:
   1. Morning: 7:00 AM – 8:00AM
   2. Afternoon: 2:00 PM – 3:00 PM

1.06 WORK SEQUENCING AND EXISTING FACILITY OPERATION

A. Contractor shall prepare and submit a detailed sequencing plan for demolition, startup, and operational transitions. Plan shall be submitted for review prior to commencement of affected work.

B. The Work shall be sequenced and scheduled to maintain continuous operation of the existing wastewater treatment facilities, unless otherwise noted.

1.07 MILESTONE DATES

A. Contractor shall be substantially complete by 540 days.

B. Contractor shall be complete by 600 days.

1.08 LIQUIDATED DAMAGES

A. As actual damages for any delay in completion are impossible to determine, the Contractor and his sureties shall be liable for and shall pay the City of Cleveland **$1500** per day as liquidated damages for each calendar day of delay beyond the completion date of work for Substantial completion.

1.09 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

1.10 EXISTING PLANT DRAWINGS (REFERENCE ONLY)

A. The following existing facility drawings are provided for reference only to aid the Contractor in understanding current plant conditions. These drawings are not guaranteed to be accurate, complete, or current.
   1. 1990 Existing Facility Drawings
   2. 2007 Existing Facility Improvement Drawings

B. Contractor is responsible for reviewing these documents and verifying actual field conditions prior to starting any Work.

C. These drawings are not record drawings, not as-builts, and may not reflect current field conditions.

D. Reference drawings are not part of the Contract Documents and shall not be relied upon for exact dimensions, locations, or conditions.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Scope of Work.
   2. Lump sum items.
   3. Unit Price items.
   4. Manufacturers' equipment.
   5. Allowance items.
   6. Sales tax.
   7. Schedule of values.
   8. Applications for payment.
   9. Change procedures.
   10. Defect assessment.
   11. Stored Materials.
   12. Alternates.

1.02 SCOPE OF WORK

A. The project is to be bid as one lump sum price.

B. Only quantities listed in the bid schedule shall be measured for payment, unless the Owner has approved extra work in accordance with the Contract Documents and has so advised the Contractor before the work was actually performed.

C. Any and all other materials, labor, etc., furnished and required shall be considered as incidental to the items to be measured.

D. The unit or lump sum prices bid for the various items shall be full compensation for furnishing all materials, tools, equipment, labor and incidentals necessary and required to complete the work as shown on the plans and called for in the specifications.

E. The quantities to be paid for shall be determined by actual measurement of the amounts placed. The Engineer shall make all measurements and the Contractor shall make certain all work has been measured before concealing; otherwise, Contractor may be required to uncover or make accessible any work so concealed in order to receive payment for such items.

1.03 LUMP SUM ITEMS

A. All items shown on the drawings or called for in the specifications and not specifically shown in the bid schedule will be paid for at the lump sum price shown in the bid. Lump sum items will be paid for based on approved construction schedules and percentage of lump sum item actually completed at time of pay request.

B. Include all items required for normal construction in the lump sum bid.

1.04 ALLOWANCE ITEMS

A. Included in the Contract, for use upon Owner's instruction.

B. Contractor’s costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Contract Price and not in the Allowances.

C. Funds will be drawn from Allowances only by Change Order.

D. At closeout of Contract, funds remaining in Allowance will be credited to Owner by Change Order.

E. The Contractor shall not be allowed an adjustment of Contract Time for Work performed under these Allowance Items unless the work in question has a demonstrable impact on the overall project Critical Path.

1.05 SALES TAX

A. All Sales Tax should be included in the Lump Sum Bid item. Please note that it is the intent of the City to recover Sales Tax per a refund process that is available in the State and will require the Contractor to keep accurate records of all taxable Major Equipment purchases and submit such records as reasonably requested by the City. The statements from the major equipment purchases should at a minimum show date of purchase, description, and purchase price including sales tax.

1.06 SCHEDULE OF VALUES

A. Submit printed schedule on Contractor's standard form or electronic media printout.

B. Submit Schedule of Values in duplicate within fifteen (15) days after date of Owner-Contractor Agreement.

C. Format: Utilize Table of Contents of this Project Manual.

D. Revise schedule to list approved Change Orders, with each Application for Payment.

1.07 APPLICATION FOR PAYMENT

A. Submit three (3) copies of each application on the form included in Section 00 62 76 Contractor’s Application for Payment, or approved equal.

B. Direct Purchase amounts previously paid by the Owner shall be shown as a credit or previously paid (excluding sales tax). Refer to Paragraph Manufacturers Equipment (Sales Tax Exempt), this Section.

C. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

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

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

F. Include a cover letter identifying the following:
   1. Project.
   2. Application number and date.
   3. Detailed list of enclosures.
   4. For stored products:
      a. Item number and identification as shown on application.
      b. Description of specific material.

G. Substantiating Data: When Engineer requires substantiating information, submit data justifying dollar amounts in question. Include a cover letter identifying the following:
   1. Current construction photographs.
   2. Partial release of liens from major subcontractors and vendors.
   3. Record documents for review by Owner and Engineer, which will be returned to Contractor.
   4. Affidavits attesting to off-site stored products.
   5. Construction progress schedules, revised and current.

1.08 CHANGE PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Engineer will advise of minor changes in the Work not involving adjustment to Contract Price or Contract Time by issuing work directives.

C. The Engineer may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, and a change in Contract Time for executing the change.

D. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Price and Contract Time. Changes proposed by Contractor must be included within a Change Order, which must be approved by Engineer and Owner before it becomes effective.

E. Stipulated Price Change Order: Based on Proposal Request or Contractor's request for Change Order as approved by Engineer.

F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Work Directive Change. Changes in Contract Price or Contract Time will be computed as specified for Time and Material Change Order.

G. Work Directive Change: Engineer may issue directive signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Price or Contract Time. Promptly execute change.

H. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract.

Architect/Engineer will determine change allowable in Contract Price and Contract Time as provided in Contract Documents.

I. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

J. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.

K. Change Order Forms: Document 00 63 63 - Change Order.

L. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

M. Correlation of Contractor Submittals:
   1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Price.
   2. 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.
   3. Promptly enter changes in Project Record Documents.

1.09 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct appropriate remedy or adjust payment.

C. The defective Work may remain, but unit price will be adjusted to new price at discretion of Engineer and Owner.

D. Defective Work will be partially repaired to instructions of Engineer and Owner, and unit price will be adjusted to new price at discretion of Engineer and Owner.

E. Individual specification sections may modify these options or may identify specific formula or percentage price reduction.

F. Authority of Engineer and Owner to assess defects and identify payment adjustments is final.

G. 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. Products not completely unloaded from transporting vehicle.
   4. Products placed beyond lines and levels of required Work.
   5. Products remaining on hand after completion of the Work.
   6. Loading, hauling, and disposing of rejected products.

1.10 STORED MATERIALS

A. Partial payment shall be made for approved materials stored at the project site, provided invoices for said materials are furnished in accordance with payment request submittal.

B. Stored Materials Worksheet shall be submitted with all pay applications requesting stored materials. Stored Material Worksheet shall include, at a minimum, the following quantities and calculations:
   1. Number of units on hand last period.
   2. Number of units received this period.
   3. Number of units installed this period.
   4. Number of units on hand this period.
   5. Unit price.
   6. Cost of units on hand end of this period.
   7. Total cost of stored materials on hand.

1.11 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.

B. Schedule of Alternates are described in the Bid Form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

1.02 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

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 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. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

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 FIELD ENGINEERING

A. Employ Land Surveyor registered in State of Georgia and acceptable to Engineer.

B. Engineer will furnish coordinate positions of all key components to allow Land Surveyor to properly lay out the work. Promptly notify Engineer of discrepancies discovered.

C. Control datum for survey is that shown on Drawings.

D. Verify set-backs and easements; confirm drawing dimensions and elevations.

E. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

F. Submit copy of certificate signed by Land Surveyor certifying elevations and locations of the Work are in conformance with Contract Documents.

G. Maintain complete and accurate log of control and survey work as Work progresses.

H. On completion of foundation walls and major site improvements, prepare certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

I. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

J. Promptly report to Engineer relocation required because of changes in grades or other reasons.

K. Make no changes without prior written notice to Engineer.

1.04 PRECONSTRUCTION MEETING

A. Engineer will schedule meeting after Notice of Award.

B. Attendance Required: Owner, Engineer, and Contractor.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
5. Designation of personnel representing parties in Contract, and Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Scheduling.
8. Scheduling activities of Geotechnical Engineer.

D. Record minutes and distribute copies within five (5) days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.05 SITE MOBILIZATION MEETING

A. Engineer or Owner will schedule meeting at Project site prior to Contractor occupancy.

B. Attendance Required: Owner, and Contractor, Contractor's Superintendent, and major Subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements and occupancy.

3. Construction facilities and controls.
4. Temporary utilities.
5. Survey and layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within five (5) days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.06 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum 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, Owner, Engineer, 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 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 five (5) days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SCOPE

A. The work under this section includes preparing, furnishing, distributing, reporting on, and periodic updating of the construction schedules as specified herein.

B. The purpose of the schedule is to demonstrate that the Contractor can complete the overall Project within the Contract Time, and meet all required interim milestones.

1.02 REQUIREMENTS

A. Refer to the General Conditions, and Section 01 10 00, "Summary".

B. Each Contractor's approach to planning, scheduling, and execution of the Work shall be disclosed to the Owner by submission of the Contractor's Project Schedule (CPS) information and data as specified in this Section.

C. The Contractor shall coordinate its operations and schedules with those of the Owner and other Prime Contractors through the Engineer. The Contractor shall also coordinate its routine operations with other contractors who may be performing on the Owner's Job Site, in a manner that shall avoid interference therewith, and shall cooperate in the arrangements for delivery and storage of Materials and Equipment on or to the Job Site. In cases where conflicting schedules occur, the Engineer shall reconcile and prioritize activities.

1.03 DEFINITIONS

A. References to the Critical Path Method (CPM) of scheduling shall be to establish technical standards for compliance with this Section.

B. As-Planned (CPS): Refers to the initial schedule proposed by the Contractor, reviewed by the Engineer, and found to be in compliance with the contract documents by the Engineer. It will establish the plans and sequences by which the Contractor intends to carry out and complete the work within the time allotted therefore.

C. Activity: An element within any Schedule establishing the time, cost and resources required for performing or furnishing a part of the Work, or a requisite step.

D. Activity reports: Computerized tabular reports that shall include schedule data used in analyzing project status. Specific reports will require different data, as described later in paragraph 2.1.F. of this section. Typical data to be incorporated into the reports includes: Activity identifier, description, assigned resources, assigned cost, original duration, remaining duration, percent complete, preceding and succeeding activities, early start and early finish dates, and contract float. Activity durations shall be stated in work days. The Contract Time shall restrain the late finish dates. Milestones representing commencement of Work conditions shall be shown as restraining early start dates.

E. Contract float: Working days between the Contractor's anticipated date for early completion of the Work, or specific part, and the specified Contract Completion Date.

F. CPM Schedule: Computerized schedule in Critical Path Method format using Precedence Diagraming.

G. CPS Schedule: The construction schedule in CPM format developed by the Prime Contractor in accordance with the Contract Documents.

H. Critical Path: A path of Activities having the longest duration and which controls achievement of Contract Milestone or the Contract Completion Date.

I. Early Dates: An Activity's early start date and early finish date, i.e., the dates an Activity will start and finish if started at the earliest end of the range of dates that the Schedule indicated the Activity can be performed and still achieve the milestones and Contract Time.

J. Free Float: Number of working days by which an activity in the Project Schedule may be delayed from its Early Dates without delaying the early start of the activities immediately following it.

K. Late Dates: The late start date and late finish date, i.e., the dates an Activity will start and finish if started at the latest end of the range of dates that the Schedule indicates the Activity can be performed and still achieve the milestones and Contract Time.

L. Milestone Date: An event designated in the Contract for the purpose of establishing times for a key aspect of the Work to take place.

M. Overall Project Schedule: An overall CPM, precedence format schedule incorporating all Prime Contractor Project Schedules related to all Contract Work coordinated by the Engineer.

N. Recovery Schedule: A revision of the CPS which the Contractor develops, as a result of falling behind schedule, and which is proposed to the Engineer to disclose a plan for finishing the Work within the Contract Time.

O. Two-month look ahead schedule: An extraction from the CPS, disclosing the next month's work.

P. Two-week look ahead schedule: A detailed expansion of the CPS which delineates all work activities to be conducted over the upcoming two week window of time. This schedule will be the basis for forecasting workload at each monthly coordination meeting.

Q. Update Schedule: A CPS submittal disclosing Contractors' remaining Work and the "as-built" schedule for the completed work.

R. Work Breakdown Structure (WBS): hierarchical organization of major Work items/area used as a basis for development of a CPS and identification of all activities required to complete the Work

1.04 APPROVAL

A. Approval of the Contractor's construction program, and revisions thereto, shall in no way relieve the Contractor of any duties and obligations under the Contract. Such approval is limited to the format of the Schedule and does not in any way indicate approval of, or concurrence with, the Contractor's means, methods, and ability to carry out the Work.

1.05 USE OF FLOAT

A. Float is not for the exclusive benefit of either the Contractor or the Owner. Free float shall be "owned" by the project, however, consumption of free float for any reason shall be coordinated with the Engineer. Any proposal to consume Float accommodate changes in the Work, however originated, or to mitigate the effect of events which may delay performance or completion or all or part of the Work within the Early Dates must be approved by the Engineer.

B. Contract float shall be "owned" by the Owner and managed by the Engineer. Consumption of contract float shall be clearly justified and adjudicated by the initiating entity, entity, to the satisfaction of the Engineer.

C. The Contractor shall demonstrate, adjust, or remove any Float suppression means, e.g., preferential sequencing (crew movements, equipment and material use, etc.), extended durations, imposed dates, or scheduling of non-critical Work, and other schedule constraints, as a prerequisite to a request for an increase in Contract Price or Contract Time.

1.06 QUALITY ASSURANCE

A. In preparing the CPS, it is the responsibility of the Contractor to work with each of his Subcontractors and Suppliers to obtain information on work activities and sequencing, and to request written interpretations of schedule requirements from the Engineer as necessary.

B. The Contractor shall use Primavera P3 (current version), Sure Trak (current version) or other Engineer approved compatible CPM scheduling software to produce the CPS. This software shall run on PC compatible equipment and be capable of processing and plotting schedule data as specified in this Section. Should the Contractor elect to use Sure Trak, formatting shall be in the P3 format.

1.07 CPS SUBMITTALS

A. The Contractor shall submit to the Engineer for their use one (1) electronic copy and two (2) hard copies, plus the number of copies to be returned to the Contractor, of each CPS submittal. Each Submittal shall bear the Contractor’s stamp, signed by the Contractor’s Project Manager. The Contractor’s stamp shall state that the Contractor has determined or verified all data on the CPS and assumes full responsibility for doing so, and that the contractor has reviewed and coordinated the sequences in the CPS with the requirements of the Contract Documents. Each CPS shall be assigned a revision number by the Contractor, staring with Rev. 0 for the “As-Planned” CPS for the Work as awarded.

B. Prerequisite to each submittal the Contractor is completely responsible for, as a minimum:
   1. Checking and verifying that the CPS shows the overall priority and sequence of Activities with which the Contractor intends to accomplish the Work or Work remaining

to comply with the Contract Time and those sequences of Work indicated in or required by the Contract Documents.
2. Anticipating and identifying foreseeable events or site conditions that may in any manner affect the cost, progress, schedule, performance, and furnishing of the Work or Work remaining. Examples are interfaces with other contractors, material or equipment deliveries, labor constraints, operating equipment constraints, or similar circumstances.
3. Reflecting the means, methods, techniques, sequences, and procedures of construction chosen by the Contractor (subject to requirements of the Contract Documents).
4. Accurately recording how complete Work was performed as to sequencing and timing.

C. The Engineer will review and return the Contractor's CPS submittal within the times described in this Section. The Engineer's review will generally be for , but not limited to:
1. Conformance with Contract Time and those sequences of Work indicated in or required by the Contract Documents:
2. Verifying compliance with Contract Milestones;
3. Reviewing preservation of Contract Float;
4. Analyzing the Contractor's need to use Contract Float;
5. Comparing as-built data with that represented in previous Update Schedule;
6. Verifying conformance with the requirements of the Contract Documents which may have a bearing on the CPM Schedule; and,
7. Checking interference with other Prime Contractors and incorporation into the Project Schedule.

D. When reviewed by the Engineer, the CPS submittal will be returned to the Contractor as either "Revise and Resubmit" or "Resubmittal Not Required". Submittals stamped as "Resubmittal Not Required" will represent the most current CPS as of the data of the schedule. Neither the Engineer's review of a CPS, nor the Engineer's statement of "Resubmittal Not Required", will relieve the Contractor from responsibility for complying with the contract requirements including but not limited to the Contract Time requirements, adhering to those sequences of Work indicated in or required by the Contract Documents, or from completing any Work omitted from the CPS within the Contract Time.

E. The Contractor shall make the required adjustments or corrections in a CPS submittal returned to him as "Revised and Resubmit", and shall deliver to the Engineer the CPS resubmittal directing specific attention in writing, on both the schedule and the submittal cover sheet, to any adjustments or corrections made other than those in response to the Engineer's comments on the previous submittal. Resubmittals shall use the same revision number followed by the letters "A," "B," etc., as applicable. The Engineer will review and return the resubmittals using the same procedures as noted in this Section.

F. The Contractor recognizes the Owner reserves the right to request changes to the Project Schedule at any time. If the Project Schedule is so changed by the Owner, the Milestone dates will be correspondingly adjusted by the Owner through the Engineer.

1.08 CPS RECOVERY

A. Unless otherwise directed in writing by the Owner or Engineer, the Contractor shall promptly undertake appropriate action at no additional cost to the Owner to recover schedules whenever the Contractor fails to achieve a Milestone established in the CPS, or the Contractor's progress is not commensurate with that required to adhere to the Contract Time or Milestones.

B. It is anticipated that any need for recovery will be determined in the monthly progress meeting with the Contractor while reviewing the Contractor's two-week look-ahead schedule, two-month look ahead schedule, and updates of the previously scheduled work over the course of a month. The Engineer will make the determination of the need for a recovery schedule and will formally request a recovery schedule from the Contractor, if required.

C. The Contractor shall submit within one week, an informal plan of recovery with his two month look-ahead schedule which will initiate the recovery action to be taken by the Contractor. This informal plan will be incorporated into the meeting minutes. With the next Application for Payment, a formal recovery schedule will be submitted with a written recovery statement to the Engineer describing time lost on the CPS within the shortest reasonable time.

D. Appropriate recovery actions will include, but not be limited to; assignment of additional labor, subcontractors, or equipment; shift or overtime Work; expediting of submittals or deliveries; or any combination of these. Overlapping of Activities or sequencing changes to increase Activity concurrence shall be deemed appropriate only if properly substantiated by the necessary resources in the recovery schedule.

E. Any changes to the Contractor's Project Schedule that change any Milestone will not be effective until approved by the Owner.

1.09 DEALING WITH “ALTERNATIVES”

A. All versions of the CPS up to, and including, the AS-Planned CPS, shall be based solely on the specific work sequences or procedures of construction indicated in or required by the Contract Documents for the Work as awarded, and shall exclude any "alternate" proposals.

B. The Engineer's final determination on any Contractor-proposed alternates will not be made until after the AS-Planned CPS is developed as provided in this Section and consideration is given to the possible impact upon other Prime Contractors working on the project.

1.10 EARLY COMPLETION

A. An early completion CPS is one which anticipates completion of all or specified part of the Work ahead of the corresponding Contract Time.

B. The Contractor shall not be entitled to any extension in Contract Time, nor to recover any delay, disruption, interference, hindrance, extension of an early completion date established on the As-Planned CPS, until all Contract Float, if any, is used or consumed with the concurrence of the Engineer and performance or completion of the Work, or specified part, necessarily extends beyond the corresponding Contract Time or Milestone.

1.11 CONTRACTOR NON-COMPLIANCE

A. The Engineer may refuse to recommend the whole or part of any payment if, in the Engineer's opinion, the Contractor's failure, refusal or neglect to provide the required CPS information precludes a proper evaluation of the Contractor's progress.

B. Engineer's assistance with schedule preparation shall not relieve the Contractor of his responsibilities for determination of the methods, techniques, and sequences for the performance of the Work.

C. These remedies for the Contractor's failure, neglect or refusals to comply with the requirements of this Section are in addition to, and not in limitation of, those provided under the Contract Provisions.

PART 2 PRODUCTS

2.01 CONTRACTOR'S PROJECT SCHEDULE (CPS)

A. The CPS shall break down the Work into activities and relationships to the extent required to disclose the overall approach to the Work and to allow the Engineer to fulfill the review objectives itemized in this Section. The CPS shall, as a minimum:
   1. Divide the Work activities and show the progression of the Work from the Notice to Proceed to the end of the Contract Time. The activities shall be resource-loaded if required by the Engineer.
   2. Identify the responsibilities of the Contractor, the Owner, and t Engineer relate to items of interface with work (e.g., cure time between concrete placements) and procurement performed by others, specified construction, training, start-up and testing.
   3. Shall not combine Work located in separate structures into the same activities.
   4. Shall not combine distinct areas or elevations within a structure, Work corresponding to different Divisions of the Specifications, Work performed by different Subcontractor's, nor rough-in and finish Work of the same trade into the same activities.
   5. Consist of construction activities established with a duration of 10 working days or less, and administrative activities established with a duration corresponding with the associated task (e.g., fabrication of installed materials may require more than 10 working days, so administrative activities, per se, will be allowed greater durations). Ten percent of the construction activities may be allowed to exceed the prescribed 10 day limit, if approved by the Engineer.
   6. Consist of procurement-related Activities reflecting in detail all items involved in the preparation, submittal, review, and return of Shop Drawings and samples, and in fabrication, delivery, receipt and inspection of the items of materials, and shall not combine items furnished by separate Suppliers.
   7. Schedule, wherever possible, major equipment and material deliveries so that incorporation into the Work can take place without the requirement for on-site storage.
   8. Show finish-to-start relationships between all work activities unless otherwise authorized by the Engineer.

B. CPM diagrams shall be based on precedence diagramming format (PDM), shall be plotted on a time-scaled calendar, and shall expressively identify the Contract Time, Milestones, the Critical Path, and all Activities. Activities shall be shown on their Early Dates, with their Contract Float noted beside them. Connections between Activities, whether on the same sheet or on different sheets, shall identify both predecessor and successor Work. No relationship between Activities will use negative lag time.

C. Activity descriptive data shall match names titles and descriptions as they appear on the contract drawings. Activity codes shall be assigned to facilitate organizing schedule data and

producing grouped activities for diagram or chart preparation. At a minimum, the Contractor shall employ activity codes and corresponding description/definition for the following:

1. Area - designated "AREA"; one character field' first sequential code.
2. Facility number - designated "FAC"; two character field; second sequential code (Note that the "ARE" is the first digit of this two-digit code).
3. Structure Number - designated "STRC"; three character field; third sequential code; use the structure number and name as noted in the Drawings. Note that the first two numbers of the structure will be the Facility Number, with the first number being the Area designation
4. Functional Designation - designated "FUNC"; one character field; fourth sequential code defining the nature of the activity:
    a. Construction - "C" = all activities involved with construction forces installing equipment, materials, systems, or components associated with overall plant facilities, including cure requirements for concrete or masonry construction, coatings, or special construction.
    b. Administration -"A" = activities associated with administration of the contract, development or processing of submittals, fabrication of installed equipment, delivery of materials or equipment, schedule development/update activity, mobilization, demobilization, and the like.
5. Responsibility - designated "RESP"; four character field; sixth sequential code defining the responsible party for action on the activity. This code shall identify the Contractor, corresponding Subcontractor, supplier, or Engineer (to be designated "ENGR") responsible for the scope of work addressed by the activity. The codes for the Contractor, their Subcontractors, and suppliers shall be generated by the Contractor.

D. The Project calendar shall be the basis of the Contractor's schedule and shall identify planned work days (8-hour days, 5-day work weeks unless otherwise specified or approved) and all non-work days such as holidays and weekends. Holidays recognized in the schedule, at a minimum, shall be January 1st, Memorial Day, July 4th, Labor Day, Thanksgiving and December 25th. (If any of these holidays are on a non-work day, they shall be identified on the day nationally recognized as a holiday).

E. Adverse Weather Days.
1. Expected adverse weather days shall be shown on the critical path. The number of adverse weather days shown per month shall not be less than the mean number of days for that particular month in which precipitation meets or exceeds 0.1 inch (one-tenth of an inch).
2. The mean number of days in which the precipitation meets or exceeds 0.1 inch will be based upon the 30-year average from the most recent information available from the National Oceanic and Atmospheric Administration (NOAA) for the most proximate meteorological station to the project site.

F. Reports and report formats.
1. With each CPS submittal made, the Contractor shall include a Standard Schedule Report (custom tabular report format), Predecessor/Successor Report (standard tabular report format), and Early Start Report (custom tabular report format), 132 lines wide by 50 lines long.
2. The Standard Schedule Report shall incorporate the following data:
    a. Activity Identifier - a unique six-character numerical code that discretely identifies each activity within the schedule. The identifier shall be an "intelligent" identifier only from the standpoint that the first digit is to be the Area associated with the

activity. The remaining five digits shall be sequential, separated by no less than units of 10 (i.e., and activity in Area 3 could be 304590, and the next activity for that area would be 304600, 30461, and so on). The Contractor may elect to use intelligent identifiers for internal purposes; however, they must still follow this format. The report shall allow a 10-space field for the activity identifier.

b. Activity Description - a brief verbal description of the scope of the activity. The report shall allow a 50-space field for the activity description.
c. Responsibility - Activity Code "RESP". The report shall allow a 6-space field for the activity responsibility.
d. Original Duration - the original planned duration for the activity, in work days. The report shall allow a 6-space field for the original duration.
e. Remaining Duration - the number of work days remaining for the activity to be completed. The report shall allow a 6-space field for the activity description.
f. Percent Complete - status of progress for the activity. The report shall allow a 5-space field for the percent complete.
g. Early Start - Allow an 11-space field for this parameter.
h. Early Finish - Allow an 11-space field for this parameter.
i. Late Start- Allow an 11-space field for this parameter.
j. Early Finish - Allow an 11-space field for this parameter.
k. Total Float - Allow a 5-space field for this parameter.

3. The Standard Schedule Report shall be organized with the following hierarchy:
   a. Area (new page on change of Area)
   b. Facility (skip line on change of Facility)
   c. Structure
   d. Functional Designation
   e. Early Start
   f. Early Finish
4. The Predecessor/Successor Report is typically a standard report within Primavera Systems Schedule Software. Standard content of the report includes predecessor analysis, activity code line, and successor analysis. Skip a line only after the successor analysis. The report shall be organized by activity identifier (ascending).
5. The Early Start Report shall have the same content as the Standard Schedule Report. The report shall be organized by:
   a. Area (new page on change of Area)
   b. Facility (skip line on change of facility)
   c. Structure
   d. Functional Designation
   e. Early Start
   f. Early Finish

G. CPS Diagrams
1. With each CPS submittal made, the Contractor shall include a time-scaled, color Gantt chart of the project activities. The chart shall be organized by:
   a. Area grouping (new page on change of Area) - Heading in yellow background with black text; Arial 14 font.
   b. Facility grouping - Heading in light blue background with black text; Arial 12 font.
   c. Structure grouping - Heading in white background with black text; Arial 11 font.
   d. Functional Designation grouping - Heading in light green background with black text; Arial 10 font.
   e. Early Start
   f. Early Finish

2. The chart shall be submitted on 11x17 sheets with no more than six months of time displayed per sheet and approximately 40 activities.
3. Tabular data to be included on the chart shall be in Arial 8 font, and shall include:
    a. Activity description
    b. Original duration
    c. Remaining duration
    d. Percent complete
4. The activity's early/actual start date shall be displayed to the immediate left of the corresponding bar for each activity. The early/actual finish date shall be to the immediate right of the bar. Both displays shall be in Arial 8 font.
5. Height of each activity bar shall be approximately two-thirds of the tabular data row height.
6. Critical activity bars shall be displayed in red (color code 2).
7. Non-critical activity bars shall be displayed in green (color code 12).
8. Progress shall be displayed in blue (color code 3).

2.02 CPS NARRATIVE

A. A narrative (written progress report) shall accompany each CPS submittal (including initial, update, revision, and recovery schedules) and, at a minimum, shall discuss
    1. Number of days worked over the period, work force on hand (with high and low count for the period), construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks, etc.).
    2. General progress of the Work, which includes a listing of activities completed over the reporting period, activities started over the reporting period, mobilization/demobilization of subcontractors, major milestones achieved.
    3. Identification of new sequences, by activity, that result from a contract change.
    4. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
    5. Identification of any Activities added or deleted, and why.
    6. Steps taken to recover the schedule from time lost by the Contractor.
    7. Documentation of weather conditions over the reporting period, and any resultant impacts to the work.
    8. Changes to activity logic.
    9. Changes to the critical path.

B. In addition to the requirements in this Section, the CPS narrative shall address the Contractor's plan for management of the site (e.g., lay down and staging areas, construction traffic, etc.), the utilization of construction equipment, the buildup of trade labor, and the identification of all potential Change Orders which shall not be incorporated into CPS.

C. Format of the narrative shall be organized by Facility, within Area.

2.03 CPS MONTHLY UPDATED

A. The first CPS update submittal shall become due the first work day of the month following the submittal of a responsive "As-Planned" CPS.

B. CPS updates will be submitted monthly with the Contractor's payment application and will consist of the Contractor's current plan for the remaining work, a record of Work during the reporting period, and as-built data for the period prior to the current reporting period.

C. Each CPS update submittal shall consist of two (2) hard copies and one (1) electronic file copy.

D. The CPS update is created by statusing the current approved revision of the CPS. The data date for the CPS shall be the last work day of the previous month.

2.04 CPS RECOVERY

A. Recovery Schedules will be reviewed by the Engineer and will consist of the Contractor's proposed approach for the completing the remaining work within the Contract Time and Milestones, a record of Work during the reporting period, and As-built data for the period prior to the current reporting period.

PART 3 EXECUTION

3.01 CONTRACTOR'S PROJECT SCHEDULE (CPS)

A. The Contractor will be required to fulfill the requirement of the Specification Section in delivering its project schedule in CPM format to the Engineer covering the specified scope of its Work. The Engineer will coordinate the consolidation of each CPS into one comprehensive Project Schedule for the entire Contract Work.
   1. The As-Planned CPS submittal shall consist of 2 hard copy sets of:
   2. CPS diagrams,
   3. Schedule of Values,
   4. Computerized reports,
   5. CPS narrative.
   6. A floppy disk (diskette) with CPM data files duplicating the Contractor's files in the specified software format on 3.5-inch computer disk shall also be submitted.

B. The As-Planned CPS submittal shall become due within 10 working days after the date of the Notice to Proceed. This submittal shall reflect the Work as awarded. Receipt by the Engineer of Rev. 0 CPS submittal that does not require revision and resubmittal shall be a condition precedent to processing the Contractor's first Application for Payment.

C. The Engineer will schedule a meeting for the express purpose of reviewing the As-Planned submittal and adjudicating comments to the greatest extent possible within 5 working days of receipt of the schedule submittal. Attendees to this meeting shall be, at a minimum, the Contractor's Project Manager, Contractor's Superintendent, key Subcontractor representatives, Engineer, Owner's Representative, and others deemed appropriate by the Engineer or Owner. The Engineer shall then return the Rev. 0 CPS submittal to the Contractor within 2 work days following the review meeting. If a resubmittal is required, the Contractor shall respond with the revised, CPS resubmittal, labeled as Rev. 0A, within 5 work days.

D. Once the Contractor's Rev. 0, or Rev. 0A, CPS submittal is returned by the Engineer as "Resubmittal Not Required", it will be considered the As-Planned CPS for the Work, and as such becomes the basis for monitoring the Contractor's progress against Milestone and Contract Time.

E. Evaluation and reconciliation of extensions in Contract Time will be based on the current schedule revision, if and when such an evaluation of Contract Time is required.

3.02 CPS REVISIONS

A. Any logic change, addition or deletion of activities, or Recovery Schedule constitutes a Revision. Each CPS revision, starting with the Rev. 1 submittal, shall consist of the required copies of the updated CPS diagrams, reports, plots, narrative, and electronic data.

B. CPS revisions shall accurately represent all approved changes, adjustments, or updates in the sequencing and timing of Work remaining made, or required to be made, to ensure that the CPS stays current with the Contractor's revised plan for performing and furnishing Work remaining, or to recover schedule.

C. The Contractor shall also incorporate revisions which have been agreed upon in approved Change Orders ordered since the last revision.

D. The Contractor shall also ensure that the CPS accurately reflects for each Activity the "as-built" information shown on the previous CPS revisions(s) and updates, including, but not limited to, actual start dates, remaining days of Work, percent complete, and actual finish dates. Actual adverse weather days shall also be recorded.

E. The Engineer will initially return a CPS revision submittal with comments limited to the uncompleted work items within 10 working days of receipt by the Engineer. If a resubmittal is required, the Contractor shall respond with the required copies of a revised CPS revision submittal within 5 working days of receipt of the Engineer's comments. Once the CPS revision submittal, or resubmittal, is returned to the Contractor as "Resubmittal Not Required", it shall represent the Revised CPS for the Work as of the data date of the revision, and it shall be the basis for the monitoring of the Contractor's performance and progress.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Definitions.

B. Submittal procedures.

C. Construction progress schedules.

D. Proposed products list.

E. Product data.

F. Use of electronic CAD files of Project Drawings.

G. Shop drawings.

H. Samples.

I. Other submittals.

J. Certificates.

K. Manufacturer's instructions.

L. Manufacturer's field reports.

M. Erection drawings.

N. Construction photographs.

O. Contractor review.

P. Engineer review.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.03 SUBMITTAL PROCEDURES

A. Transmit each submittal with Engineer accepted form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Identify: Project, Contractor, Subcontractor and supplier; pertinent Drawing and detail number, and Specification Section number, appropriate to submittal.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

E. Schedule submittals to expedite Project, and deliver to Engineer at business address. Coordinate submission of related items.

F. For each submittal for review, allow fifteen (15) days excluding delivery time to and from Contractor.

G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

H. Allow space on submittals for Contractor and Engineer review stamps.

I. When revised for resubmission, identify changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

L. Incomplete Submittals: Engineer will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of Engineer.

1.04 CONSTRUCTION PROGRESS SCHEDULES

A. Comply with Section 01 32 16 - Construction Progress Schedule.

1.05 PROPOSED PRODUCTS LIST

A. Within fifteen (15) days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.06 PRODUCT DATA

A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus three (3) copies Engineer will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute in accordance with Submittal Procedures article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.07 ELECTRONIC CAD FILES OF PROJECT DRAWINGS

A. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings and preparation of As-Builts for the project. Use for other Projects or purposes is not allowed.

B. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
   1. Use of files is solely at receiver's risk. Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in Contract Documents, notify Engineer of discrepancy and use information in hard-copy Drawings and Specifications.
   2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
   3. User is responsible for removing information not normally provided on Shop Drawings and removing references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and will be immediately returned.
   4. Receiver shall not hold Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
   5. Receiver shall understand that even though Engineer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
   6. Receiver shall not hold Engineer responsible for such viruses or their consequences, and shall hold Architect/Engineer harmless against costs, losses, or damage caused by presence of computer virus in files or media.

1.08 SHOP DRAWINGS

A. Shop Drawings: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit number of opaque reproductions Contractor requires, plus three (3) copies Engineer will retain.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.09 SAMPLES

A. Samples: Action Submittal: Submit to Engineer for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:
   1. Submit to Engineer for aesthetic, color, and finish selection.
   2. Submit Samples of finishes, textures, and patterns for Engineer selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; Engineer will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. Samples will not be used for testing purposes unless specifically stated in Specification Section.

H. After review, produce copies and distribute according to "Submittal Procedures" Article and for record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.10 OTHER SUBMITTALS

A. Permits: Within 15 days after date of established in Notice to Proceed, submit a list of permits and licenses to be obtained, identifying the granting agency, and the required date of permit submittal.

1.11 CERTIFICATES

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

1.12 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.13 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Engineer's benefit as contract administrator or for Owner.

B. Submit report in duplicate within five (5) days of observation to Engineer for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.14 ERECTION DRAWINGS

A. Submit drawings for Engineer's benefit as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

C. Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

1.15 CONSTRUCTION PHOTOGRAPHS

A. Each month submit photographs with Application for Payment.

B. Provide still photography shots of general area of the grounds and vicinity of the Work areas, prior to commencing any Work on property or roadway. Once Work has begun, provide photographs at each of the major stages or events of construction related work performed that month.

C. Photographs may be taken by the Contractor's personnel but must be of professional quality. Photographs deemed unsatisfactory by Engineer or Owner will be rejected and retakes will be required.

D. Photographs: Digital photographs.
   1. Take one (1) view of each pre-existing condition of an area where Work is to begin, as evidence of existing project conditions, up to a limit of ten such shots per month.
   2. Take one (1) view of each activity, up to a limit of ten such shots per activity per month.
   3. Take five (5) views of the overall project site each month to indicate relative progress of Work.
   4. Take two (2) views of overall aerial photographs of the site for each of the following stages:
      a. 0 percent, 50 percent, 75 percent and 100 completion.

E. Provide high-resolution digital photographs to document site conditions and progress at regular intervals and as requested by the Engineer.

F. All photographs shall be time-stamped and geo-tagged if available.

G. Costs of Photography: The Contractor shall include all costs for specified video-taping, photography, drone operation (if used) in the lump sum bid price.

1.16 CONTRACTOR REVIEW

A. Review for compliance with Contract Documents and approve submittals before transmitting to Engineer.

B. Contractor: Responsible for:
   1. Determination and verification of materials including manufacturer's catalog numbers.
   2. Determination and verification of field measurements and field construction criteria.
   3. Checking and coordinating information in submittal with requirements of Work and of Contract Documents.
   4. Determination of accuracy and completeness of dimensions and quantities.
   5. Confirmation and coordination of dimensions and field conditions at Site.
   6. Construction means, techniques, sequences, and procedures.
   7. Safety precautions.
   8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with requirements of Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from Engineer.

1.17 ENGINEER REVIEW

A. Do not make "mass submittals" to Engineer. "Mass submittals" are defined as six or more submittals or items in one day or 20 or more submittals or items in one week. If "mass submittals" are received, Engineer's review time stated above will be extended as necessary to perform proper review. Engineer will review "mass submittals" based on priority determined by Engineer after consultation with Owner and Contractor.

B. Informational submittals and other similar data are for Engineer's information, do not require Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by Contractor that are not required by Contract Documents may be returned without action.

D. Submittal approval does not authorize changes to Contract requirements unless accompanied by Change Order, or Work Change Directive.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality control and control of installation.

B. Tolerances.

C. References.

D. Labeling.

E. Testing and inspection services.

F. Manufacturers' field services.

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 Engineer 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 Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.04 REFERENCES

A. For products or workmanship specified by association, trades, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, date of Owner-Contractor Agreement when there are no Bids, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Neither contractual relationships, duties, responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.05 LABELING

A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
   1. Model number.
   2. Serial number.
   3. Performance characteristics.

1.06 TESTING AND INSPECTION SERVICES

A. Owner will employ services of an independent firm to perform testing and inspection. Contractor shall pay for services from cash allowances specified in Section 01 20 00 - Price and Payment Procedures.

B. Independent firm will perform tests, inspections and other services specified in individual specification sections and as required by the City of Cleveland.
   1. Laboratory: Authorized to operate in State of Georgia.
   2. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Engineer or Owner.

D. Reports will be submitted by independent firm to Engineer, Contractor, and the City of Cleveland, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

1. Submit final report indicating correction of Work previously reported as non-compliant.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
   1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Price.

H. Agency Responsibilities:
   1. Test samples of mixes submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.
   4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.
   6. Perform additional tests required by Engineer.
   7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit two copies of report to Engineer, Contractor, and authority having jurisdiction. When requested by Engineer, provide interpretation of test results. Include the following:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.
   6. Location in Project.
   7. Type of inspection or test.
   8. Date of test.
   9. Results of tests.
   10. Conformance with Contract Documents.

J. 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.

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

B. Submit qualifications of observer to Engineer thirty (30) days in advance of required observations. Observer subject to approval of Engineer.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01 33 00 - Submittal Procedures, Manufacturers' Field Reports article.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Communication services.
   7. Temporary water service.
   8. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.

C. Temporary Controls:
   1. Security.
   2. Water control.
   3. Dust control.
   4. Erosion and sediment control.
   5. Noise control.
   6. Pest control.
   7. Pollution control.

D. Removal of utilities, facilities, and controls.

1.02 TEMPORARY ELECTRICITY

A. Provide and pay for power service required from utility source as needed for construction operation.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain adequate artificial lighting for construction operations when natural light is not adequate for work.

1.04 TEMPORARY HEATING

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

1.05 TEMPORARY COOLING

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.

1.06 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.07 COMMUNICATION SERVICES

A. Telephone Service: Provide, maintain, and pay for telephone service to field office and Engineer's field office at time of project mobilization and until completion of Work.

B. Facsimile service: Provide, maintain and pay for facsimile service including dedicated telephone line to field office and Engineer's field office at time of project mobilization and until completion of Work.

C. Internet Service: Provide, maintain, and pay for broadband Internet service to field office and Engineer's field office at time of Project mobilization. Provide desktop computer with Microsoft operating system and appropriate office function software, modem, and printer.

1.08 TEMPORARY WATER SERVICE

A. Coordinate with Owner to connect to existing water source. Provide separate metering and reimburse Owner for cost of water used.

B. Contractor shall pay all costs associated for installation, maintenance, and removal of the temporary water.

1.09 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

B. Contractor shall pay all costs for installation, maintenance, and removal of temporary sanitary facilities.

1.10 FIELD OFFICES AND SHEDS

A. Office: Weather tight, with lighting, electrical outlets, heating, cooling, and ventilating equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Provide separate private office for use of Engineer and Owner.

D. Locate offices and sheds minimum distance of 30 feet from existing and new structures.

E. Do not use permanent facilities for field offices or for storage.

F. Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors.
   1. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Work; remove at completion of Work.
   2. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
   3. Exterior Materials: Weather resistant.
   4. Interior Materials in Offices: Sheet type materials for walls and ceilings, pre-finished or painted; resilient floors and bases.
   5. Lighting for Offices: 50 ft C at desk top height, exterior lighting at entrance doors.
   6. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.

G. Environmental Control:
   1. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain comfort conditions.
   2. Storage Spaces: Heating and ventilation as needed to maintain products in accordance with Contract Documents; lighting for maintenance and inspection of products.

H. Owner And Engineer Office:
   1. Separate space for sole use of Owner and Engineer, with separate entrance door with new lock and two keys.
   2. Area: Minimum 150sq ft, minimum dimension 8ft.
   3. Windows: Minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.
   4. Electrical Distribution Panel: Two circuits minimum, 110 volt, 60 Hz service.
   5. Minimum four, 110 volt duplex convenience outlets, one on each wall.
   6. Telephone: As specified in Section 01 50 00 - Temporary Facilities and Controls.
   7. Internet: Provide internet service.
   8. Sanitary Facilities: Convenient access to private lavatory toilet facilities.
   9. Drinking Fountain: Convenient access by workers.
   10. Owner Engineer Office Furnishings:
      a. One desk 54 x 30 inch, with three drawers.
      b. Plan rack to hold working Drawings, shop drawings, and record documents.
      c. One standard four-drawer legal- size metal filling cabinet with locks and two keys for each lock.
      d. Six linear ft of metal bookshelves.
      e. Two swivel arm chairs.
      f. Two straight chairs.
      g. One tackboard 36 x 30 inch.
      h. One waste basket for each desk and table.

I. 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 01 60 00 - Product Requirements.

J. Preparation: Fill and grade sites for temporary structures sloped for drainage away from buildings.

K. Installation:

1. Install office spaces ready for occupancy 15 days after date fixed in Owner-Contractor Agreement.
2. Parking: Two hard surfaced parking spaces for use by Owner and Engineer, connected to office by hard surfaced walk.
3. Employee Residential Occupancy: Not allowed on Owner's property.

L. Maintenance And Cleaning:
1. Weekly janitorial services for offices; periodic cleaning and maintenance for office and storage areas.
2. Maintain approach walks free of mud, water, and snow.

M. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.11 VEHICULAR ACCESS

A. Use existing on-site roads for construction traffic.

1.12 PARKING

A. Use of designated parking reserved for Owner at existing site is not permitted.

B. When existing site space is not adequate, provide additional off-site parking.

C. Do not allow heavy vehicles or construction equipment in parking areas.

D. Maintenance:
1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
2. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original condition.

E. Removal, Repair:
1. Remove temporary materials and construction before Substantial Completion.
2. Repair existing facilities damaged by use to original condition.

F. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.14 SECURITY

A. Security Program:

1. Protect Work from theft, vandalism, and unauthorized entry.
2. Initiate program in coordination with Owner's existing security system at project mobilization.
3. Maintain program throughout construction period until Owner acceptance precludes need for Contractor security.

B. Entry Control:
1. Allow entrance only to authorized persons with proper identification.
2. Owner will control entrance of persons and vehicles related to Owner's operations.

1.15 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment if needed.

B. Protect site from puddles or running water.

1.16 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.

1.17 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize surface area of bare soil exposed at one time.

C. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

F. Comply with sediment and erosion control plan indicated on Drawings.

1.18 NOISE CONTROL

A. Provide methods, means, and facilities to minimize noise produced by construction operations.

1.19 PEST CONTROL

A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work.

1.20 POLLUTION CONTROL

A. 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.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.21 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

F. Equipment electrical characteristics and components.

1.02 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.

B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.

C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.

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

E. Furnish interchangeable components from same manufacturer for components being replaced.

1.03 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.
   1. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. Schedule delivery to reduce long-term on-site storage before installation and operation. Do not deliver equipment to the site more than one month prior to installation without written authorization from the Engineer.

E. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.

F. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.

G. Unload and place items delivered to the site in a manner that will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.

1.04 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. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Store cement and lime under a roof and off the ground and keep completely dry at all times.

G. Store structural, miscellaneous, and reinforcing steel off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting.

H. Store beams with the webs vertical.

I. Handle and store precast concrete in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking.

J. Handle and store brick, block and similar masonry products in a manner to reduce breakage, cracking and spalling to a minimum.

K. Store mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors in a weather-tight building to prevent injury and with adequate ventilation to prevent condensation.
   1. Building may be a temporary structure on site or elsewhere, acceptable to Engineer.
   2. Maintain temperature and humidity within range required by manufacturer.
   3. Store and fully lubricated equipment with oil, grease and other lubricants unless otherwise instructed by the manufacturer.

4. Rotate moving parts a minimum of once weekly to ensure proper lubrication and to avoid metal to metal "welding".
5. Upon installation of the equipment, start the equipment, at least half load, and once weekly for an adequate period to ensure that the equipment does not deteriorate from lack of use.
6. Change lubricants upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Put new lubricants into the equipment at the time of acceptance.
7. Prior to acceptance of the equipment, have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period.
    a. If certification is not given, the equipment shall be judged to be defective.
    b. It shall be removed and replaced at the Contractor's expense.

L. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

M. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout procedures.

B. Final Cleaning.

C. Starting of Systems.

D. Protecting installed construction.

E. Project record documents.

F. Operation and maintenance data.

G. Spare parts and maintenance products.

H. Product warranties and product bonds.

1.02 CLOSEOUT PROCEDURES

A. Prerequisites to Substantial Completion: Complete following items before requesting Certification of Substantial Completion, either for entire Work or for portions of Work:
   1. Submit maintenance manuals, Project record documents, digital images of construction photographs, and other similar final record data in compliance with this Section.
   2. Complete facility startup, testing, adjusting, balancing of systems and equipment, demonstrations, and instructions to Owner's operating and maintenance personnel as specified in compliance with this Section.
   3. Conduct inspection to establish basis for request that Work is substantially complete. Create comprehensive list (initial punch list) indicating items to be completed or corrected, value of incomplete or nonconforming Work, reason for being incomplete, and date of anticipated completion for each item. Include copy of list with request for Certificate of Substantial Completion.
   4. Obtain and submit releases enabling Owner's full, unrestricted use of Project and access to services and utilities. Include certificate of occupancy, operating certificates, and similar releases from authorities having jurisdiction and utility companies.
   5. Deliver tools, spare parts, extra stocks of material, and similar physical items to Owner.
   6. Make final change-over of locks and transmit keys directly to Owner. Advise Owner's personnel of change-over in security provisions.
   7. Discontinue or change over and remove temporary facilities and services from Project Site, along with construction tools, mockups, and similar elements.
   8. Perform final cleaning according to this Section.

B. Substantial Completion Inspection:
   1. When Contractor considers Work to be substantially complete, submit to the Engineer the following:
      a. A written notice stating the work, or designated portion thereof, is substantially complete.
      b. List of items to be completed or corrected (initial punch list).
      c. A request for a date of inspection.
   2. Within seven days after receipt of request for Substantial Completion, Engineer will make inspection to determine whether Work or designated portion is substantially complete.
   3. Should Engineer determine that Work is not substantially complete:
      a. Engineer will promptly notify Contractor in writing, stating reasons for its opinion.
      b. Contractor shall remedy deficiencies in Work and send second written request for Substantial Completion to Engineer.
      c. Engineer will reinspect Work.
      d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.
   4. When Engineer finds that Work is substantially complete, Engineer will:
      a. Prepare Certificate of Substantial Completion Section 00 65 16 - Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified and amended by Engineer and Owner (final punch list).
      b. Submit Certificate to Owner and Contractor for their written acceptance of responsibilities assigned to them in Certificate.
   5. After Work is substantially complete, Contractor shall:
      a. Allow Owner occupancy of Project under provisions stated in Certificate of Substantial Completion.
      b. Complete Work listed for completion or correction within time period stipulated.

C. Prerequisites for Final Completion: Complete following items before requesting final acceptance and final payment.
   1. When Contractor considers Work to be complete, submit written certification that:
      a. Contract Documents have been reviewed.
      b. Work has been examined for compliance with Contract Documents.
      c. Work has been completed according to Contract Documents.
      d. Work is completed and ready for final inspection.
   2. Submittals: Submit following:
      a. Final punch list indicating all items have been completed or corrected.
      b. Final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
      c. Specified warranties, workmanship/maintenance bonds, maintenance agreements, and other similar documents.
      d. Accounting statement for final changes to Contract Sum.
      e. Contractor's affidavit of payment of debts and claims.
      f. Contractor affidavit of release of liens.
      g. Consent of surety to final payment.
   3. Perform final cleaning for Contractor-soiled areas according to this Section.

D. Final Completion Inspection:
   1. Within seven days after receipt of request for final inspection, Engineer will make inspection to determine whether Work or designated portion is complete.

2. Should Engineer consider Work to be incomplete or defective:
    a. Engineer will promptly notify Contractor in writing, listing incomplete or defective Work.
    b. Contractor shall remedy stated deficiencies and send second written request to Engineer that Work is complete.
    c. Engineer will reinspect Work.
    d. Redo and Inspection of Deficient Work: Repeated until Work passes Engineer's inspection.

1.03 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean site; sweep paved areas, rake clean landscaped surfaces.

C. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.04 STARTING OF SYSTEMS

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

B. Notify Engineer seven (7) days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01 33 00 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

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. Prohibit traffic from landscaped areas.

1.06 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements, or located by GPS to sub-meter accuracy.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.

G. Submit documents to Engineer with claim for final Application for Payment.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit three (3) copies of data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable covers.
   1. Submit one (1) electronic copy of data whenever possible.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of each binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Warranties and bonds.

1.08 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

C. Submit to Engineer three (3) copies of a complete list and quantities of spare parts, maintenance and extra products furnished.

1.09 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable cover.

F. Submit prior to final Application for Payment.

G. Time Of Submittals:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to demolish, modify, remove and dispose of material as shown on the Drawings and specified herein.

B. Included, but not limited to, are demolition, modifications and removal of existing materials, equipment or work necessary to install the new work as shown on the Drawings and as specified herein and to connect with existing work in approved manner.

C. Demolition, modifications and removals that may be specified under other Sections shall conform to requirements of this Section.

D. Blasting and the use of explosions will not be permitted for any demolition work.

1.02 RELATED WORK

A. Summary of Work is included in Section 01 10 00.

B. Submittals are included in Section 01 33 00.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01 33 00, a demolition plan describing the proposed sequence, methods of operation, equipment, and disposal of each item prior to the start of work.

B. Include in the demolition plan the methods used to control the disruption of utilities, maintain current treatment operations, and manage traffic to and from the site.

1.04 QUALITY ASSURANCE

A. Demolish and remove existing construction, utilities, equipment, and appurtenances without damaging integrity of existing structures, equipment, and appurtenances that are to remain.

B. Erect and maintain barriers, lights, sidewalk sheds and other required protective devices.

C. Carry out operations to avoid interference with operations and work in the existing facilities.

D. Notification

1. At least forty-eight (48) hours before commencement of a demolition or removal, notify the Engineer and Owner in writing of proposed demolition.

2. Owner shall inspect the existing equipment, identify and mark those items which are to remain the property of the Owner. Removal of equipment shall not be started without the permission of the Engineer and Owner.

3. Obtain written approval from utility companies and municipal departments prior to discontinuing or interrupting utility services as part of demolition work.

4. Obtain written authorization from the Engineer before disrupting any utilities.

E. The Owner and the Engineer do not assume any responsibility for the actual condition of the structures to be demolished or modified.

F. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur prior to the start of demolition work.

G. Notify Engineer upon discovery of hazardous materials.

H. Repair or remove and replace with new items those items, which are to remain that are damaged due to demolition activity, at no additional cost to the Owner. Repairs shall be made to a condition at least equal to that which existed prior to start of work.

I. Access:

1. Conduct demolition and modification operations and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both onsite and offsite and to ensure minimum interference with occupied or used facilities.

2. Special attention is directed towards maintaining safe and convenient access to the existing facilities for plant personnel and vehicles.

J. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Engineer and Owner. Closing or obstructing of roadways, sidewalks and passageways adjacent to the work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.

K. Furnish alternate routes around closed or obstructed traffic in access ways.

1.05 DISPOSAL OF MATERIAL

A. All material and items of equipment that are not marked by the Owner for salvage shall become the Contractor's property and shall be removed from the site.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 GENERAL

A. All materials and equipment removed shall become the property of the Contractor, except for those that the Owner has identified and marked for his use. All materials and equipment marked by the Owner to remain shall be carefully removed, so as not to be damaged, cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or Construction Coordinator or loaded onto trucks provided by the Owner.

B. Dispose of all demolition materials, equipment, debris and all other items not marked by the Owner to remain, off the site and in conformance with all existing applicable laws and regulations.

C. Exercise precautions for fire prevention. Make fire extinguishers approved for Class A, B. and C fires available at all times in areas where performing demolition work with burning torches. Do not burn demolition debris on site.

D. Provide safe working conditions for personnel. Provide protection from inclement weather for materials, equipment, and personnel located in partially dismantled structures. Prior to any demolition, erect a safety barricade around the entire demolition work area.

E. Erect temporary partitions to separate demolition work areas from areas to remain, to prevent dust penetration and damage to existing materials and equipment.

F. Do not disrupt foot or vehicular traffic within work area at all times during demolition operations. Provide and maintain lights, barriers, and temporary passageways for free and safe access.

G. Pollution Controls:

1. Use water sprinkling, temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

2. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding and pollution.

H. Clean adjacent structures, facilities, and improvements of dust, dirt and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the work.

I. Finished grading elevations in the existing Plant site should remain as close to original elevations as possible after demolition.

3.02 STRUCTURAL DEMOLITION

A. Remove structures to the lines and grades shown unless otherwise directed. Where no limits are shown, the limits shall be 4-in outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Engineer with no additional compensation to the Contractor.

B. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise directed. Demolished items shall not be used in backfill adjacent to structures or in pipeline trenches.

C. After removal of parts or all of masonry walls, slabs and like work which tie into new work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.

3.03 MECHANICAL DEMOLITION

A. Mechanical removals shall consist of dewatering, dismantling and removing of existing septic systems, piping, pumps, motors, equipment and other appurtenances as specified, shown, or required for the completion of the work. This may require using a submersible pump to remove any liquids that remain in the facility and that cannot be drained and shall include cutting, capping, and plugging as required.

B. Existing process, water, chemical, gas, fuel oil and other piping not required for the new work shall be properly removed where shown or where it will interfere with new work. Piping not indicated to be removed or which does not interfere with new work shall be removed to the

nearest solid support, capped and left in place. Chemical and fuel lines and tanks shall be purged and made safe prior to removal or capping.

C. The removal and proper disposal of all underground storage tanks shall be coordinated with the EPD Underground Storage Tank Program.

D. All mechanical equipment shall be salvaged to the extent possible. Equipment in good condition may be reconditioned and sold; remaining metals may be sold for scrap.

E. In the case that a facility is to be abandoned in place, all concrete and steel structures shall ideally be demolished three feet below ground level. All concrete and steel tanks shall be cracked to allow for drainage of rainwater. Soil shall be backfilled over structures.

F. The entire facility shall be stabilized with grass and its NPDES permit shall be revoked or allowed to expire. A letter shall be sent to the EPD indicating that the facility is no longer in service.

3.04 ELECTRICAL DEMOLITION

A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panelboards, lighting fixtures and miscellaneous electrical equipment all as shown on the Drawings, specified herein, or required to perform the work.

B. All existing electrical equipment and fixtures to be removed shall be disconnected and removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to maintain the integrity of the grounding systems.

C. All conduits and wires shall be removed and disposed of offsite. All wiring in underground ductbanks shall be removed. All direct burial cable shall be removed.

D. Poles and overhead wiring within the limits of demolition shall be abandoned as shown. Poles shall be completed removed from the site. The overhead wires shall be salvaged and stored. Perform this work after the proposed service has been completed and energized, and in accordance with the approved schedule.

E. All lighting fixtures shall be removed from the site. Florescent bulbs shall be removed and disposed offsite in accordance with environmental regulations.

F. Wall switches, receptacles, starters and other miscellaneous electrical equipment shall be removed and disposed of off the site as required.

3.05 CLEAN-UP

A. Remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Formwork for cast-in place concrete.
   2. Shoring, bracing, and anchorage.
   3. Openings for other affected work.
   4. Architectural form liners.
   5. Form accessories.
   6. Form stripping.

B. Related Sections:
   1. Section 03 20 00 - Concrete Reinforcing.
   2. Section 03 30 00 - Cast-In-Place Concrete.
   3. Section 05 50 00 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.

1.02 REFERENCES

A. PS 1 – Construction and Industrial Plywood.

B. American Concrete Institute:
   1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 301 - Specifications for Structural Concrete.
   3. ACI 318 - Building Code Requirements for Structural Concrete.
   4. ACI 347 - Guide to Formwork for Concrete.

C. ASTM International:
   1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
   2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.03 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.
   1. Indicate design data for formwork.
   2. Indicate loads transferred to structure during process of concreting, shoring and reshoring.
   3. Include structural calculations to support design.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. For wood products furnished for work of this Section, comply with AF&PA.

1.05 DELIVERY, STORAGE, AND HANDLING

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

B. Deliver void forms and installation instructions in manufacturer's packaging.

C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.06 COORDINATION

A. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

B. Lumber Forms:
   1. Application: Use for edge forms and unexposed finish concrete.
   2. Boards: “Standard” Grade Douglas Fir, straight, dressed all sides, uniform width and thickness, free from surface defect and of a sufficient grade to support the designed loads.

C. Plywood Forms:
   1. Application: Use for exposed finish concrete.
   2. Forms: Conform to PS 1; waterproof, resin-boned, exterior type Douglas Fir.

D. Prefabricated Steel Forms: Will be of sufficient quality to assure the structure will meet all code requirements.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, adjustable length, cone type, with waterproofing washer, free of defects capable of leaving holes larger than 7/8 inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
   1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.

2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture. Manufactured by Richmond "Rich Cote" or L & M "Debond", or equal.

E. Vapor Retarder: Where indicated on Drawings, 8 mil thick polyethylene sheet.

F. Bituminous Joint Filler: ASTM D1751.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

H. Water Stops: Rubber or Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

I. Fillets for Chamfered Corners: ¾ inch wood strips.

2.03 COATINGS

A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.02 INSTALLATION

A. Earth Forms:
1. Earth forms are not permitted.

B. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.

4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:
1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 318.

G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

H. Obtain Engineer’s approval before framing openings in structural members not indicated on Drawings.

I. Install fillet and chamfer strips on external corners of beams, joists, and columns.

J. Install void forms in accordance with manufacturer's recommendations.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Do not coat forms for

concrete indicated to receive “scored finish”. Apply form coatings before placing reinforcing steel.

3.04 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
   1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
   2. Place ties at least 1 inch away from finished surface of concrete.
   3. Leave inner rods in concrete when forms are stripped.
   4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
   1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
   2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
   3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
   4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
   1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   2. Do not embed wood or uncoated aluminum in concrete.
   3. Obtain installation and setting information for embedded items furnished under other Specification sections.
   4. Securely anchor embedded items in correct location and alignment prior to placing concrete.

5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
   1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   2. Coordinate work to avoid cutting and patching of concrete after placement.
   3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:
   1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
   2. Slope slabs to drain where required or as shown on Drawings.
   3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
   1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
   2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:
   1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
   2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.05 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.06 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.07 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 318.

3.08 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Reinforcing bars.
   2. Welded wire fabric.
   3. Reinforcement accessories.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 30 00 - Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.
   3. ACI 530.1 - Specifications for Masonry Structures.
   4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
   1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   3. A185/A185M-07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   4. ASTM A496/A496M - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   5. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
   6. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   7. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
   8. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   9. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   10. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
   11. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
   12. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

13. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

C. American Welding Society:
   1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute:
   1. CRSI - Manual of Standard Practice.
   2. CRSI - Placing Reinforcing Bars.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
   1. Certified copies of mill test report of reinforcement materials analysis may be considered evidence of compliance provided such tests are regularly conducted by the reinforcement supplier by experienced, competent personnel using adequate testing equipment.
   2. Engineer may order independent lab testing on mill samples or delivered steel reinforcement if mill tests are considered inaccurate or inadequate.
   3. Results of laboratory or mill tests submitted to Engineer shall be of tests conducted no more than 90 days before delivery.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

1.05 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.06 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, plain billet bars, uncoated finish.

B. Plain Wire: ASTM A82/A82M; unfinished.

C. Welded Plain Wire Fabric: ASTM A185/A185M; in flat sheets or coiled rolls; unfinished.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic-coated steel type; size and shape to meet Project conditions.

D. Reinforcing Splicing Devices: Exothermic welding type; full tension and compression; sized to fit joined reinforcing.

2.03 FABRICATION

A. Fabricate concrete reinforcement in accordance with ACI 318.

B. Form standard hooks for bends, stirrups and tie hooks, and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous plain bar or wire.

F. Form ties and stirrups from the following:
   1. For bars No. 10 and Smaller: No. 3 deformed bars.
   2. For bars No. 11 and Larger: No. 4 deformed bars.

G. Weld reinforcement in accordance with AWS D1.4.

H. Locate reinforcement splices not indicated on Drawings, at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
   1. Do not weld crossing reinforcement bars for assembly.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318.

1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain concrete cover around reinforcement in accordance with ACI 318 as follows:

Reinforcement Location		Minimum Concrete Cover
Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	4 inches
	No. 5 bars and smaller	2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	1 inch
Beams and Columns		1-1/2 inches
Shell and Folded Plate Members	No. 6 bars and larger	3/4 inches
	No. 5 bars and smaller	1/2 inches

F. Splice reinforcing in accordance with splicing device manufacturer's instructions.

3.02 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

C. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.03 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform field inspection and testing in accordance with ACI 318.

C. Provide free access to Work and cooperate with appointed firm.

D. Reinforcement Inspection:
1. Placement Acceptance: Specified and ACI 318 material requirements and specified placement tolerances.

2. Welding: Inspect welds in accordance with AWS D1.1.
3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
4. Weldability Inspection: Inspect for reinforcement weldability when formed from steel other than ASTM A706/A706M.
5. Continuous Weld Inspection: Inspect reinforcement as required by ACI 318.
6. Periodic Weld Inspection: Other welded connections.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete for the following:
   1. Slabs on grade.
   2. Control, expansion and contraction joint devices.
   3. Equipment pads.
   4. Thrust blocks.
   5. Manholes.
   6. Foundation walls.
   7. Supported Slabs.

B. Related Sections:
   1. Section 03 10 00 - Concrete Forming and Accessories.
   2. Section 03 20 00 - Concrete Reinforcing.
   3. Section 31 00 00 - Earthwork.

1.02 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 305 - Hot Weather Concreting.
   3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   4. ACI 308.1 - Standard Specification for Curing Concrete.
   5. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   3. ASTM C33 - Standard Specification for Concrete Aggregates.
   4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
   7. ASTM C150 - Standard Specification for Portland Cement.
   8. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   9. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   10. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   11. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   12. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.

13. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
14. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
15. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
16. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
17. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
18. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
19. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
20. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
21. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
22. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
23. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.03 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 0.3 perms when tested in accordance with ASTM E96/E96M, water method.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on joint devices, attachment accessories and admixtures.

C. Design Data:
   1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
      a. Hot and cold weather concrete work.
      b. Air entrained concrete work.
   2. Identify mix ingredients and proportions, including admixtures.
   3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

D. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.05 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 318.

B. Conform to ACI 305 when concreting during hot weather.

C. Conform to ACI 306.1 when concreting during cold weather.

D. Acquire cement and aggregate from one source for Work.

E. Fire Rated Construction:
   1. Tested Rating: Determined in accordance with ASTM E119.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Maintain concrete temperature after installation at minimum 50 degrees F (10 degrees C) for minimum 7 days.

1.08 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal, Type IA - Air Entraining, Type II – Moderate, Type IIA - Air Entraining, Type III - High Early Strength, Type IIIA - Air Entraining Portland type.

B. Normal Weight Aggregates: ASTM C33.
   1. Coarse Aggregate Maximum Size: In accordance with ACI 318.

C. Water: ACI 318; potable, without deleterious amounts of chloride ions.

2.02 ADMIXTURES

A. Furnish materials in accordance with Georgia Department of Transportation.

B. Air Entrainment: ASTM C260.

C. Chemical: ASTM C494/C494M.

D. Silica Fume: ASTM C1240.

E. Slag: ASTM C989; ground granulated blast furnace slag.

F. Plasticizing: ASTM C1017/C1017M.

2.03 ACCESSORIES

A. Bonding Agent: Two component epoxy.
   1. Manufacturers:
      a. Euco Epoxy Model #463.
      b. Euclid Chemical Company Model #615.
      c. Sika Chemical Corporation Model #615.

B. Vapor Retarder: ASTM E1745; 6 mil thick clear polyethylene film.

C. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.04 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type C: ASTM D1752; Premolded sponge rubber.

B. Construction Joint Devices: formed to tongue and groove profile.

C. Expansion and Contraction Joint Devices: ASTM B221.

D. Sealant: ASTM D6690, Type I.

2.05 CONCRETE MIX

A. Select proportions for concrete in accordance with ACI 318.

B. Provide concrete to the following criteria:
   1. Class A - Normal Weight 4,500 psi @ 28 days
   2. Class B - Normal Weight 3,000 psi @ 28 days

C. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.
   1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
   2. Do not use calcium chloride nor admixtures containing calcium chloride.
   3. Use set retarding admixtures during hot weather.
   4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing.

D. Average Compressive Strength Reduction: Not permitted.

E. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94/C94M.

F. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 318.

B. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

D. Deposit concrete at final position. Prevent segregation of mix.

E. Place concrete in continuous operation for each panel or section determined by predetermined joints.

F. Consolidate concrete.

G. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

H. Place concrete continuously between predetermined expansion, control, and construction joints.

I. Do not interrupt successive placement; do not permit cold joints to occur.

J. Placing during non-daylight hours
   1. Concrete shall be placed during daylight hours unless otherwise approved by the Engineer. Placing of concrete in a portion of work shall not be started unless that portion of the work can be completed during daylight. Daylight is defined as the period one hour before sunrise to one hour after sunset.

2. If it is desired by the Contractor to place concrete during non-daylight hours, the Contractor shall provide an adequate lighting system approved by the Engineer. Approval of the placing of concrete during non-daylight hours shall in no way lessen the responsibility of the Contractor as related to the Work.

3.04 CONCRETE FINISHING

A. Provide formed concrete with finish as Scheduled in this section.

B. Finish concrete floor surfaces in accordance with ACI 318.

C. Wood float surfaces with full bed setting system.

D. Steel trowel surfaces receiving resilient flooring.

E. Steel trowel surfaces which are indicated to be exposed.

F. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains.

3.05 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
   1. Protect concrete footings from freezing for minimum 5 days.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 318.

D. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.

E. Spraying: Spray water over floor slab areas and maintain wet for 7 days.

3.06 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform field inspection and testing in accordance with ACI 318.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to Engineer for review prior to commencement of Work.

E. Concrete Inspections:
   1. Continuous Placement Inspection: Inspect for proper installation procedures.
   2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

F. Strength Test Samples:

1. Sampling Procedures: ASTM C172.
2. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, standard cured.
3. Sample concrete and make one set of four cylinders for every 75 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
4. Make one additional cylinder during cold weather concreting, and field cure.

G. Field Testing:
1. Slump Test Method: ASTM C143/C143M.
2. Air Content Test Method: ASTM C173/C173M.
3. Temperature Test Method: ASTM C1064/C1064M.
4. Measure slump and temperature for each compressive strength concrete sample.
5. Measure air content in air entrained concrete for each compressive strength concrete sample.

H. Cylinder Compressive Strength Testing:
1. Test Method: ASTM C39/C39M.
2. Test Acceptance: In accordance with ACI 318.
3. Test one cylinder at 7 days.
4. Test two cylinders at 28 days.
5. Hold one cylinder for 56 days if the average of the two 28 day tests does not reach the required compressive strength.
6. Dispose remaining cylinders when testing is not required.

I. Core Compressive Strength Testing:
1. Sampling and Testing Procedures: ASTM C42/C42M.
2. Test Acceptance: In accordance with ACI 318.
3. Drill three cores for each failed strength test from concrete represented by failed strength test.

J. Water Soluble Chloride Ion Concentration Test Method: ASTM C1218/C1218M; tested at 28 days.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.07 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections as directed by Engineer in accordance with ACI 318.

3.08 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 03 41 00

PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes structural precast concrete for:
   1. Columns and bearing saddles.
   2. Beams.
   3. Spandrels.
   4. Girders.
   5. Purlins.
   6. Floor.
   7. Channel slabs.
   8. Inverted tee beam.
   9. Grout packing.
   10. Connection devices.
   11. Lintels.
   12. Bond beams.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute:
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. A185/A185M-07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   3. ASTM A416/A416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
   4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM C150 - Standard Specification for Portland Cement.
   6. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.
   2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

D. Precast/Prestressed Concrete Institute:
   1. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

2. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete.
3. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete.

1.03 DESIGN REQUIREMENTS

A. Size components to withstand design loads.

B. Maximum Allowable Deflection: 1/360 span.

C. Seismic Design: Design and detail elements and connections to resist seismic force in accordance with ACI 318.

D. Design members exposed to weather to allow movement of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.

E. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

F. Calculate structural properties of framing members in accordance with ACI 318.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Signed and sealed by professional engineer.

C. Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials, and sealed by professional engineer.

D. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.

E. Samples: Submit two samples 12 x 12 inch in size illustrating surface finish treatment.

F. Design Data: Signed and sealed by professional engineer.
1. Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing and connections.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with requirements of PCI MNL-116, PCI MNL-123, PCI MNL-120.

B. Fire Rated Construction: Determined in accordance with ASTM E119.

1.06 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum three years documented experience.

B. Erector: Company specializing in erecting Work of this section approved by manufacturer.

C. Design precast concrete members under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Georgia.

D. Welder: Qualified within previous 12 months for types of welds indicated, in accordance with AWS D1.1 and AWS D1.4.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

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

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

C. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

D. Protect members to prevent staining, chipping, or spalling of concrete.

E. Mark each member with date of production and final position in structure.

1.09 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work of framing components not pre-tensioned but associated with the Work of this section.

C. Coordinate cutting required openings 10 inches and smaller.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: Portland, conforming to ASTM C150 Type I. Type III allowed at no cost increase to Owner.

B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator, as appropriate to design requirements and PCI MNL-116.

2.02 REINFORCEMENT

A. Tensioning Steel Tendons: ASTM A416/A416M Grade 250K or 270K, of sufficient strength commensurate with member design.

B. Deformed Reinforcement: ASTM A615/A615M Grade 60, steel bars.

C. Welded Steel Wire Fabric: ASTM A185/A185M Plain Type.

2.03 ACCESSORIES

A. Connecting and Supporting Devices: ASTM A36/A36M carbon steel. Plates, angles, items cast into concrete or items connected to steel framing members, inserts, conforming to PCI MNL-123.

2.04 FABRICATION

A. Fabrication procedure to conform to PCI MNL-116 and ACI 318.

B. Maintain plant records and quality control program during production of precast members. Make records available upon request.

C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.

D. Tension reinforcement tendons as required to achieve design load criteria.

E. Fabricate required openings with dimension larger than 8 inches and embed accessories provided by other Sections, at indicated locations.

F. Exposed Ends at Stressing Tendons: Fill recess with non-shrink grout, trowel flush.

G. Weld steel fabrications in accordance with AWS D1.1. Weld reinforcing steel in accordance with AWS D1.4. Do not tack weld reinforcing.

2.05 FINISHES

A. Finish exposed-to-view finish surfaces of precast concrete members uniform in color and appearance.

B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes including non-uniformity, staining, or surface cracking.

C. Plant Finish (Finish A): Normal plant finish; surface may contain small surface holes caused by air bubbles, minor chips or spalling at edges or ends, without major discoloration.

2.06 FABRICATION TOLERANCES

A. Conform to PCI MNL-116.

B. Maximum Variation From Intended Camber: 5/8 inch.

C. Maximum Out of Square: 1/8 inch/10 feet, non-cumulative.

D. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.

E. Maximum Bowing of Members: Length of Bow/360.

2.07 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

B. Test and analyze stressing tendons in accordance with ASTM A416/A416M.

C. Test and analyze concrete in accordance with ACI 318.

D. Take six concrete test cylinders placed in accordance with ASTM C31.

E. Take slump tests for every set of test cylinders in accordance with ASTM C143.

F. Take one air entrainment test for each set of exterior concrete test cylinders taken.

G. 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 tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions are ready to receive work and field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Prepare support equipment for erection procedure, temporary bracing, and induced loads during erection.

3.03 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Align and maintain uniform horizontal and vertical joints, as erection progresses.

C. Maintain temporary bracing in place until final support is provided. Protect members from staining.

D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.

E. Adjust differential camber between precast members to tolerance before final attachment.

F. Install bearing pads.

G. Level differential elevation of adjoining horizontal members with grout.

H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.

I. Grout underside of column and beam bearing plates and joints between members at roof and floor locations.

J. Weld reinforcing steel in accordance with AWS D1.4. Do not tack weld reinforcing.

K. Secure units in place. Perform welding in accordance with AWS D1.1.

3.04 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Erect members level and plumb within allowable tolerances.

C. Conform to PCI MNL-116.

D. Exposed Joint Dimension: 3/8 inch plus or minus 1/4 inch.

E. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise Engineer. Execute modifications as directed by Engineer.

3.05 FIELD QUALITY CONTROL

A. Welding: Inspect welds in accordance with AWS D1.1.

3.06 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect members from damage caused by field welding or erection operations.

C. Use non-combustible shields during welding operations to protect adjacent Work.

3.07 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

SECTION 03 60 00

GROUTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Portland cement grout.
   2. Rapid curing epoxy grout.
   3. Non-shrink cementitious grout.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute:
   1. ACI 318 - Building Code Requirements for Structural Concrete.

B. American Society of Testing and Materials:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
   3. ASTM C150 - Standard Specification for Portland Cement.
   4. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
   5. ASTM C307 - Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
   6. ASTM C531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   7. ASTM C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacings and Polymer Concretes.
   8. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit product data on grout.

C. Manufacturer's Installation Instructions: Submit manufacturer’s instructions for mixing, handling, surface preparation and placing epoxy type and non-shrink type grouts.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver grout in manufacturer's unopened containers with proper labels intact.

C. Store grout in a dry shelter, protect from moisture.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not perform grouting if temperatures exceed 100 degrees F.

C. Maintain minimum temperature of 45 degrees F before, during, and after grouting, until grout has set.

PART 2 PRODUCTS

2.01 PORTLAND CEMENT GROUT MATERIALS

A. Portland Cement: ASTM C150, Type I and II.

B. Water:
1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
   a. Corrosion of steel.
   b. Volume change increasing shrinkage cracking.
   c. Efflorescence.
   d. Excess air entraining.

C. Fine Aggregate:
1. Washed natural sand.
2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.02 RAPID CURING EPOXY GROUT

A. Manufacturers:
1. Sika Model Sikadur Hi-Mod.
2. Adhesive Engineering Model Concressive 1001 LPL or 1001 Regular.

B. Rapid Curing Epoxy Grout: High strength, three component epoxy grout formulated with thermosetting resins and inert fillers. Rapid-curing, high adhesion, and resistant to ordinary chemicals, acids and alkalies.

Property	Test	Result
Compressive Strength	ASTM C579	12,000 psi at 7 days
Tensile Strength	ASTM C307	2,000 psi minimum
Coefficient of Expansion	ASTM C531	30x10-6 in per degree F
Shrinkage	ASTM C827	None

2.03 NON-SHRINK CEMENTITIOUS GROUT

A. Manufacturers:
   1. Euclid Chemical Model EUCO N-S.
   2. Master Builders Company Model Masterflow 713.
   3. UPCO Division of Emhart Chemical Company Model Upcon High Flow.

B. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

C. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	10,000 psi to 10,800 psi

2.04 FORMWORK

A. Refer to Section 03 10 00 for formwork requirements.

2.05 CURING

A. Prevent rapid loss of water from grout during first 48 hours by use of approved membrane curing compound or with use of wet burlap method.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify areas to receive grout.

3.02 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.03 INSTALLATION - FORMWORK

A. Construct leakproof forms anchored and shored to withstand grout pressures.

B. Install formwork with clearances to permit proper placement of grout.

3.04 MIXING

A. Mix and prepare non-shrink cementitious grout in accordance with manufacturer's instructions.
   1. Capable of developing minimum compressive strength of 2400 psi in 48 hours and 7000 psi in 28 days.

B. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.05 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.06 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.07 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Field inspection and testing will be performed in accordance with ACI 318 and under provisions of Section 01 40 00 - Quality Requirements.

C. Submit proposed mix design of each class of grout to inspection and testing firm for review prior to commencement of Work.

D. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 04 20 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 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Pre-faced concrete masonry units.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

1.03 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PERFORMANCE REQUIREMENTS

A. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to International Building Code.

B. Structural masonry units shall conform To ASTM C 55 or ASTM C 90 and are sampled and tested in accordance with ASTM C 140.

C. For grouted masonry, the grout shall conform to ASTM C 476 with minimum grout compressive strength equals *f 'm* but not less than 3,000 psi. The compressive strength of grout shall be determined in accordance with ASTM C 1019.

D. Sound absorbing structural masonry units shall be type RSC 8" when cells not grouted and type RSC/RF4 8" when cells are grouted. Sound absorption coefficient shall be .94 at 1000 Hertz frequency with sound transmission loss of 58-65 at 1000 Hertz frequency.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:

1. Split-faced concrete masonry units, in the form of small-scale units.

D. Samples for Verification: For each type and color of the following:

1. Split-faced concrete masonry units.
2. Accessories embedded in masonry.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

F. Qualification Data: For testing agency.

G. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.
    a. Include material test reports substantiating compliance with requirements.
    b. For masonry units and sound absorbing structural masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

H. Mix Designs: For each type of mortar and grout Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 270, International Building Code Table 2103.7 (1) and Table 2103.7(2) for mortar mixes required to comply with proportion and property specifications.
2. Include test reports, per ASTM C 476 and International Building Code Table 2103.10, for grout mixes required to comply with compressive strength requirement.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C1093 for testing indicated, as documented according to ASTM E548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Build sample panels for typical exterior wall in sizes approximately 48-in by 48- in high by full thickness.

2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.

3. Clean one-half of exposed faces of panels with masonry cleaner indicated.

4. Protect approved sample panels from the elements with weather-resistant membrane.

5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Engineer in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Engineer in writing.

F. Pre-installation Conference: Conduct conference at Project site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

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

1.08 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24-inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof 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 from mortar splatter by spreading coverings 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 onto 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 substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in International Building Code.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40-deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in International Building Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.03 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

2. Provide square-edged units for outside corners, unless otherwise indicated.

3. Provide sound absorbing structural masonry units in sizes indicated on the contract documents.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

a. Products:

1) Addiment Incorporated; Block Plus W-10.

2) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.

3) Master Builders, Inc.; Rheopel.

C. Split-faced and Smooth-faced Concrete Masonry Units: ASTM C 90, 2000 International Building Code.

1. Unit Compressive Strength: Provide units with minimum load bearing compressive strength of 2500 psi.

2. Weight Classification: Normal weight. (Width 4”,8”,12”x16”)

3. Size: Manufactured to dimensions specified in "Concrete Masonry Units" Paragraph above.

4. Pattern and Texture:

a. Standard pattern, split-face finish. Lafarge or Engineers approved equal.

b. Standard pattern, smooth-face finish.

5. Colors: From manufacturer’s standard range.

2.04 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. 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, Type S.

1. Products:

a. Capital Materials Corporation; Flamingo Color Masonry Cement.

b. Essroc, Italcementi Group; Brixment or Velvet.

c. Holcim (US) Inc.; Mortamix Masonry Cement.

d. Lafarge North America Inc.; Magnolia Masonry Cement.

e. Lehigh Cement Company; Lehigh Masonry Cement

f. National Cement Company, Inc.; Coosa Masonry Cement.

C. Mortar Cement: ASTM C 1329 2000 International Building Code.

1. Products:

a. Lafarge North America Inc.; Lafarge Mortar Cement.

D. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

E. Aggregate for Grout: ASTM C 404.

F. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products:

a. Addiment Incorporated; Mortar Kick.

b. Euclid Chemical Company (The); Accelguard 80.

c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.

d. Sonneborn, Div. of ChemRex; Trimix-NCA.

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

1. Products:

a. Addiment Incorporated; Mortar Tite.

b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.

I. Water: Potable.

2.05 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951 2000 International Building Code.

1. Interior Walls: Hot-dip galvanized, carbon steel.

2. Exterior Walls: Hot-dip galvanized, carbon steel.

3. Wire Size for Side Rods: W1.7 or 0.148-inch.

4. Wire Size for Cross Rods: W1.7 or 0.148-inch.

5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.

6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Tab type, truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.06 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82; with ASTM A 153/A 153M, Class B-2 coating.

2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.

3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Corrugated Metal Ties: Metal strips not less than 7/8-inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from steel sheet, galvanized after fabrication. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.

C. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.097-inch thick, steel sheet, galvanized after fabrication, galvanized sheet may be used at interior walls, unless otherwise indicated.

2.07 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

C. Anchor Bolts: Headed 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/A 153M, Class C; of dimensions indicated.

D. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).

2.08 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual and as follows:

1. Fabricate continuous flashings in sections 96 inches minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

2. Fabricate through-wall metal flashing embedded in masonry from, with ribs at 3 inch intervals along length of flashing to provide an integral mortar bond.

3. Fabricate through-wall flashing with drip edge where, unless otherwise indicated. Fabricate by extending flashing ½-inch from wall, with outer edge bent down 30 degrees and hemmed.

B. Solder and Sealants for Sheet Metal Flashings.

1. Elastomeric Sealant: ASTM C920, chemically curing polysulfide sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.09 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use one of the following, unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from UV-resistant synthetic fiber, 3/8-inch in diameter, in length required to produce 2 inch exposure on exterior and 18 inches in cavity between wythes. Use only for weeps.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Products:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.

b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.

c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

E. Masonry accessories as indicated on construction documents.

2.10 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers:

a. Diedrich Technologies, Inc.

b. EaCo Chem, Inc.

c. ProSoCo, Inc.

2.11 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. Limit cementitious materials in mortar to portland cement and lime.

3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement and lime.

4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, BIA Technical Notes 8A, Section 2103 2000 International Building Code for Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S or N.
2. For reinforced masonry, use Type S or N.
3. For mortar parge coats, use Type S or N.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S or N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Engineer's sample.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

F. Grout for Unit Masonry: Comply with ASTM C476, 2000 International Building Code.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 2103.10 in the 2000 International Building Code.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

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 work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, maximum.

2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼-inch in 10 feet maximum.

3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet maximum.

3.03 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs. Adhere to isometric view. See contract drawings for clarification

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

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

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

3.04 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

3.05 MASONRY JOINT REINFORCEMENT

1. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.06 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 3/8-inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 16 inches o.c. horizontally.

3.07 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows using one of the following methods:

1. Install 1/2-inch foam rubber backer rod with 3/8 inch by 3/8 inch caulk bead.

2. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.08 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in Sections 2103.11.1 through 2103.11.7 in the 2000 International Building Code.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Limit height of vertical grout pours to not more than 60 inches.

3.09 CONCRETE BLOCK TESTS

A. Tests in accordance with ASTM C 90 and C 140, latest editions.

B. Compressive strength of units based on net area, shall be 2500 psi minimum.

C. Prior to delivery of concrete block units Contractor shall furnish to an approved independent testing laboratory sufficient samples of concrete masonry units for testing as described above. Results of these shall be reported to the Engineer and approval obtained prior to commencement of masonry work.

D. At periodic intervals of not more than 30 days during the progress of masonry work, additional tests shall be run and results reported in like manner. There shall be a minimum of one additional test prior to the completion of any masonry work not lasting at lease 30 days.

E. Costs of the tests shall be borne by the Owner.

3.10 MASONRY PRISMS

A. Baseline Testing
   1. Baseline tests by an approved independent testing laboratory shall be made on masonry prisms prior to the commencement of work. Four prisms shall be constructed and tested in accordance with the latest edition of ASTM E 447. Two prisms shall be tested at 7 days and the remaining two at 28 days. No work shall be performed prior the Engineer's approval of the 28-day test results. Baseline prism testing shall be congruent with baseline mortar testing. Prisms shall be field constructed.

B. Construction Testing
   1. Construction tests by an approved independent testing laboratory shall be made on masonry prisms during the construction of each lift of masonry between floors, for each structure. Four prisms shall be constructed in accordance with the latest edition of ASTM E 447 for each test.

C. Prisms shall be field samples constructed from concrete masonry units of the same size and type as the structure being erected with cross webs mortared. They shall be made by mechanics performing the masonry work using random selected masonry units and job mixer mortar. Hollow cores shall not be grouted.

D. In building the prisms, the moisture content of the units at the time of laying, the consistency of the mortar, and the width and thickness of mortar joints shall be the same as used in the structure.

E. Test prisms shall be cured per ASTM E 447, latest edition.

F. The ends of each prism shall be capped with a satiable material such as calcined gypsum to provide bearing surfaces plane within .003 inches and perpendicular to the axis of the prism.

G. Prisms shall be tested in accordance with the applicable provisions of ASTM E 447.

H. Two prisms for each construction test shall be broken at 7 days and the remaining two at 28 days.

I. Cost of all tests shall be borne by the Owner.

3.11 GROUT TESTS

A. Test for concrete grout fill shall be in accordance with ASTM C 1019.

B. Three specimens shall be taken for each days work. These specimens shall be broken at 28 days.

C. Costs of all tests shall be borne by the Owner.

3.12 MORTAR TESTS

A. Baseline Testing

1. Baseline tests by an approved independent testing laboratory shall be made on mortar cylinders prior to the commencement of work. Four cylinders shall be constructed and tested in accordance with the latest edition of ASTM C 780. Two cylinders shall be tested at 7 days and the remaining two at 28 days. No work shall be performed prior to the Engineer's approval of the 28-day test results. Baseline mortar testing shall be congruent with baseline masonry prism testing. Cylinders shall be field samples. Specimens shall be 2" x 4" cylinders.

2. In addition masonry cement samples, and masonry sand samples shall be submitted to an approved independent laboratory, by the contractor, for testing prior to the commencement of work. Masonry cement samples shall be tested in accordance with ASTM C 91. Masonry sand shall be tested in accordance with ASTM C 144. All results shall be submitted to the Engineer for review prior to the commencement of work.

3. Once approved, neither the mix nor the materials shall be altered during the course of work except upon written order of the Engineer.

B. Construction Testing

1. Construction tests by an approved independent laboratory shall be made on mortar cylinders each day that block work is laid. Two cylinders shall be constructed in accordance with ASTM C 780 for each test. Specimens shall be 2" x 4" cylinders. Contractor shall be responsible for providing minimum facilities for storage as described in ASTM C 780. One cylinder shall be tested at 7 days and the final cylinder shall be tested at 28 days. All cylinders shall be tested in accordance with the latest edition of ASTM C 780.

2. The cost of all mortar testing shall be borne by the Owner.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, 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 sealant application, where indicated.

C. Point and tool holes made by foam insulation installer.

D. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

8. Clean stone trim to comply with stone supplier's written instructions.

9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

SECTION 05 00 00

MISCELLANEUOS METALS

PART 1 GENERAL

1.01 SUMMARY

A. Furnish all labor, equipment, materials and incidentals required to fabricate and install miscellaneous metals complete as indicated on the Drawings and as specified herein.

B. Miscellaneous metal items described on the Drawings and not necessarily named therein, shall be provided as shown and are subject to applicable requirements of this section.

C. Related Sections:
   1. Section 09 90 00: Painting.
   2. Section 05 05 25: Anchor Bolts.
   3. Section 05 10 00: Structural Metal Framing.
   4. Section 40 23 00: Water and Wastewater Process Piping.

1.02 SUBMITTALS

A. Submit to the Engineer, in accordance with the General Conditions and Division 01 shop drawings and product data showing materials of construction and details of installation for all items furnished under this Section.

B. Detailed shop drawings, product data sheets, and erection and installation details for miscellaneous metals items shall be submitted in accordance with the Section 01 33 00 of these specifications.

C. Submittals shall indicate thickness, type, grade, class of metal, and dimensions, and shall show construction details, reinforcement, anchorage, welds and fasteners, and installation with relation to other construction.
   1. Submittals shall also include welder electrode certifications and copies of welding certifications for each welder, and each type of field weld to be performed on the job.
   2. Welder certifications shall be in accordance with AWS D1.1, latest edition.

D. Shop drawings shall be made to conform with the design drawings.
   1. Contract drawings shall take precedence over shop drawings unless otherwise authorized in writing.
   2. Review of the shop drawings by the Engineer does not constitute a change to the contract.

E. The Contractor shall be responsible for all dimensions. He shall coordinate all dimensions with the requirements of the Contract Drawings and notify the Engineer of any discrepancy.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM A36 – Standard Specification for Carbon Structural Steel.

2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
6. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
7. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
11. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy with Improved Formability.
12. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings.
13. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
14. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
15. ASTM A536 - Standard Specification for Ductile Iron Castings.
16. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

B. American Iron and Steel Institute (AISI)

C. American Welding Society (AWS)
1. AWS D1.1 – Structural Welding Code - Steel
2. AWS D1.2 – Structural Welding Code - Aluminum

D. Federal Specifications
1. FS – FF – B – 575C – Bolts, Hexagonal and Square

E. Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other sections.

C. All welding shall be performed by qualified welders and shall conform to the applicable AWS Welding Code.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store miscellaneous metals above ground on platforms or other supports and protect from weather with suitable covering. Do not permit water ponding or moisture collection on stored items.

B. Handle steelwork to prevent damage to members and to shop paint coat and to prevent accumulation of mud, dirt, or other foreign materials capable of interfering with field paint application.

PART 2 PRODUCTS

2.01 GENERAL

A. Material shall be free from defects impairing strength, durability or appearance, of best commercial quality for purposes specified. It shall have structural properties to safely withstand strains and stresses to which normally subjected.

B. Fastenings shall, insofar as practicable, be non-corrosive, non-staining and concealed. Fastenings that are exposed shall be countersunk and finished flush.

C. Exposed welds shall be ground smooth to form a neat uniform fillet without weakening base metal.

D. Unexposed welds shall have all slag removed before applying shop coating. Molded, bent or shaped members shall be formed with clean sharp arises, without dents, scratches, cracks or other defects. Provide all anchors, bolts, shims and accessory items required for building into or fastening to adjacent work.

2.02 MATERIALS

A. Unless otherwise indicated, materials shall conform to the latest revision of the following standards:

1.	Structural Steel	ASTM A36
2.	Structural Steel Tubing	ASTM A500, Grade B
3.	Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53
4.	Steel Sheets	ASTM A366
5.	Gray Iron castings	ASTM A48, Class 35
6.	Ductile Iron Castings	ASTM A536
7.	Carbon Steel Bolts and Studs	ASTM A307, Grade A
8.	High Strength Steel Bolts, Nuts and Washers	ASTM A325
9.	Galvanizing	ASTM A123
10.	Galvanizing Hardware	ASTM A53

2.03 FABRICATION

A. Fabricate work in shops with adequate machinery to produce the items as described herein.

B. Assemble each item in the shop checking field dimensions and establishing proper tolerances for joints. Disassemble work only to the extent required for shipping and reassemble in the field.

C. Measurements shall be accurate, cutting true in line, joints tight and secure.

D. When cutting torch is used the burned edges of the metal shall be milled to dimension.

E. Holes shall be drilled or punched, not cut with the torch. Punching or drilling shall be accurately done and any holes not matching shall be reamed and not drifted.

F. Welding shall be done with electric arc equipment and executed in accordance with the latest edition of AWS D1.1 or AWS D1.2. Welding joints in metal cut with torch shall have the scale and burned metal ground or chipped back to bright metal before welding. Welded joints that will be exposed to view shall have the welds so formed that the joint can and shall be ground smooth with the connected surfaces.

G. Joining of metal members shall be designed to develop the full strength of the members at the connection. Where members are bolted together not less than two (2) bolts are to be used for each connection, unless otherwise noted.

H. Cut, reinforce, drill, and tap miscellaneous metal work as indicated to receive finish hardware and anchorage.

2.04 GALVANIZING

A. All galvanizing shall be done by the hot-dip process after fabrication conformity with requirements of ASTM A123, A153, A384, and A385 latest editions. Articles to be galvanized shall be pickled before galvanizing.

B. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleaned and recoated with zinc to the required thickness by the hot dip process.

C. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections, and other defects not consistent with acceptable galvanizing practice.

D. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A239, latest edition.

2.05 MISCELLANEOUS STRUCTURAL STEEL ITEMS COMPONENTS

A. Miscellaneous structural steel items shall be fabricated to details shown on the Drawings with clean, straight sharply defined profiles and smooth surfaces.

B. Holes shall be drilled or punched.

C. Items include but are not limited to beams, angles, support brackets, base plates, door sills, roof top fixture supports, roof opening framing, and any other miscellaneous steel called for in the Drawings.

2.06 MISCELLANEOUS ITEMS

A. Provide bolts, nuts, anchor bolts, plates, anchors, ties, clamps, hangers, nails, spikes, screws, straps, toggle and expansion bolts, and other items not previously specified.

B. All anchoring devices shall be stainless steel, either wedge type or chemical as required.

C. All connection bolts, nuts, and washers shall be galvanized. See Section 05 10 00 Structural Metal Framing for additional information.

D. Items shall be of the size, shape, material and detail indicated for the purpose intended.

2.07 STAIRS & PLATFORMS

A. Steel stairs and platforms shall be fabricated from steel conforming to the latest edition of ASTM A36 and shall be hot dipped galvanized after fabrication, unless noted otherwise.

B. Stair and platform design, fabrication and installation shall conform to OSHA regulations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Setting loose plates:
   1. Clean concrete bearing surfaces free from bond-reducing materials, and roughen to improve bond to surfaces. Clean the bottom surface of bearing plates.
   2. Set loose leveling and bearing plates on wedges, or other adjustable devices.
   3. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims; but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
   4. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

B. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

C. Cutting, fitting, and placement:
   1. Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications.
   2. Set work accurately in location, alignment, and elevation and make plumb, level, true, and free from rack, measured from established lines and levels.
   3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.
   4. Fit exposed connections accurately together to form tight hairline joints.
   5. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
   6. Grind exposed joints smooth, and touch up shop paint coat. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

D. Field welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of weld made, and methods in correcting welding work.

E. Touch up painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

3.02 ALUMINUM PROTECTION

A. Dissimilar metal shall be kept from direct contact by a heavy coat of alkali resistant bituminous paint or zinc chromate primer made with synthetic resin vehicle, the vehicle being either of the phenolic resin type or the alkyd resin type. Such paint shall be allowed to dry before assembly of the parts.

END OF SECTION

SECTION 05 05 25

ANCHOR BOLTS

PART 1 GENERAL

1.01 SUMMARY

A. Furnish all labor, materials and equipment required to install the following anchors:
   1. Expansion and Adhesive Anchor Bolts or Rods for mechanical equipment as detailed on the Drawings or as required by equipment manufacturer's anchor bolt setting plan.
   2. All AISI Type 316 Anchor Rods indicated on the Drawings required to attach or anchor ladders, handrails, stairs, ship's ladders and structural steel shapes to hardened concrete in concealed wet wells or other highly corrosive areas.
   3. All expansion bolts indicated on the Drawings required to attach or anchor ladders, handrails, stairs, ship's ladders and structural steel shaped to hardened concrete or masonry.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM), latest editions.
   1. F593 Standard Specification for Stainless Steel Bolts, hex Cap Screws, and Studs.
   2. F594 Standard Specification for Stainless Steel Nuts.

B. Federal Specification, latest edition.
   1. FF-S-325 Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry).

C. Manual of Steel Construction (AISC), latest edition.

1.03 DELIVERY, STORAGE, AND HANDLING

A. All material shall be stored in a manner that will protect it from deterioration and damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. All anchor bolts and anchor rods shall be of stainless steel meeting requirements of ASTM F593, Alloy Group I, Condition CW.

B. All nuts shall be of stainless steel meeting requirements of ASTM F594, Alloy Group I, Condition CW.

C. All washers shall meet dimensional requirements of ASTM F436. Material for washers shall be stainless steel, Type 316.

D. Expansion anchors shall meet requirements of FS FF-S-325. All expansion bolts shall be stainless steel.

1. For concrete, wedge type, Group II, Type 4, Class 1 or 2; self-drilling type, Group III, Type 1 or non-drilling type, Group VIII, Type 1 or 2.
2. For masonry, lag shield type, Group II, Type 1, or split shield type, Group II, Type 3, Class 3.

E. Vinyl Ester Adhesive Anchor Systems
1. Two-component, insensitive to moisture, designed to be installed in adverse freeze/thaw environments.
2. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
3. Container Markings: Include manufacturer's name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
4. Anchor Rods: Stainless steel threaded rods, sized by adhesive manufacturer for design loads required and adhesive system used.

PART 3 EXECUTION

3.01 ANCHOR BOLT SETTING

A. Begin installation only after concrete or masonry receiving anchors have attained design strength.

B. Accurately locate and hold all anchor bolts in place by templates until the concrete has hardened.

C. Furnish anchor bolts for equipment with baseplates with pipe sleeves to permit adjustment and grouting.
1. Cast anchor bolts integrally with concrete.
2. Pipe sleeve shall have an internal diameter not less than three times bolt diameter and shall be not less than 10 bolt diameters long.

D. Install in accordance with manufacturer's specific quality control submittal instructions.
1. Hole diameters are critical to installation, use only drills recommended by anchor manufacturer.
2. Follow manufacturer's safe handling instructions.

3.02 ADHESIVE ANCHOR INSTALLATION

A. Drill anchor rod holes into concrete through item being supported or locate by a template.
1. Drill all holes by a tool designed by or approved by manufacturer of anchor bolts.

B. Installation of anchor rods shall be in compliance with manufacturer’s recommendations for maximum holding power, but in no case shall depth of hole be less than 4-rod diameters.
1. Minimum distance between center of any anchor rod and an edge or exterior corner of concrete shall be not less than 6 times diameter of hole in which it is installed.

C. Do not install when temperature of concrete is below 35 F or above 110 F.

D. Follow specific manufacturer safe handling practices when handling and installing concrete anchors.

3.03 EXPANSION BOLT INSTALLATION

A. Drill expansion bolt holes into concrete through item being supported or locate by a template.
   1. Drill all holes by a tool designed by or approved by manufacturer of expansion anchors.

B. Installation of expansion anchors shall be in compliance with manufacturer's recommendations for maximum holding power, but in no case shall depth of hole be less than four bolt diameters.
   1. Minimum distance between center of any expansion anchor and an edge or exterior corner of concrete shall be not less than 6 times diameter of hole in which it is installed.

END OF SECTION

SECTION 05 10 00

STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Furnish all labor, equipment, materials and incidentals required to fabricate and install structural steel including bearing plates, columns, beams, and miscellaneous shapes and plates required to erect the structural framing as shown on the Drawings and as specified herein.

B. Related Sections:
   1. Section 03 60 00: Grouting
   2. Section 05 00 00: Metals
   3. Section 05 21 00: Steel Joist Framing
   4. Section 05 31 23: Steel Roof Decking
   5. Section 09 90 00: Painting and coatings

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00, complete shop drawings and product data showing materials of construction and details of installation for all items furnished under this Section.
   1. Shop and erection drawings for all structural steel components. Include materials, anchor bolts, member and connection details, piece marks, openings, shop and field bolting and welding. Indicate cleaning, shop painting, and hot-dip galvanizing.
   2. Approval will be for strength only and shall not relieve the Contractor of responsibility for proper fit of members, or connections not detailed on the Drawings.
   3. Welding procedures for each type of weld.

B. Test Reports and Certificates
   1. Submit two certified copies of mill test reports on each steel proposed for use showing the physical properties and chemical analysis. Reports shall be of steel made within the last sixty days before shipment.
   2. Submit welder certifications in accordance with the latest revision of AWS D1.1
   3. Submit certification that the railing system is in compliance with OSHA requirements and the Standard Building Code.

1.03 REFERENCES

A. American Institute of Steel Construction (AISC)
   1. AISC S302 – Code of Standard Practice for Steel Buildings and Bridges.
   2. AISC S335 – Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary.
   3. AISC M016 – Manual of Steel Construction Allowable Stress Design.

B. American Society for Testing and Materials (ASTM)
   1. ASTM A36 – Standard Specification for Carbon Structural Steel

2. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products.
4. ASTM A143 – Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
5. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
8. ASTM A384 – Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
9. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
10. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
11. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
12. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
13. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

C. American Welding Society (AWS)
1. AWS A5.1 – Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
2. AWS D1.1 – Structural Welding Code - Steel

D. Research Council on Structural Connections of the Engineering Foundation (RCSCEF)
1. Specification for Structural Joints using ASTM A325 or ASTM A490 Bolts.

E. Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.04 QUALITY ASSURANCE

A. Structural steel shall be in accordance with the AISC Standard for Structural Steel Buildings – Allowable Stress Design and Plastic Design and the Code of Standard Practice for Steel Buildings and Bridges, unless otherwise indicated.

B. All welding shall be performed by qualified welders and be in accordance with AWS D1.1, unless otherwise indicated or in the AISC Standard.

C. The Contractor shall be responsible for all errors detailing, fabrication and for the correct fitting of the structural members. The Contractor shall make all measurements in the field to verify that all dimensions shown on shop drawings are coordinated with the dimensions on the plans, elevations and sections.

D. If steel is damaged or does not fit-up, the Contractor shall prepare and submit drawings showing his proposed corrective measures to the Engineer. No modification shall be made to the steel until such drawings have been approved by the Engineer and a change order issued.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with manufacturer's instructions.

B. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

C. Protect materials from weather, high heat, water immersion, rusting, corrosion, and other damage.

D. Store structural shapes off ground on platforms or skid supports with webs of flanged shapes vertical. Cover and protect steel from rain and ground splatter.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural steel shapes and plates shall conform to ASTM A36.

B. Steel tubing shall conform to ASTM A500, Grade B or ASTM A501.

C. High strength mechanically galvanized steel bolts, nuts, and washers shall conform to ASTM A325.

D. Anchor Bolts shall be galvanized and conform to ASTM A307.

E. Electrodes for manual arc-welding shall conform to AWS A5.1, E70XX.

2.02 FABRICATION

A. After shop drawings are approved, fabricate each element to the size and connection indicated on the fabrication shop drawings.

B. Steel shall be fabricated in a shop having equipment for shearing, punching, cutting, welding and high strength bolting.

C. Skilled workmen under experienced supervision shall execute work. Certified welders shall do welding.

D. No splice or other connection shall be made without first having been detailed and approved.

2.03 GALVANIZING

A. Steel members, fabrication, and assemblies shall be galvanized after fabrication by hot-dip process in accordance with ASTM A123.

B. Safeguard against steel embrittlement in conformance with ASTM A143.

C. Safeguard against warpage or distortion of steel members to conform to ASTM A384.

D. Finish and uniformity of zinc coating and adherence of coating shall conform to ASTM A123 or A153, as applicable.

E. Bolts, nuts, washers, and iron and steel hardware components shall be galvanized in accordance with ASTM A153.

F. Touch-up:
   1. Repair damaged galvanized surfaces in accordance with ASTM A780.
   2. Dry film thickness (dft) of applied materials shall not be less than galvanized coating thickness required by ASTM A53, A123, or A153, as applicable.
   3. Touch up prime painted surface with same galvanized primer applied in shop. Clean damaged surfaces first to assure proper paint adhesion.

2.04 SHOP PAINTING

A. Shop painting shall conform to the requirements of Section 09 90 00.

B. All steel and iron work shall be cleaned of mill scale, rust, dust, oils and grease by use of wire brushes and scrapers, and all members shall be given one coat of a rust inhibitive primer paint 3.5 mils (dft).

C. The prime coat on all steel exposed to view shall be applied in such a manner that will not cause runs or drips. Any such run or drips shall be removed prior to finish painting. Prime coat shall be 3.5 mils (dft).

PART 3 EXECUTION

3.01 ERECTION

A. All structural metal work shall be set and secured with temporary or permanent connections as required. Temporary connections can be made with bolts, welds, C-clamps, or other devices.

B. Anchor bolts shall be located and built into the connecting work in advance.

C. All steel shall be secured in position by temporary means until all final connections are complete. It shall be the responsibility of the Contractor to secure all steel against displacement during erection and to maintain it against displacement until the structure, both masonry and steel, have been completed.

D. All field connections shall be high strength bolted connections, except where field welding is shown or specified.

E. All bolts, including anchor bolts, shall have enough projection to expose not less than 1 1/2 threads (not inches) after nut is tightened.

F. Holes for expansion bolts shall be made by first securing the steel item in place then drilling the holes through the holes in the steel using the steel as a template. Drilling of the holes by

center measurement will not be permitted. Reaming or burning of the holes in the steel will not be permitted. The drill size shall be of the same diameter as the bolt.

3.02 CONNECTIONS

A. Beam and girder connections shall meet Tables II or III, Part 4 of the ASIC Code Eighth Edition unless otherwise prescribed on plans.

B. Except as otherwise prescribed on plans, all connections of beams or girders shall be designed as flexible and shall be proportioned for the reaction shear. If, however, a concentric connection is not possible, the Engineer shall be notified.

C. Where final connection is to be welded provision shall be made for securing the members together during erection and alignment.

D. Fabricator shall punch all holes for the attachment of nailers, hangers and other work that is specified and shown to be attached to the steel.

E. Where a steel joist is designated on plans as a strut joist, it shall serve as an erection strut and shall have bolted end connections. Provision shall be made in the steel to receive these joist, and two 9/16" OH shall be provided for each connection (OSHA).

3.03 FIELD TESTS AND INSPECTION

A. Inspection of and preparation of materials and welding shall be by the visual method as covered in AWS D1.1. Inspection shall cover the following:
   1. Butt welds introduced by the fabricator shall be inspected. Such welds shall be indicated on shop drawings with the appropriate reference joint number as covered in the AISC latest edition.
   2. All welds indicated on contract drawings as full penetration welds shall be inspected.
   3. Inspection shall be made of a random selection of 15% of fillet welds. If the fillet welding fails to pass this inspection, then all such welding shall be inspected and passed before acceptance.
   4. If inspection of full strength welding is not accomplished during preparation and welding, nondestructive testing will be provided in compliance with AWS 1.1. The Contractor shall pay for such testing.

B. Inspection will be required of a random selection of 15% of all high strength shop and field bolting. To be acceptable, 95% of all bolts tested shall meet design tension, and no bolt shall test to less than 85% of design tension. If the bolting fails to meet this requirement, the Contractor shall rework the bolts and additional tests of 50% of all bolts shall be made until the above requirements are met.

C. All inspection shall be made by a registered engineer or by an inspection laboratory approved by the Engineer.

D. Inspection reports shall include certification the following:
   1. The work has been checked against the contract drawings and that full strength butt welds have been provided where they were called for on plans.
   2. The work has been checked against the contract drawings and full strength butt welds introduced by the fabricator have been provided

3. That fillet welds have been inspected.
4. That the welding has been accomplished to meet AWS Standards
5. That high strength bolting has met the requirements of this section
6. One copy of inspection reports shall be furnished to the Engineer and one to the Contractor.

3.04 FIELD PAINTING

A. All steel exposed to view shall be field painted in accordance with Section 09 90 00.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Work covered by this section includes furnishing all labor, equipment, and materials required to furnish and install fabricated aluminum products including all fittings, anchors, sleeves, and accessories, as shown on the Drawings or specified herein.

B. Related Sections:
   1. Section 05 00 00: Miscellaneous Metals.

1.02 SUBMITTALS

A. Submit complete shop drawings, operation and maintenance data, and engineering data in accordance with requirements of the section 01 33 00 of these specifications.

B. Submit in accordance with supplier’s recommendations and procedures for maintaining and repairing handrail including methods, cleaning materials, refinishing materials, and precautions as to the use of materials which may be detrimental to handrail finish.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Provide in accordance with manufacturer's instructions and Section 01 40 00.

B. Keep handling to a minimum and maintain protective covering on the products until work is complete.

PART 2 PRODUCTS

2.01 GENERAL

A. Aluminum shall be in accordance with Section 05 00 00.

2.02 ALUMINUM HANDRAIL

A. Aluminum handrail for vertical and horizontal members shall be seamless, 1½-in, Schedule 40, 6063-T832 or 6063-T6 aluminum alloy pipe. Aluminum fittings shall be of wrought material of the same composition as rails and posts or cast aluminum of aluminum alloy No. 214. Aluminum fittings shall have a stainless steel or 2024-T4 aluminum alloy.

B. Aluminum handrails and exposed fittings shall have a clear anodized finish (204 R-1). Minimum coating thickness shall be 0.4 mils.

C. Aluminum pipe railings shall be of all welded construction or they may be assembled with flush type fittings and concealed or non-projecting pins and fasteners.

D. Welded joints shall be made by inert gas welding (MIG) using aluminum welding rods of aluminum alloy X5356. All welded joints shall be cleaned of flux and weld spatter and the weld bead shall be ground smooth, rubbed, and polished to provide a flush and neat uniform appearance.

E. Slip joints to facilitate removal of pipe railing shall be provided at all intersections, changes in direction, or intervals, not to exceed 25 feet in straight runs of railing. The slip joint shall be designed and constructed to provide strength equivalent to a straight section of pipe.

F. All handrail installations shall provide for draining of entrapped water from the railing system by minimum 15/64-inch-diameter weep holes or other approved means.

G. Kickplates shall be of wrought material of the same composition and finish as the rails and posts.

H. Stainless steel eyebolts shall be furnished and installed on stanchions where guard chains will be attached.

I. Guard chains shall be provided across all pipe railing openings where shown, specified, or required. Chain links shall be ¼-inch galvanized steel of welded construction, 12 links to the foot. One end shall be connected to a ¼-inch stainless steel eyebolt in the stanchion and the other end shall be connected by opposite stanchion.

2.03 ALUMINUM GRATINGS

A. Aluminum gratings shall be fabricated of I-shaped or rectangular 6061-T6 or 6063-T6 aluminum alloy bars welded or pressure locked together into rigid panels. Grating and banding bars shall be machine cut. Top surfaces of main bearing bars shall be grooved or serrated to provide a non-slip surface.

B. Grating panels shall be simply supported by shelf angles on two sides of the opening and shall be reversible. The gratings shall be of the type that can be made in panels of the widths and lengths appropriate to the openings shown on the Drawings, and no gratings will be accepted which require individual panels to be made up by binding narrow panels together with end or intermediate binding strips welded thereto. The ends of all grating panels and edges of all opening shall be provided with banding strips of the same depth and thickness of the main bars, welded thereto, and neatly finished at the intersections with the bars. After installation, there shall not be more than ¼-inch clearance between sides of adjacent panels. Panels shall be furnished in sizes that are easily handled.

C. The top surface of all bars shall be flush and all gratings shall lie flat with no tendency to rock when installed. Cross bars and edge bars of adjacent panels shall align for neatness. All main bearing bars shall be parallel. Crossbars shall be cut off flush with outside face of sidebars.

D. Grating panels shall be securely anchored in place with stainless steel “J” bolts or aluminum saddle or hook clamps. Galvanized hardware shall not be acceptable. A minimum of 2 fasteners over each support shall be provided.

E. Main bearing bars shall be supported by aluminum shelf angles of the size and thickness as shown on the Drawings. There shall not be more than ¼-inch clearance between the ends of the grating panels and the inside vertical face of the shelf angle.

F. Grating panels shall be within ±3/16-inch of authorized length and width and shall have a maximum difference in length of opposite diagonals of 3/16-inch. Spacing of bearing bars shall be within 1/32-inch of authorized spacing.

G. All surfaces shall be sound, smooth, clean, and free from defects. Completed sections shall be level and true so as to rest firmly on the bearing angles along the entire contact surface. Openings, where required, shall be neatly and accurately made to the dimensions required as shown on the Drawings. Poorly fitted or damaged grating shall be replaced. All angular, circular, or reentrant cuts shall be made by sawing or shearing. Flame cutting will not be permitted.

H. Unless otherwise shown, openings to be covered with grating shall be bound on all four sides with a continuous shelf angle frame having welded corners and sufficient strap anchors for anchorage into the concrete.

I. Aluminum surfaces to be embedded in concrete or otherwise placed in contact with masonry construction shall be given a heavy shop coat of a zinc chromate primer in accordance with Federal Specification TT-P-645. The paint shall be applied as received from the manufacturer without the addition of any thinner.

J. Where changes in channel direction, openings for gates, ends of grating runs, etc., prohibit adequate support for grating, additional cross-angles shall be furnished to provide a seating surface.

K. Gratings shall be laid out so that openings in the grating are centered on a joint between adjacent panels. Where joints occur normal to the direction of span, they shall be centered on structural support with not more than 1/8-inch between ends of adjoining panels.

2.04 ALUMINUM STAIRS

A. The aluminum stairs shall have structural aluminum channel stringers and supports, aluminum tread plate treads and platforms, and sheet aluminum risers as indicated on the Drawings and in the details.

B. The treads shall be formed from 1½-inch thick aluminum grating and the risers shall be formed from .080-inch thick sheet aluminum.
   1. The treads shall be supported by and attached to 1¼-inch by 1¼-inch by 3/16-inch aluminum carrier angles bolted to the stringers.
   2. The treads shall be no less than 10 inches in width.
   3. The risers shall be bolted to the treads with stainless steel bolts.

C. All platforms shall be fabricated of ¼-inch thick aluminum tread plate and shall be supported on the edges by structural aluminum angles and at the midspans by structural aluminum tees.

D. The aluminum plate for treads and platforms shall have an acceptable nonskid pattern surface.

E. The contractor shall provide all structural aluminum angle hangers, struts, rod hangers, closure plates, and brackets indicated or necessary to complete the stairs as indicated.

2.05 CHECKERED FLOOR PLATES

A. Unless otherwise shown, checkered floor plates shall be 6061-T6 aluminum alloy with raised diamond pattern on the upper surface.

B. Floor plate shall have a minimum thickness of ¼-inch and shall be designed for an extreme fiber stress in bending of not more than 10,000 psi and a deflection of not more than 1/300 of span under a uniform load of 200 pounds per square foot. However, in no case shall the thickness of the floor plates be less than that shown on the drawings for the specified clear span.

2.06 STAIR NOSINGS

A. Stair nosing shall be extruded 6063-T6 aluminum 3-inches wide by ¼-inch thick with 5 abrasive-filled ribs.
   1. Owner shall select abrasive filler color.
   2. Each nosing shall have 2 anchors minimum embedded in concrete.
   3. Maximum anchor spacing shall be 16-inches with anchors spaced 3-inches from each end of nosing.
   4. Nosing length shall be stair width less 6-inches.

B. Install stair nosings on concrete stairs at each tread and along platform and landing edges at beginning of stair flights.
   1. Nosings shall extend to within 3-inches of each tread end or wall surface.

2.07 ALUMINUM LADDERS

A. Aluminum ladders shall be furnished and installed at the locations shown on the contract drawings.

B. The ladders shall be constructed with side rails of 2½-inch by ½-inch flat bar and brackets of 3-inch by ½-inch flat bar with rungs of 1-inch diameter bars, shouldered, driven through the side rails and penned.
   1. Maximum bracket support spacing shall be 5’-0” on centers.
   2. In general, the ladders shall extend to within 6-inches of the access opening.
   3. Ladders shall be constructed of 6061-T6 aluminum.
   4. Wedge-type expansion anchors shall be used to attach aluminum ladders to walls as indicated on contract drawings, unless ladder is located in a concealed wet well.
   5. Stainless steel anchor rods shall be used to attach aluminum ladders in concealed wet wells or other highly corrosive areas.

PART 3 EXECUTION

3.01 INSTALLATION

A. Aluminum railings shall be erected plumb, straight, and true at the locations and elevations shown on the Drawings. Prefabricated aluminum handrail shall be assembled and installed in strict compliance with the manufacturer’s instructions.

B. Horizontal members of aluminum railings shall be fastened into concrete or masonry walls with flush-type flange fitting anchors with a minimum diameter of 3½-inches. Anchor screws shall be flat-head stainless steel screws with a minimum length of 3-inches.

C. Vertical members of aluminum railings shall be embedded in aluminum pipe sleeves either set in concrete or welded to a fascia flange for bolted anchorage as shown on the Drawings.
   1. Aluminum pipe sleeves shall be fabricated from 2½-inch. Schedule 40, 6061-T6 aluminum alloy pipe.
   2. Pipe sleeves for removable sections of handrail shall be fabricated from 2-inch, Schedule 40, aluminum alloy pipe.
   3. A ¼-inch-thick aluminum alloy plate having a diameter the same as the outside diameter of the pipe shall be welded to the bottom of each pipe sleeve.
   4. Aluminum pipe sleeves shall be set or anchored with the top flush with the top of the finished concrete a minimum of 6-inches.
   5. Spacing of vertical members shall not exceed 5 feet.

D. Aluminum pipe sleeves to be embedded in concrete shall be given one shop coat of zinc chromate primer and one heavy coat of alkali-resistant bituminous paint on all surfaces.
   1. That portion of vertical handrail members to be embedded in pipe sleeves shall be given one shop coat of zinc chromate primer and one heavy coat of bituminous paint.

E. Shop-applied coatings that are damaged during transit, storage, and handling will be repaired to the satisfaction of the Engineer.

F. Pipe sleeves shall be thoroughly cleaned of all dust and foreign material prior to placing handrails.
   1. Vertical railing members shall be centered in the pipe sleeves and the annular space filled to overflowing with a handrail setting cement, “Leadlite,” “Basolite,” “Hydrotite,” or equal.
   2. Excess setting shall be cleaned off, leaving a 1/8-inch buildup sloping away from the post.

G. Following installation, aluminum handrail shall be cleaned using soap and clean water.
   1. Acid solutions, steel wool, or harsh abrasives shall not be used.
   2. If stains remain after cleaning, remove finish and restore in accordance with the manufacturer’s recommendations.

H. Surfaces of aluminum materials to be in contact with concrete or dissimilar metals shall be given one shop coat of zinc chromate primer followed by one heavy coat of alkali-resistant bituminous paint.

I. All defective, damaged, or otherwise improperly installed handrails shall be removed and replaced with material that satisfies the requirements of this section.

3.02 INSTALLATION OF GRATINGS

A. Gratings shall be installed in accordance with the manufacturer’s recommendations.

B. Gratings shall have no tendency to shift, rock, or rattle and shall not exhibit excessive deflection under normal foot traffic.

3.03 INSTALLATION OF STAIR TREADS

A. Stair treads shall be installed at the proper spacing and alignment and shall be level. Stairs shall not sway or vibrate under ordinary foot traffic. Additional bracing or supports shall be provided, if necessary.

3.04 DISSIMILAR METALS

A. Where aluminum comes into contact with a dissimilar metal, a washer, neoprene gasket, or 10-mil polyethylene film shall be used between the surfaces so they shall be kept from direct contact.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Wood sleepers.
7. Plywood backing panels.

1.02 SUBMITTALS

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

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

B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.03 QUALITY ASSURANCE

A. This Article may be retained to specify lumber and other wood products made from certified wood for LEED-NC or LEED-CI Credit MR 7, which requires that a minimum of 50 percent of wood-based materials be certified.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S, unless otherwise indicated.

B. Engineered Wood Products: Provide 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: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, 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).

1. Preservative Chemicals at end cuts of pressure treated lumber: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

C. Mark lumber 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.

2.03 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: **19 percent**.

B. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade of any species.

C. Framing Other Than Non-Load-Bearing Interior Partitions: No. 2 any of the following species:

1. Hem-fir (north); NLGA.
2. Douglas fir-larch; WCLIB or WWPA.
3. Mixed southern pine; SPIB.
4. Douglas fir-south; WWPA.
5. Hem-fir; WCLIB or WWPA.
6. Douglas fir-larch (north); NLGA.

2.04 ENGINEERED WOOD PRODUCTS

A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. Extreme Fiber Stress in Bending, Edgewise: 2600 psi for 12-inch nominal- depth members.
2. Modulus of Elasticity, Edgewise: 1,500,000 psi .

B. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
1. Web Material: Oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
2. Structural Properties: Provide units with depths and design values not less than those indicated.

C. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.

1. Material: **product made from any combination solid lumber, wood strands, and veneers**
2. Thickness: 1-1/2 inches.

2.05 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NeLMA.
3. Northern species, No. 2 Common grade; NLGA.
4. Western woods, Construction or 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, in thickness indicated or, if not indicated, not less than ¾ inch nominal thickness.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Power-Driven Fasteners: NES NER-272.

C. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and flat washers.

2.08 METAL FRAMING ANCHORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, coating designation.

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. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.02 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 16 00

SHEATHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Roof sheathing.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for plywood backing panels.

1.03 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.04 QUALITY ASSURANCE

A. Plywood.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

2.02 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 24/0.

2. Nominal Thickness: Not less than 3/4 inch.

2.03 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

1. Roof Sheathing:

a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.

b. Space panels 1/8 inch apart at edges and ends.

3.02 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

3.03 PROTECTION

A. Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

END OF SECTION

SECTION 06 16 26

UNDERLAYMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Self-adhering sheet underlayment.

B. Related Sections include the following:

   1. Division 6 Section "Rough Carpentry" for roof deck wood structural panels.
   2. Division 7 Section "Flashing and Sheet Metal" for metal roof penetration flashings and counterflashings not part of this Section.

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For the following products, of sizes indicated, to verify color selected.
   1. Self-Adhering Underlayment: 12 inches (300 mm) square.

C. Qualification Data: For Installer, including certificate signed by the underlayment manufacturer stating that Installer is approved, authorized, or licensed to install underlayment system indicated].

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for underlayment.

E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual that is approved, authorized, or licensed by underlayment system manufacturer to install underlayment system indicated.

B. Source Limitations: Obtain ridge and hip cap shingles self-adhering sheet underlayment through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Administrative Requirements"

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store underlayment rolls on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle, store, and place roofing materials in a manner to avoid significant or permanent damage to roof deck or structural supporting members.

B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

1.07 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit underlayment system to be performed according to manufacturer's written instructions and warranty requirements.

1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.08 WARRANTY

1. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first 5 years nonprorated.
2. Workmanship Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Polyethylene Faced: ASTM D 1970, minimum of 40-mil-thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release paper backing; cold applied.

1. Products:

a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A."
b. Grace, W. R. & Co.; Grace Ice and Water Shield.
c. Henry Company; Perma-Seal PE.
d. Johns Manville International, Inc.; Roof Defender.
e. NEI Advanced Composite Technology; AC Poly Ice and StormSeal.
f. Owens Corning; WeatherLock M.
g. Polyguard Products, Inc.; Polyguard Deck Guard.
h. Protecto Wrap Company; Rainproof TM.
i. SafSeal Innovations; SafSeal 7740.
j. Tamko Roofing Products

2.02 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized steel wire with low profile capped heads or disc caps, 1-inch minimum diameter.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through asphalt shingles.
3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.02 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install at locations indicated below, lapped in direction to shed water. Lap sides not less than 3-1/2 inches Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

3.03 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Flashing and Sheet Metal" and on the contract documents.

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.

END OF SECTION

SECTION 06 17 53

SHOP-FABRICATED WOOD TRUSSES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes wood roof trusses and truss accessories.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for roof sheathing and subflooring and dimension lumber for supplementary framing and permanent bracing.

1.03 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.

2. NLGA - National Lumber Grades Authority.

3. SPIB - Southern Pine Inspection Bureau.

4. WCLIB - West Coast Lumber Inspection Bureau.

5. WWPA - Western Wood Products Association.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.

2. Maximum Deflection Under Design Loads:

a. Roof Trusses: Vertical deflection of 1/180 of span.

b. Roof Trusses: Horizontal deflection at reactions of 1-1/4 inches.

1.05 SUBMITTALS

A. Product Data: For metal-plate connectors, metal framing anchors, bolts, and fasteners.

B. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

D. Qualification Data: For fabricator, Engineer, metal plate connector manufacturer and installer.

E. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

F. Research/Evaluation Reports: For the following, showing compliance with 2000 International Building Code in effect for Project:

1. Metal-plate connectors.

1.06 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPIHIB.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Source Limitations for Connector Plates: Obtain metal connector plates through one source from a single manufacturer.

D. Comply with applicable requirements and recommendations of the following publications:

1. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

E. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with TPI recommendations to avoid damage and lateral bending. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.08 COORDINATION

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Connector Plates:

a. Alpine Engineered Products, Inc.

b. CompuTrus, Inc.

c. Eagle Metal Products.

d. Jager Industries, Inc.

e. Mitek Industries, Inc.

f. Robbins Engineering, Inc.

g. TEE-LOK Corporation.

h. Truswal Systems Corporation.

2. Metal Framing Anchors:

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.

2.02 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS 20 for moisture content specified.

3. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

B. Grade and Species: Provide visually graded dimension lumber for truss chord and web members, of the following grade and species:

1. Grade for Chord Members: No. 2.

2. Grade for Web Members: Same grade as indicated for chord members.

3. Species: Southern pine; SPIB.

4. Grading Method: Visual.

5. Design Values: Modulus of elasticity of at least 1,500,000 psi and an extreme fiber stress in bending of at least 1650 psi.

2.03 METAL CONNECTOR PLATES

A. General: Fabricate connector plates to comply with TPI 1 from metal complying with requirements indicated below:

B. Hot-Dip Galvanized Steel Sheet: ASTM A653/A653M, G60 coating designation; Designation SS, Grade 33, and not less than 0.036 inch thick.

2.04 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Bolts: Steel bolts complying with ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers.

F. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

G. Truss Tie-Downs: Hot dipped galvanized clips to fasten roof trusses to top plates below. Tie fastens to side of truss and face of top plates. Provide clips as indicated on drawings.

2.05 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Protective Coatings: SSPC-Paint 16, coal-tar epoxy-polyamide paint.

2.06 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPIHIB.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. Before installing, splice trusses delivered to Project site in more than one piece.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.

H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

I. Install wood trusses within installation tolerances in TPIHIB.

J. Do not cut or remove truss members.

K. Replace wood trusses that are damaged or do not meet requirements.

1. Do not alter trusses in field.

L. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, “Fastening Schedule”, in ICC’s “International Building Code”.

3.02 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush-apply primer, when part of coating system, and one coat of protective coating.

1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Exterior standing and running trim.

2. Interior standing and running trim for field-painted finish.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

2. Division 9 Section "Painting and Coating" for priming and backpriming of finish carpentry.

1.03 DEFINITIONS

A. Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.

2. NHLA - National Hardwood Lumber Association.

3. NLGA - National Lumber Grades Authority.

4. SPIB - Southern Pine Inspection Bureau.

5. WCLIB - West Coast Lumber Inspection Bureau.

6. WWPA - Western Wood Products Association.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.

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.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

1. Champion International Corp.
2. Georgia-Pacific Corp
3. Hardel Mutual Plywood Corp
4. K Ply Inc
5. Louisiana-Pacific Corporation.
6. McKenzie Forest Products
7. Plum Creek Timber Company, L. P.
8. S.D.S. Lumber Co.; Bingen Plywood Division.
9. Simpson Timber Co.
10. Stimson Lumber Co
11. Superior Lumber Co.; Plywood Division
12. Textured Forest Products, Inc.

2.02 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

B. Softwood Plywood: DOC PS 1.

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) , 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).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:

a. Alkaline Copper Quat (ACQ).

b. Copper Azole (CBA).

c. Sodium Borates (SBX).

2. Chromated copper arsenate (CCA) shall not be allowed

3. Do not use chemical formulations that require incising.

4. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

5. Kiln-dry material after treatment to levels required for untreated material. Do not use material that is warped or does not comply with requirements for untreated material.

6. Mark each treated item with the Quality Mark Requirements of an inspection agency approved by the American Lumber Standards' Committee Board of Review.

7. Application: where indicated.

2.04 EXTERIOR STANDING AND RUNNING TRIM

A. Lumber Trim for Painted Applications: Kiln-dried, solid lumber with surfaced (smooth) face and of the following species and grade:

1. Grade Prime 1 Common hem-fir; NLGA, WCLIB, or WWPA.

2.05 EXTERIOR SOFFITS

A. S4S Poplar finger jointed.

1. Thickness: ¾” inch.

2.06 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of 1½-in into substrate, unless otherwise recommended by manufacturer:

B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A153/A153M.

C. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry use.

D. Flashing: Comply with requirements in Division 7 Section "Flashing and Sheet Metal" for flashing materials installed in finish carpentry.

E. Sealants: Comply with requirements in Division 7 Section "Joint Sealants" for materials required for sealing siding work.

2.07 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours, unless longer conditioning is recommended by manufacturer.

C. Prime lumber for exterior applications to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 9 Section "Painting and Coating."

3.03 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.

3. Install to tolerance of 1/8-inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32 inch maximum offset for flush installation and 1/16 inch maximum offset for reveal installation.

4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, “Fastening Schedule”, in ICC’S “International Building Code”.

3.04 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

1. Match color and grain pattern across joints.

2. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.05 ADJUSTING

A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.06 CLEANING

A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06 40 23

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Cabinets.

2. Solid Polymer Fabrications.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

2. Division 6 Section "Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

3. Division 6 Section 06 61 16 “Solid Surfacing Fabrications” for counter and vanity tops.

1.03 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, adhesive for bonding plastic laminate and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.

4. Apply WI-certified compliance label to first page of Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish**,** with 1 sample applied to core material and specified edge material applied to 1 edge.

2. Corner pieces as follows:

a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.

b. Miter joints for standing trim.

3. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates. WI-certified compliance certificates.

G. Qualification Data: For Installer and fabricator.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program or Licensee of WI's Certified Compliance Program.

B. Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Installer Qualifications**:** Certified participant in AWI's Quality Certification Program or Licensee of WI's Certified Compliance Program**.**

D. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in the contract documents. Coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide materials that comply with requirements of AWI's WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.

2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1**,** made with adhesive containing no urea formaldehyde.

2.02 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets as indicated in the contract documents.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100^{o} opening, self-closing.

C. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.03 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.

2. Contact Adhesive: 250 g/L.

F. Adhesive for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: adhesive specified above for faces

2.04 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated.

D. Complete fabrication, including assembly**,** finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.05 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

B. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

C. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.

D. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches on centers. With ¼" toggle bolts.

E. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Secure backsplashes to walls with adhesive.

3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

F. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06 61 16

SOLID SURFACING FABRICATIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following horizontal and trim solid surface product types:
   1. Countertops with sinks
   6. Vanity tops
   7. Tabletops
   14. Cove backsplashes

B. Related Sections include the following:
   2. Division 5 Section “Metal Fabrications” for Blocking.
   3. Division 6 Section “Rough Carpentry” for Blocking.
   6. Division 22 Section “Plumbing Fixtures.”

1.03 DEFINITION

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.04 SUBMITTALS

A. Product data:
   1. For each type of product indicated.

B. Shop drawings:
   1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
      a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
      b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
      c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

C. Samples:
   1. For each type of product indicated.
      a. Submit minimum 6-inch by 6-inch sample in specified gloss.
      b. Cut sample and seam together for representation of inconspicuous seam.
      c. Indicate full range of color and pattern variation.

2. Approved samples will be retained as a standard for work.

D. Product data:
1. Indicate product description, fabrication information and compliance with specified performance requirements.

E. Product certificates:
1. For each type of product, signed by product manufacturer.

F. Manufacturer certificates:
1. Signed by manufacturers certifying that they comply with requirements.

G. NSF/ANSI standards:
1. Refer to www.nsf.org for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.

H. Maintenance data:
1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
a. Maintenance kit for finishes shall be submitted.

2. Include in project closeout documents.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

B. Fabricator/installer qualifications:
1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

C. Applicable standards:
1. Standards of the following, as referenced herein:
a. American National Standards Institute (ANSI)
b. American Society for Testing and Materials (ASTM)
c. National Electrical Manufacturers Association (NEMA)
d. NSF International

2. Fire test response characteristics:
a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 450 or less.

D. Coordination drawings:
1. Shall be prepared indicating:
a. Plumbing work.

b. Electrical work.
c. Miscellaneous steel for the general work.
d. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.

2. Content:
a. Project-specific information, drawn accurately to scale.
b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
c. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
d. Provide alternate sketches to designer for resolution of such conflicts.
1) Minor dimension changes and difficult installations will not be considered changes to the contract.

E. Drawings shall:
1. Be produced in 1/2-inch scale for all fabricated items.

F. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.
1. No review or approval will be forthcoming.

2. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.
B. Store components indoors prior to installation.
C. Handle materials to prevent damage to finished surfaces.
1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.07 WARRANTY

A. Provide manufacturer's warranty against defects in materials.
1. Warranty shall provide material and labor to repair or replace defective materials.
2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

B. Manufacturer's warranty period:
1. Ten years from date of substantial completion.

1.08 MAINTENANCE

A. Provide maintenance requirements as specified by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
1. Subject to compliance with requirements, provide products by one of the following:
a. Corian® surfaces from the DuPont company (basis of design).
b. Avonite,Inc.
c. The Swan Corporation.

2.02 MATERIALS

A. Solid polymer components
1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

B. Thickness:
2. 1/2 inch

C. Integral vanity:
1. 19 inch X 16 inch oval.
2. Color:
a. To match vanity top.
3. Mounting:
a. Seamed undermount.

D. Backsplash:
1. Applied.

E. Sidesplash:
1. Applied.

F. Performance characteristics:

Property	Typical Result	Test
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10-6 psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10-6 psi	ASTM D 790
Hardness	>85	Rockwell “M” Scale ASTM D 785
	56	Barcol Impressor ASTM D 2583
Thermal Expansion	3.02 x 10-5 in./in./°C (1.80 x 10-5 in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 &

		Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact Resistance: Sheets	No fracture—1⁄2 lb. ball: 1⁄4" slab—36" drop 1⁄2" slab—144" drop	NEMA LD 3-2000 Method 3.8
Weatherability	ΔE*94<5 in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	
Water Absorption	Long-term 0.4% (3⁄4") 0.6% (1⁄2") 0.8% (1⁄4")	ASTM D 570
Toxicity	99 (solid colors) 66 (patterned colors)	Pittsburgh Protocol Test (“LC50”Test)
Flammability	All colors (Class I and Class A)	ASTM E 84, NFPA 255 & UL 723
Flame Spread Index	<25	
Smoke Developed Index	<25	

† Approximate weight per square foot: 1⁄2", 4.4 lbs.
Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.
NEMA results based on the NEMA LD 3-2000

2.03 ACCESSORIES

A. Joint adhesive:
1. Manufacturer’s standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

B. Sealant:
1. Manufacturer’s standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

C. Sink/lavatory mounting hardware:
1. Manufacturer’s standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.

D. Conductive tape:
1. Manufacturer’s standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

E. Insulating felt tape:
1. Manufacturer’s standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.04 FACTORY FABRICATION

A. Shop assembly
1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
a. Reinforce with strip of solid polymer material, 2" wide.
3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
4. Rout and finish component edges with clean, sharp returns.
a. Rout cutouts, radii and contours to template.
b. Smooth edges.
c. Repair or reject defective and inaccurate work.

B. Thermoforming:
1. Comply with manufacturer's data.
2. Heat entire component.
a. Material shall be uniform, between 275 and 325 degrees Fahrenheit during forming.
3. Form pieces to shape prior to seaming and joining.
4. Cut pieces to finished dimensions.
5. Sand edges and remove nicks and scratches.

2.05 FINISHES

A. Select from the manufacturer's standard color chart.
1. Color:
a. To be selected by Owner.
B. Finish:
1. Provide surfaces with a uniform finish.
a. Matte; gloss range of 5–20.

PART 3 — EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
1. Provide product in the largest pieces available.
2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
a. Exposed joints/seams shall not be allowed.
3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.
4. Cut and finish component edges with clean, sharp returns.

5. Rout radii and contours to template.
6. Anchor securely to base cabinets or other supports.
7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
8. Carefully dress joints smooth, remove surface scratches and clean entire surface.
9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

B. Coved backsplashes and applied sidesplashes:
1. Install applied sidesplashes using manufacturer's standard color-matched silicone sealant.
2. Adhere applied sidesplashes to countertops using manufacturer's standard color-matched silicone sealant.

C. Coved backsplashes and sidesplashes:
1. Provide coved backsplashes and sidesplashes at all walls and adjacent millwork.
2. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on the drawings.
3. Adhere to countertops using manufacturer's standard color-matched Joint Adhesive.

D. Integral sinks/vanities:
1. Provide solid surface materials bowls and/or lavatories sinks with overflows in locations shown on the drawings.
2. Secure sinks and lavatory bowls to tops using manufacturer's recommended sealant, adhesive and mounting hardware to maintain warranty.

3.03 REPAIR

A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.04 CLEANING AND PROTECTION

A. Keep components clean during installation.
B. Remove adhesives, sealants and other stains.

END OF SECTION

SECTION 06 81 15

FIBERGLASS REINFORCED PLASTIC COMPONENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to install fiberglass reinforced plastic (FRP) grating and structural support systems as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. Miscellaneous Metals are included in Section 05 50 00

1.03 SUBMITTALS

A. Submit in accordance with the Section 01304, copies of all materials required to establish compliance with this Section. Submittals shall include at the following:

1. Complete shop drawings showing materials, properties and details of fabrication, construction and installation items under this Section.

2. Two sets of samples for review in representative sizes as acceptable. Samples shall be representative of construction; workmanship, appearance and surface finish of the manufactured items which are proposed. Samples shall be from plant production.

3. Certified test data based on tests of actual production samples that demonstrate that the products conform to the stress and deflection requirements specified herein.

B. The Engineer may reject any item that does not meet the standards of the representative tested or submitted samples.

1.04 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the products herein specified shall be in accordance with the standards of the below listed organizations.

1. American Society for Testing and Materials (ASTM)

a. ASTM D349 – Standard Test Methods for Laminated Round Rods Used for Electrical Insulation

b. ASTM D638 – Standard Test Method for Tensile Properties of Plastics

c. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

d. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

2. American Iron and Steel Institute (AISI)

3. Occupational Safety and Health Administration (OSHA)

B. Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The fiberglass reinforced plastic components manufacturers shall be experienced in the manufacture of items of similar size and quality and shall present proof as required of successful installations involving the items under similar conditions to this project.

B. The work of this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

C. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other sections.

PART 2 - PRODUCTS

2.01 MATERIALS AND PROPERTIES

A. Resin for FRP components shall be an acceptable fire retardant vinyl ester, integrally resistant without applied coatings to ultra-violet radiation; to high concentrations of hydrogen sulfide gas, its solutions and associated compounds; to sodium hypocholorite, sodium hydroxide, aluminum sulfate, and polymer; and to the wastewater occurring at the project site.

B. Provide compatible and equally resistant resin as acceptable for shop and field sealing of cut edges.

C. Minimum physical properties for pultruded structural FRP shapes and plates shall be as follows:

1. Tensile Strength (coupon) 30,000 psi – ASTM D638
2. Tensile Strength (full section in bending) 20,000 psi at 75 degrees F
3. Modulus of Elasticity 2.3 x 10^6 psi at 75^o F, 1.8 x 10^6 psi at 125^o F – ASTM D790
4. Barcol Hardness – 50
5. Water Absorption – 0.75 percent (by weight) – ASTM D349
6. Specific Gravity – 1.66 – ASTM D792

D. FRP components shall have integral colors acceptable to the Engineer selected from standard resins.

E. Stainless Steel

1. Shapes – AISI Type 304
2. Fasteners and components – Type 18-8

2.02 GRATING, TREADS, AND LADDERS

A. FRP grating, treads, ladders and structural members shall be the pultruded type by IKG Borden, Nashville, TN; Duradek by AFC Inc., Chatfield, MN; Imco Reinforced Plastics, Inc., Moorestown NJ; Chemgrate Corp., Woodinville WA; or equal.

B. Outer surfaces, cut edges, or any surfaces that are exposed to air during curing shall be finished to obtain complete cure of the resin without air inhibition by coating the surface after initial cure with resin without air inhibition by coating the surface after initial cure with resin containing paraffin. Softening or tackiness of any surface under an acetone test will be considered evidence of incomplete cure.

C. Factor of safety shall be five based on ultimate stress. Grating shall be at least 1½-in deep, and have either a T-bar or rectangular bar shape.

D. T-bar shaped FRP grating shall be constructed of straight parallel bearing bars and composed of a glass fiber and thermosetting resin pultruded composite. The beating bars to be placed edgewise and joined by structural crossties every 12-in, maximum. Crossties shall be 3/8-in diameter fiberglass rod with glass fiber reinforced plastic or stainless steel ferrules and polypropylene spacers. The upper bar surface shall have a coarse quartz/epoxy grit surface to provide skid resistance.

E. Rectangular shaped FRP grating shall be constructed of straight parallel bearing bars and cross bars composed of glass fiber resin, compression molded at high temperatures and pressure. No dry glass fibers shall be visible on any surface of bearing bars or cross bars. Bearing bars shall be spaced on 1-in centers and cross bars spaced on 6-in centers. Top surfaces shall have grit surface for skid resistance.

F. The FRP grating shall meet the following loading requirements. In addition to the dead load of the grating (and FRP plate where indicated) the grating shall be capable of supporting a uniform live load of 100 psf with 1 percent deflection and a concentrated live load of 800 lbs applied to a 12-in x 1-in area at the midpoint of the span.

G. Provide structural FRP angles frames, stair and grating stringers, structural support shapes, grit impregnated plate where required, ladders with cages, and appurtences as shown.

H. Angles frame shall be continuous around the opening in order to present an even and flat support for the grating except as otherwise shown. The angles and anchors shall be as detailed.

I. FRP grating shall be securely attached to supporting members and angles. Attachment to FRP supporting members shall either be stainless steel or FRP with stainless steel fasteners. Each grating panel shall be attached to supporting members at a minimum of four locations (two each edge). All materials and incidentals required for attaching grating to angle frame supports shall be furnished and installed under this Section.

   1. All fasteners for iron salt locations shall be Kynar coated

J. Coordinate the layout of grating panels with work of other Sections to provide openings for approved mechanical equipment, operators, gates and other items that require penetrations or openings in the grating. Grating panels shall be further subdivided and supported to provide maximum panel weight of 110 lbs.

2.03 HANDRAILING

A. FRP handrailing shall be as manufactured by IKG Borden, Nashville, TN; Duradek Handrail System by AFC, Inc.; Imco Reinforced Plastics; or equal. System shall withstand a 200 lbs load applied at any point, in any direction to the toprail within a maximum deflection of L/360. Provide in configurations shown, required and accepted.

B. System shall be composed of 2-in square FRP tubes; solid FRP connector plugs snugly fitting the inside dimensions of tubes; solid 0.49- in diameter FRP connector rods; and flattened corrugated 0.125- n thick, 4-in high, FRP kickplates with 0.5- deep corrugations and stainless steel drive rivets for fastening to posts. Provide FRP sleeves for removable connections to concrete and provide FRP baseplate assemblies with stainless steel fasteners for wall connections and slab connections where shown. Provide approved epoxy cement for all tube, plug and rod connections and epoxy grout for post connections set in concrete.

C. Fabricate with continuous posts and top rail, with intermediate rails cut between posts. Miter corners and direction changes neatly. Provide for rail expansion as required with internal plugs cemented one side and square, resin sealed, tube ends. Provide for kickplate expansion as detailed.

D. Expansion bolts shall be Kwikbolts by Hilti or equal, expansion studs with nuts and Washers. Provide miscellaneous bolts, nuts and washers as required. Size as shown. Provide all fastener components in stainless steel.

1. All fasteners for iron salt locations shall be Kynar coated.

2.04 FIBERGLASS WEIRS AND BAFFLES

A. Fiberglass reinforced polyester (FRP) weirs and baffles shall be installed where shown on the Drawings. All weir plates, scum baffle plates, buff plates, and cover plates shall be FRP. A "low profile" resin system shall be used to insure that all surfaces are smooth, resin rich, free of voids and porosity, without dry spots, crazes, or unreinforced areas to provide increased corrosion and weather resistance. All edges shall be sealed in the mold. Resin shall be of the isopthalic type. Plate thickness shall be 3/8-inch minimum, or as shown on the Drawings. FRP weirs and baffles shall be blue-green in color. Each section shall be of the depth and overall length as indicated on the Drawings. Each section shall be provided with mounting holes at 12 inches on center, unless shown otherwise on the Drawings, to provide a minimum 2-inch vertical or horizontal adjustment. Sections shall be secured to walls or trough with 316 stainless steel anchor bolts and 5-inch minimum diameter washers to prevent short-circuiting. Ends of weir plates shall be secured with 6-inch wide butt plates arranged to allow for horizontal expansion. Type 316 stainless steel anchor bolts shall be furnished by the FRP supplier.

B. Laminate shall contain a glass content of 30+2% using Type "E" glass with chrome or silane finish. Powdered reinforcements shall consist of 47.5+1% of resin mixture. Final laminate thickness shall be within +10 percent of the nominal specified thickness. Ultraviolet absorbers shall be added to the resin to prevent deterioration from sunlight. Where weir plates are of non-standard length or non-standard mounting hole configuration, such machined or cut edges shall be resin sealed with seal mix.

C. All items shall be manufactured in accordance with ASTM D2996 and ASTM D3917. The manufacturer shall maintain a continuous quality control program and shall, upon request, furnish the Engineer with certified test reports consisting of physical tests of samples to verify that the laminate has the following minimum physical properties:

Requirement	Minimum Results	Test Method
Tensile Strength (psi)	14,000	ASTM D 638
Flexural Strength (psi)	25,000	ASTM D 790
Flexural Modulus (psi)	1.0 x 106	ASTM D 790
Impact, Notched, Izod, (foot pound per inch)	15.0	ASTM D 256
Barcol Hardness	Minimum, 35 Average,40	ASTM D2583
Water Absorption, (% 24 hours)	0.1 Max	ASTM D 570
Average coefficient of thermal expansion (inch per inch per °F)	10.5 x 10-6	ASTM D 696

D. The procedure used in determining the above properties shall be in accordance with the ASTM Standards, Part 35, using the method designated above. Hardness tests shall be made on the resin rich surfaces of the test samples. Test coupons shall be prepared in accordance with the appropriate ASTM test method.

E. Baffle plate lengths shall be made to fit the installation, but lengths shall not exceed 10 feet. Lap plates shall be provided to secure the ends of the plates. Type 316 stainless steel hardware shall be furnished by the FRP supplier for securing baffle plates to 316 SS support brackets and lap plates. Type 316 SS anchor bolts shall be used for anchoring scum baffle supports to the wall.

F. All items furnished under this Section shall be as manufactured by PLASTI-FAB, Inc., Warminster Fiberglass, Leopold, or equal.

2.05 FIBERGLASS LOUVERS

A. Louvers furnished under this Specification apply to all louvers up to 24" x 24", and shall be shipped from the manufacturer's shop as completed units, ready for installation, packaged in cardboard or crated as required, together with mullions, trim, and accessory items which may be necessary for final installation. Field fasteners into steel or concrete to be supplied by Contractor.

B. Each piece, part, or unit shall be clearly identified with a chemical resistant tag, showing manufacturer's drawing number, part number, and location.

C. All louvers furnished under this Specification shall meet the following requirements:

1. Louvers shall be fabricated from pultruded FRP structural shapes, using non-metallic pivot pins and epoxy bonded joints.

2. Adjustable louvers shall be supplied in individual units up to 48-inches wide. Fixed units shall be in widths up to 12 feet, with integral blade supports installed at 36-inch centers.

3. FRP mullion columns shall be used to subframe large openings for placement of multiple louver units. Metallic fasteners shall be Type 304 stainless steel, unless otherwise specified.

4. Standard louvers (fixed and adjustable) shall be 4-inches deep using "storm-proof" type blades, with a blade angle of 35 from the horizontal when open, and 45 percent minimum free area.

5. Standard manual lever-type positive locking operators shall be used on each adjustable unit. Spring and chain, gang, and air cylinder operators are available and should be so specified when required.

6. 1/2-inch mesh PVC bird screen shall be shop installed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All components shall be installed in full accordance with the Drawings, the final shop Drawings and manufacturer’s recommendations by mechanics skilled in the installation of this type of work.

END OF SECTION

SECTION 07 10 00

DAMPPROOFING AND WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

A. Furnish labor, material and equipment to apply waterproofing and dampproofing materials as herein specified in locations as specified and/or shown on the Drawings.

B. Waterproofing shall be applied to the following construction.

C. Exterior face of concrete walls and masonry block walls exposed to grade where the interior finished floor is below grade including any locations opposite a wet wall condition.

D. Apply membrane vapor barrier beneath all interior concrete floor slabs on grade.

1.03 QUALITY ASSURANCE

A. For the purpose of establishing the design and quality of waterproofing products, these specifications are based on products manufactured Koppers Company. Additional manufacturers approved as equals are:

1. Grace Construction Products

2. J and P Petroleum Products

3. Sonneborn

B. Manufacturers having products similar in design, function and quality may submit for approval.

1.04 SUBMITTALS

A. Submit materials list of products and manufacturers printed recommendations for application.

1.05 JOB CONDITIONS

A. Materials shall be delivered to site in manufacturer’s standard containers and protected from the elements until application.

B. Inspect surfaces to which materials are to be applied for conditions adversely affecting the finished work. Do not apply materials until surfaces are properly repaired or replaced.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Below grade waterproofing of concrete surfaces shall be coated with Bitumastic No. 50 as manufactured by Koppers.

B. Membrane vapor barrier: 6 mil. polyethylene.

PART 3 - EXECUTION

3.01 BELOW GRADE WATERPROOFING

A. Concrete surface must be free from all sharp projections, dirt, dust and loose materials. Point and patch all areas including all voids and holes. Apply two coats of coating at the rate of 60 sf./gal. The first coat must be thoroughly dry before the application of the second coat with a minimum of 24 hours between coats.

3.02 INSTALLATION OF MEMBRANE VAPOR BARRIER

A. Install vapor barrier over compacted, clean earth, free of debris and protrusions.

B. Install vapor barrier with edges lapped 6" and sealed with mastic over entire 6" of lap. Apply membrane in 96" width. Lay membrane with seams perpendicular to and lapped in the direction of the pour.

C. Where expansion joints are indicated in slab, lay vapor barrier continuous under expansion joint filler.

D. Seal openings in vapor barrier around pipes and other protrusions with mastic. Fold corners to form complete envelope.

E. Protect installation form damage until concrete slab is in place.

F. Turn vapor barrier down foundation wall minimum of 4".

G. Vapor Barrier installation is required beneath the Following structures only:

1. All Electrical Rooms

2. The ATAD

3. The Control Operations & Maintenance Building

4. The Chemical Building

END OF SECTION

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes cold-applied, emulsified- asphalt dampproofing applied to the following surfaces:

1. Exterior, below-grade surfaces of concrete and masonry foundation walls.

2. Exterior face of inner wythe of exterior masonry cavity walls.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

B. Material Certificates: For each product, signed by manufacturers.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.05 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cold-Applied, Emulsified-Asphalt Dampproofing:

a. Euclid Chemical Company (The).

b. Gardner Asphalt Corporation.

c. Henry Company.

d. Karnak Corporation.

e. Koppers Industries, Inc.

f. Malarkey Roofing Company.

g. Meadows, W. R., Inc.

h. Sonneborn, Div. of ChemRex, Inc.

i. Tamms Industries.

2. Protection Course, Asphalt-Board Type or ½ inch OSB:

a. W R Grace & Co.; Construction Products Div.

b. Meadows, W. R., Inc.

c. Sonneborn, Div. of ChemRex, Inc.

2.02 BITUMINOUS DAMPPROOFING

A. Cold-Applied, Emulsified-Asphalt Dampproofing:

1. Trowel Coats: ASTM D1227, Type II, Class 1.

2. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.

3. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

2.03 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. Protection Course, Asphalt-Board Type: Premolded, ½-inch thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.03 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.

2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

B. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior whether indicated or not.

1. Apply from finished-grade line to top of footing, extend over top of footing, and down outside face of footing.

2. Extend 12-inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

C. Apply dampproofing to provide continuous plane of protection on interior face of above grade, exterior concrete and masonry walls unless walls are indicated to receive direct application of paint.

1. Continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by delaying construction of intersecting walls until dampproofing is applied.

3.04 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gal/100 sq. ft for first coat and 1-gal/100 sq. ft. for second coat, one fibered brush or spray coat at not less than 3-gal/sq. ft. or one trowel coat at not less than 4-gal/100sq. ft..

B. On Unparged Masonry Foundation Walls: Apply primer and two brush or spray coats at not less than 1.5-gal/100 sq. ft. for first coat and 1-gal/100 sq. ft. for second coat, primer and one fibered brush or spray coat at not less than 3-gal/100 sq. ft., or primer and one trowel coat at not less than 5-gal/100 sq. ft.

C. On Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1-gal/100 sq. ft.

3.05 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.06 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E84.
2. Fire-Resistance Ratings: ASTM E119.
3. Combustion Characteristics: ASTM E136.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass-Fiber Insulation:

a. CertainTeed Corporation.

b. Johns Manville Corporation.

c. Knauf Fiber Glass.

d. Owens Corning.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Faced Mineral-Fiber Blanket Insulation: ASTM C665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from slag or rock wool.

2.03 AUXILIARY INSULATING MATERIALS, FOAMED-IN PLACE AND BLOWN-IN INSULATION

A. Foamed-in place masonry Wall Insulation

1. CORE-FILL 500 Guide Specification, AIA Format, Long Form is made a part of this specification and us included at the end of this section.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

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

3.02 PREPARATION

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

3.03 INSTALLATION, GENERAL

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

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

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

C. For wood-framed construction, install mineral-fiber blankets according to ASTM C1320 and as follows:

1. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.

3.05 PROTECTION

A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Installation of roof insulation on new construction ready to receive roofing or waterproof membrane.

1.02 RELATED WORK

A. Perimeter, rigid, and batt or blanket insulation: Section 07 21 00 Thermal Insulation.

B. Sheet metal components: Section 07 60 00, Flashing and Sheet Metal.

1.03 QUALITY CONTROL

A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisors' qualification.

B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00, Submittals.

B. Manufacturer's Literature and Data:

1. Roof insulation, each type
2. Fastening requirements
3. Insulation span data for flutes of metal decks

C. Samples:

1. Roof insulation, each type
2. Nails and fasteners, each type

D. Certificates:

1. Indicating type, thickness and thermal conductance of insulation.
2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.
3. Documentation of supervisors training and experience showing knowledge of roofing procedures.

1.05 DELIVERY, STORAGE AND MARKING

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.

B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.

1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.

2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.

C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.06 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

1. UU-B-790A Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

C. American Society for Testing and Materials (ASTM):

1. C208 Cellulosic Fiber Insulating Board
2. C209 Test Methods for Cellulosic Fiber Insulating Board
3. C552 Cellular Glass Thermal Insulation
4. C726 Mineral Fiber Roof Insulation Board
5. C728 Perlite Thermal Insulation Board
6. C1289 Faced Rigid Cellular Polyisocynurate Thermal Insulation Board
7. D41 Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
8. D312 Asphalt Used in Roofing
9. D2178 Asphalt Glass Felt Used in Roofing and Waterproofing
10. D2822 Asphalt Roof Cement
11. F1667 Driven Fasteners: Nails, Spikes, and Staples

D. Factory Mutual Engineering and Research Corporation (FM):

1. Construction Bulletin 1-28 Insulated Steel Decks.
2. P8016 Specification Tested Product Guide

E. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual - Fourth Edition.

F. Underwriters Laboratories, Inc. (UL):

1. Fire Resistance Directory

G. U.S. Department of Commerce (NBS):

1. PS 1-83 Construction and Industrial Plywood

H. National Particleboard Association (NPA):

1. A208.1-93 Mat-Formed Wood Particleboard

PART 2 - PRODUCTS

2.01 INSULATION

A. Polyisoyanurate, ASTM C1289 Class 1 Type 2.

B. Composite Board: ASTM C1289, Type III.

1. Nail base insulating board:

a. Top surface not less than 10 mm (3/8 inch) thick plywood, wafer board or wood particleboard nail base surface.

1) Plywood: NBS PS 1, Exposure 1.

2) Particleboard: ANSI A208.1, Type 1 Grade 1-M-2 or Type 2, Grade 2-M-2.

b. Insulation: Polyisoyanurate conforming to material specifications.

c. Bottom surface faced with felt facers.

2.02 MISCELLANEOUS

A. Building Paper (Sheathing Paper):

1. Fed. Spec. UU-B-790, Type I, Barrier paper, Grade D, Water - Vapor permeable, Style 1a, Uncreped, not reinforced; or, Style 1b, Uncreped, not reinforced, red rosin sized.

2. Weighing approximately six pounds per 100 square feet.

2.03 FASTENERS

A. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.

B. Nails for securing base sheets, and first ply of vapor retarder, to wood nailers and deck:

1. Type I, Style 20, zinc coated steel roofing nails with minimum head diameter of 10 mm (3/8 inch) through metal discs at least 25 mm (one inch) across; or,

2. One piece nails with an integral flat cap at least 24 mm (15/16 inch) across.

C. Nails for securing building paper and dry felt edge strips to wood nailer and decks:

1. Type I, Style 20, zinc coated steel roofing nails, 16 mm (5/8 inch) minimum head diameter.

2. Type IV, staples, Style 3, flat top crown, zinc coated may be used.

D. Nails into plywood: Annular thread type of length to provide at least 19 mm (3/4 inch) penetration.

E. Nails for securing base sheet, building paper, or first ply of vapor retarder to structural wood fiber decks:

1. Self-clinching type having an integral flat cap not less than 25 mm (one inch) across.

2. Nails shall have a holding power of not less than 18 kg (40 pounds) per fastener.

F. Fasteners for securing insulation to steel decks:

1. Conform to requirements of Factory Mutual Research Corporation for wind uplift.
2. Self-drilling galvanized screws with 50 mm (two inch) diameter disk.
3. Antibackout thread design.
4. Have a pullout resistance of 14 kg (30 pounds) minimum.

PART 3 - EXECUTION

3.01 GENERAL

A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.

B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.

C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

D. 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 only to dry substrates.

E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10°C (50°F). Do not apply materials to substrate having temperature of 10°C (50°F) or less.

F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

G. Building Paper (Red rosin):

1. Lay paper smoothly without buckles or wrinkles at right angles to the roof slope, starting at the low point.
2. Lap each sheet of paper at least 50 mm (two inches) over preceding sheet, and at ends.
3. Staple or nail sufficiently to hold in place until the vapor retarder or insulation is installed.

3.02 SURFACE PREPARATION

A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.

B. Remove projections that might damage materials.

C. Cover wood sheathing, poured gypsum, gypsum plank, and cement wood fiber plank with a layer of building paper (red rosin).

3.03 SELECTION OF RIGID INSULATION

A. Insulation Type:

1. Use polyisocyanurate board.
2. Use not less than two layers of insulation unless specified otherwise.
3. Use either (1/2 inch) thick perlite board or mineral fiberboard as a top layer over polyisocyanurate board. Composite board is acceptable.

B. Insulation Thickness:

1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of not less than 13 for uniform thickness
2. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Owner.
3. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 1-1/2 inches.

3.04 INSTALLATION OF INSULATION

A. Lay insulating units with close joints, in regular courses and with cross-joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in Type III or IV asphalt firmly pressed into the hot bitumen. Keep bitumen below surface of insulation to receive single ply rubber roofing.

B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing felt

C. Cover all insulation installed on the same day by either:

1. The roofing membrane as specified.
2. Temporary protection as specified.

D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.

E. Cut to fit tight against blocking or penetrations.

F. Over Nailable Decks:

1. Lay first ply of felt down dry and mop second ply to first ply at laps. Nail both plies to deck as specified.
2. Lay base sheet down dry with mineral surface down; lap and nail down as specified.

G. Steel Deck:

1. Material and method of application of insulation systems used on metal decks shall meet the requirements of Underwriters laboratories for Class A or Factory Mutual Research Corporation for Class I Insulated Steel Roof Deck.
2. Mechanically anchor insulation to steel deck to conform to FM Class Insulated Steel Roof Deck.

H. Locate the long dimension edge joints to have solid bearing on top of deck ribs; do not cantilever over deck rib openings or flutes.

END OF SECTION

SECTION 07 41 13

METAL ROOF PANELS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Factory-formed and field-assembled, standing-seam metal roof panels.

B. Related Sections include the following:

1. Division 7 Section "Flashing and Sheet Metal" for copings not part of metal roof panel assemblies.

2. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.03 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight roofing system.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm sq. ft. of roof area when tested according to ASTM E 283 at the following test-pressure difference:

1. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.

C. Water Penetration: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

1. Fire/Windstorm Classification: Class 1A- 90.

2. Hail Resistance: MH.

E. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

   a. Uniform pressure of 22 lbf/sq. ft., acting inward or outward.

2. Snow Loads: 5 lbf/sq. ft.

F. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120º F, ambient; 180º F, material surfaces.

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

   a. Flashing and trim.

   b. Gutters.

   c. Downspouts.

2. Roof panels and attachments.

3. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

4. Metal gutters and downspouts.

C. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.

2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.

3. Accessories: 12 inches long Samples for each type of accessory.

E. Qualification Data: For Installer.

F. Field quality-control inspection reports.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:

1. Metal Roof Panels: Include reports for air infiltration, water penetration, performance.

2. Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

H. Maintenance Data: For metal roof panels to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Installer's responsibilities include fabricating and installing metal roof panel assemblies and providing professional engineering services needed to assume engineering responsibility.

B. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated.

1. Do not modify intended aesthetic effects, as judged solely by Engineer, except with Engineer’s approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.

2. Metal roof panels shall be identified with appropriate markings of applicable testing and inspecting agency.

D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockup of typical roof eave as shown on Drawings; approximately 48 inches square by full thickness, including insulation, underlayment, attachments, and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

E. Preliminary Roofing Conference: Before starting roof deck and sheathing construction, conduct conference at Project site. Review methods and procedures related to roof deck and sheathing construction and metal roof panels including, but not limited to, the following:

1. Meet with Owner, Engineer, Owner's insurer if applicable, testing and inspecting agency representative, metal roof panel Installer, metal roof panel manufacturer's representative, deck and sheathing Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.

4. Examine deck, substrate and sheathing conditions for compliance with requirements, including flatness and attachment to structural members.

5. Review structural loading limitations of deck and sheathing during and after roofing.

6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

8. Review temporary protection requirements for metal roof panels during and after installation.

9. Review roof observation and repair procedures after metal roof panel installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.09 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including rupturing, cracking, or puncturing.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Weathertight Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Basis-of-Design Product: The design for each metal roof panel specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. 24 Gauge Hot-Dipped Galvanized Steel ASTM A446-85 Grade C, G-90 Coating ASTM A653 & A924.

2. Surface: Smooth, flat finish.

3. Exposed Finishes: Apply the following coil coating, as specified.

a. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating applied on the Coil Coating Line with a top side film thickness of 0.80 to 0.90 mil over 0.20 to 0.25 mil prime coat to provide a total dry film thickness of 1.0 to 1.15 mil. The reverse side shall be coated with a backer coating of 0.25 mil nominal dry film thickness. Finish shall conform to all tests for adhesion, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.

b. Humidity Resistance 1000 hours

c. Salt Spray Resistance 1000 hours.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½-inch wide and 1/8-inch thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.03 UNDERLAYMENT MATERIALS

A. See Section 06 16 26 for “UNDERLAYMENT”.

2.04 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.

1. Fasteners for Roof Panels: Self-drilling or self-tapping 410 stainless steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.

2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling 410 stainless steel screws with hex washer head.

3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.05 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels Formed with vertical ribs at panel edges, designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and snapping panels together.

1. Basis-of-Design Product: a comparable product of one of the following:
2. Manufacturers:
    a. Berridge Manufacturing Company.
    b. Color As selected by Owner.
3. . Clips: Standard
4. Panel Height: 1.5 inches.
5. Uplift Rating: UL 90.

2.06 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Clips: Minimum 0.0625 inch thick, 410 stainless steel panel clips designed to withstand negative-load requirements.
3. Cleats: Mechanically seamed cleats formed from minimum 0.0250 inch thick, stainless-steel or nylon-coated aluminum sheet.

B. Flashing and Trim: Formed from 0.0179 inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from 0.0179 inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96 inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches o.c., fabricated from same metal as gutters. Finish gutters to match metal roof panels.

1. Gutter Style: As shown on contract documents.
2. Expansion Joints: Butt type.
3. Accessories: 40 mil EPDM liners fully adhered.

D. Downspouts: Formed from 0.0179 inch thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; in 10 foot long sections, complete with formed elbows and offsets. Finish downspouts to match metal roof panels.

E. Other accessories: Fabricate and finish all metal trim, closures, etc. as indicated on the drawings.

2.07 FABRICATION

A. General: Fabricate and finish metal roof 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. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. in edges to be seamed, form seams, and solder.

3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from 410 stainless steel.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.08 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

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

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Flashing and Sheet Metal."

C. Install fasciae and copings to comply with requirements specified in Division 7 Section "Flashing and Sheet Metal."

3.03 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal roof panels by torch is not permitted.

2. Provide metal closures at peaks, rake edges, rake walls and each side of ridge caps.

3. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install ridge caps as metal roof panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Fasteners:

1. Steel Roof Panels: Use stainless-steel fasteners. Fasten continuous clip 24-inch on center.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

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

1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1½-in. telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 96 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building as indicated on drawings.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of ¼ inch in 20 feet on slope and location lines as indicated and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish labor, equipment and material to install sheetmetal flashing and trim.

1.02 SUBMITTALS

A. Submit shop drawings and manufacturers data for all materials supplied under this Section.

B. Submit color charts to Engineer or Architect.

PART 2 - PRODUCTS

2.01 COPINGS, GRAVEL STOPS AND EDGE TRIM

A. Fabricate copings, gravel stops and edge trim of same material and color as preformed metal roofing. Color shall be selected from manufacturer's standard line to match roof panels.

2.02 MISCELLANEOUS AND STEP FLASHING

A. Fabricate miscellaneous flashing of 26 gage hot dipped galvanized sheet metal. Finish shall match metal roof panels.

2.03 CLEATS

A. Fabricate cleats of same metal and gauge as sheet being anchored.

2.04 FABRICATION

A. Shop fabricates items according to profiles shown on the Drawings and the approved shop drawings. Comply with applicable standard industry details.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Do not proceed with installation of sheet metal work until construction intended to receive the work is completed and accepted.

B. Handling and installation of sheet metal work shall comply with manufacturer's recommendations.

C. Coordinate the work with other work for the correct sequencing of items, which make up the entire membrane roofing system. It is required that the flashing and sheet metal work be permanently watertight and not deteriorate in excess of manufacturer's published limitations.

D. Provide for thermal expansion of all exposed sheet metal work exceeding 15 feet running length, except as otherwise indicated.

E. Separate aluminum from dissimilar metals and cementitious materials by means of an isolation membrane or bituminous coating applied to the aluminum surface in contact with the substrate.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Roof curbs.
2. Roof walkways.
3. Preformed flashings.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
2. Division 7 Section "Metal Roof Panels" for preformed metal roofing and ridge vents.
3. Division 7 Section "Flashing and Sheet Metal" for shop- and field-fabricated metal flashing and counter-flashing, and miscellaneous sheet metal trim and accessories.

1.03 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Method of attaching roof accessories to roof or building structure.
2. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Samples: For each type of exposed factory-applied finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

E. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

1. With Engineer's approval, adjust location of roof accessories that would interrupt roof drainage routes**.**

1.08 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.02 METAL MATERIALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Galvanized Steel Sheet: ASTM A653/A653M, G90 coated.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Class AZ50 coated.

3. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

   a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements in AAMA 2605, except as modified below:

      1) Humidity Resistance: [2000] hours.

      2) Salt-Spray Resistance: [2000] hours.

2.03 MISCELLANEOUS MATERIALS

A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1½-in thick.

B. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

E. Roofing Cement: ASTM D4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.04 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

   1. Manufacturers:

      a. Colony Custom Curbs.

      b. Commodity Products Company, Inc.

      c. Conn-Fab Sales, Inc.

      d. Curbs Plus Inc.

      e. Custom Curb, Inc.

      f. LM Curbs.

      g. Loren Cook Company.

h. Metallic Products Corporation.

i. Pate Company (The).

j. Roof Products & Systems Corporation.

k. Roof Products, Inc.

l. Thaler Metal Industries Ltd.

m. ThyCurb; Div. of Thybar Corporation.

n. Uni-Curb, Inc.

o. Vent Products Company, Inc.

2. Load Requirements: Provide curbs that will sustain loads imposed.

3. Material: Galvanized steel sheet, 0.052 inch thick.

a. Finish: Prime painted.

4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

5. Factory insulate curbs with 1½-in thick, cellulosic-fiber board insulation.

6. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.

7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.05 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Manufacturers:

a. Colony Custom Curbs.

b. Commodity Products Company, Inc.

c. Conn-Fab Sales, Inc.

d. Curbs Plus Inc.

e. Custom Curb, Inc.

f. LM Curbs.

g. Loren Cook Company.

h. Metallic Products Corporation.

i. Pate Company (The).

j. Roof Products & Systems Corporation.

k. Roof Products, Inc.

l. Thaler Metal Industries Ltd.

m. ThyCurb; Div. of Thybar Corporation.

n. Uni-Curb, Inc.

o. Vent Products Company, Inc.

2. Material: Galvanized steel sheet, 0.052 inch thick.

a. Finish: Prime painted.

3. Factory-install continuous wood nailers 3½-inches wide at tops of equipment supports.

4. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as metal roof panels.

5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

6. Fabricate units to minimum height of 12 inches, unless otherwise indicated.

7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.06 PREFORMED FLASHINGS

A. Exhaust Vent Flashings: Double-wall metal flashing sleeve, urethane insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar, and as follows:

1. Manufacturers:

a. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.

3. Diameter: As indicated.

B. Vent Stack Flashing: Metal flashing sleeve, with integral deck flange, un-insulated, and as follows:

1. Manufacturers:

a. Thaler Metal Industries Ltd.

2. Metal: Aluminum sheet, 0.064 inch thick, mill finished.

3. Height: 7 inches.

4. Diameter: As indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.

2. Verify dimensions of roof openings for roof accessories.

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

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation:

1. Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation:

1. Set equipment support so top surface of equipment support is level.

3.03 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 9 Painting and Coating Section.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.04 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes joints sealants for the following applications:

1. Exterior joints in the following vertical surfaces and horizontal non-traffic surfaces:

a. Control and expansion joints in unit masonry.

b. Joints in glass unit masonry assemblies.

c. Joints between materials listed above and frames of doors, windows, and louvers.

d. Other joints as indicated.

B. Related Sections include the following:

1. Division 4 Section “Unit Masonry” for masonry control and expansion joint fillers and gaskets.

2. Division 8 Section “Glazing” for glazing sealants.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates interior and exterior.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer’s color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification; For each type and color of joint sealant required, provide Samples with joint sealants in ½ inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI’s Sealant Validation Program.

F. Qualification Data: For Installer and testing agency.

G. Preconstruction Field Test Reports; Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in “Quality Assurance” Article.

H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test result and written recommendations for primers and substrate preparation needed for adhesion.

I. Field Test Report Log: For each elastomeric sealant application.

J. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

K. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Notice to Proceed with the Work.

1. Testing Agency Qualifications: An impendent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Engineer.

2. Conduct field tests for each application indicated below:

a. Each type of elastomeric sealant and joint substrate indicated.

b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Engineer seven days in advance of dates and times when test joints will be erected.

4. Arrange for test to take place with joint-sealant manufacturer's technical representative present.

   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix XI in ASTM C1193.

      (i) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.

6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joints substrates during testing.

1.06 PROJECT CONDITIONS

A. Do Not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40°F.

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacture for application indicated.

4. Contaminants capable of interfering with adhesive have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agree to furnish elastomeric joint sealant to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design specifications.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Owner from manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

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

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

C. Single-Component Acid-Curing Silicone Sealant

1. Products;
    a. Bostik Findley; Chem-Calk 1200
    b. Dow Corning Corporation; 999-A
    c. GE Silicones; Construction SCS 1200
    d. Pecora Corporation; 860
    e. Polymeric Systems, Inc.; PSI-601
    f. Schnee-Morehead, Inc.; SM5732 Polyglaze
    g. Sonneborn, Division of ChemRex, Inc.;OmniPlus
    h. Tremco; Tremsil 200
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25

4. Use Related to Exposure: NT (nontraffic)
5. Uses Related to Joint Substrates: G

2.04 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26° F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufactures of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer’s written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellants, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    a. Concrete
    b. Masonry
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal
    b. Glass

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    1. Do not leave gaps between ends of sealant backings.
    2. Do not stretch, twist, puncture, or tear sealant backings.
    3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
    1. Place sealants so they directly contact and fully wet joint substrates.
    2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tools sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

4. Provide flush joint configuration where indicated per Figure 5B in ASTM C1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.

b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to, as appropriate for type of joint-sealant application indicated.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.

4. Inspect tested joints and report on the following:

a. Whether sealant in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

b. Whether sealants filled joint cavities and are free of voids.

c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether

joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimension.

6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application JS-(1): Exterior vertical control and expansion joints in unit masonry.

1. Joint-Sealant: Single component nonsag polysulfide sealant.
2. Joint-Sealant Color: As selected by Owner from manufacturer’s full range.

B. Joint-Sealant Application JS-(2): Interior and exterior sealant-pointed mortar joints in glass unit masonry assemblies.

1. Joint-Sealant: Single component nonsag polysulfide sealant.
2. Joint-Sealant Color: As selected by Owner from manufacturer’s full range.

C. Joint-Sealant Application JS-(3): Exterior perimeter joints between masonry or concrete and frames of doors, windows and louvers.

1. Joint-Sealant: Single component nonsag polysulfide sealant.
2. Joint-Sealant Color: As selected by Owner from manufacturer’s full range.

D. Joint-Sealant Application: JS-(4): Vertical control and expansion joints on exposed interior surfaces of exterior walls.

1. Joint-Sealant: Single component nonsag polysulfide sealant.

2. Joint-Sealant Color: As selected by Owner from manufacturer's full range.

E. Joint-Sealant Application JS-(5): Interior perimeter joints of exterior openings.

1. Joint-Sealant: Single component nonsag polysulfide sealant.

2. Joint-Sealant Color: As selected by Owner from manufacturer's full range.

F. Joint-Sealant Application JS-(6): Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint-Sealant: Single component mildew-resistant neutral-curing silicone sealant.

2. Joint-Sealant Color: White

G. Joint-Sealant Application JS-(7): Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.

1. Joint-Sealant: Single component nonsag polysulfide sealant.

2. Joint-Sealant Color: White

H. Joint-Sealant Application JS-(8): Perimeter joints between interior wall surfaces and frames of interior doors and windows.

1. Joint-Sealant: Latex sealant

2. Joint-Sealant Color: As selected by Owner from manufacturer's full range.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SCOPE

A. Work covered by this section consists of furnishing all labor, equipment and material required to furnish and install all metal doors, frames, and related work as described herein and/or shown in the Drawings.

1.02 SHOP DRAWINGS AND ENGINEERING DATA

A. Submit complete shop drawings and engineering data in accordance with requirements described in the section titled Section 01 33 00 of these Specifications.

B. Shop drawings shall indicate elevations of each door type, details of each frame type, location in the building for each item, conditions and special details of construction, methods of assembling sections, locations and installation connections, and finishing system.

1.03 SHIPMENT, PROTECTION AND CLEANING

A. Shipment

1. For welded type frames, provide temporary steel spreaders fastened across bottom of frames, where construction will permit concealment, leave spreaders in place after installation, otherwise remove spreaders after frames are set and anchored. In place of spreaders, frames may be strapped, or in packages. Before shipping, label each frame and door with metal or plastic tags to show their location, size, door swing and other pertinent information.

B. Protection

1. Protect doors and frames from damage during transportation and at the job site, store at the site under cover on wood blocking or on suitable floors. After installation, protect doors and frame from damage during subsequent construction activity. Damaged work will be rejected and shall be replaced with new work.

C. Cleaning

1. Upon completion, metal surfaces of doors and frames that are factory finished shall be thoroughly cleaned and touched-up as recommended by the door manufacturer.

1.04 GUARANTEE

A. Provide a guarantee against defective or deficient products and workmanship in accordance with requirements of the section titles “Warranties and Bonds” or these Specifications.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All hollow metal doors and frames shall be the product of a member of the Steel Door Institute. Doors and frames shall conform to the requirements of Steel Door Institute SDI-100 and SDI-112 for Type III extra heavy-duty door.

B. Metal Frames

1. Location and Type

a. All metal frames for doors, mullions, interior glazed panes, and interior louvered panels shall be formed of steel to sizes and shapes indicated. Frames shall be combination type with integral trim and fabricated with full welded joint and shall be of the double rabbet design.

2. Type and Gauges of Metal

a. Metal for frames shall be cold-rolled steel sheets with clean smooth surfaces complying with ASTM A366. Except where other gauges are indicated or specified, frames shall be fabricated from steel, not lighter than 16gauge. Provide concealed metal reinforcement for hard water as required. The gauges of metal for reinforcement shall be in accordance with the manufacturer's recommendations for the type of hardware, and the thickness and width of doors to be hung in the frame, provided that the gauges used are not lighter than 7 gauge for hinges, 12 gauge for closers, and 14 gauge for lock strikes and rod strikes.

3. Workmanship and Design

a. The finished work shall be strong and rigid, neat in appearance and free from defects. Fabricate molded members straight and true with corner joints well formed, in true alignment and fastenings concealed where practicable. Where exterior frames are set in masonry, provide a caulking groove ¼-inch wide by 5/8-inch deep, with a closed back, to receive the caulking compound. Metal frames fro use in interior exposed masonry partitions shall be trim and neat at masonry to receive caulking compound. Frames shall be manufactured and machined to within +/- 1/32-inch of required dimensions.

4. Forming Corner Joints

a. Joints for welded frames shall be mitered, mechanically interlocked, and arc-welded for full width of frame and trim. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush.

5. All frames shall be of the rigid welded type.

6. Provisions for Hardware

a. Frames shall be prepared at the factory for installation of hardware specified in the section titled, "Door Hardware" of these Specifications. Welding of hinges to frames will not be permitted. Frames shall be mortised, reinforced, drilled and tapped to templates to receive all mortised hardware. Frames to receive surface applied hardware shall be provided with reinforcing plates only. Provide cover boxes in back of all hardware cutouts. Doorframes shall be punched to receive rubber or vinyl door silencers. Provide 3 silencers on lock sides of single doors and two silencers for each leaf in heads of double doorframes. Furnish the required number and type of silencers with the frames. Lock strikes shall be set out and adjusted to provide clearance for silencers. All hardware preparation and reinforcement shall be in accordance with Steel Door Institute SDI-107.

7. Mullions and Transom Bars

a. Mullions and transom bars shall be closed or tubular construction, and shall member with heads and jambs and be secured thereto. Use butt-welded joints for all construction. Provide adjustable floor anchors and spreader connections at bottom of mullions.

8. Wall Anchors

a. For Frames Set in Masonry

1 Provide 10-inch long corrugated or other deformed-type adjustable anchors at jambs. Provide mortar guard at lock. Anchors shall be galvanized.

2 Provide mortar guards for all frames to receive door closer.

9. Floor Anchors

a. Provide floor clips of not less than 16-gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be adjustable and drilled for 3/8-inch diameter anchor bolts. Anchors shall be galvanized.

10. Extension Clips

a. Where floor fill occurs, the bottom of frames shall terminate at the indicated finished floor levels and be supported by an adjustable extension slip angle resting on and anchored to the structural slab.

11. Frame Prime Coat

a. All surfaces of all frames that will be concealed after the installation shall receive a field application of an approved coat of asphaltic bituminous primer paint.

b. **NOTE:** The manufacturer shall use extreme care in preparing the frames for contact with the concrete grout required in the jamb portion of all frames. Frames that rust out or become defective by rusting action shall be removed, new frames installed and refinished, all by the Contractor at no additional cost to the Owner.

12. Grouting

a. All hollow metal frames set in masonry shall have the head and jambs grouted full.

13. Labeled Frames

a. Where an UL-labeled fire door is specified or shown, metal frame and anchorage hardware shall be UL listed and labeled. No not remove label from frame.

14. Frames shall be prime painted at the factory.

C. Flush Hollow Metal Doors

1. Doors indicated on Drawings as flush hollow metal and including flush hollow metal doors with glazed and/or louvered openings shall comply with the type, or types, or construction as specified. Doors shall be furnished as a package unit complete with frames as specified hereinbefore and prepared to receive the hardware as specified in the section titled “Door Hardware” of these Specifications.

2. Hollow metal doors shall be of the flush, seamless, extra heavy-duty type for high use, industrial applications. Door shall be constructed using 16-gauge sheet steel face panels either welded to a reinforced steel core or chemically bonded to a composite core. Core shall be constructed of rigid urethane foam, rigid polystyrene foam, phenolic resin impregnated hexagonal honeycomb, or a metal grid fabricated from 16-gauge steel channels. Doors constructed suing metal spacers or a metal grid shall be formed with

continuous, minimum 16-gauge steel channels. Top and bottom edges shall be finished flush and sealed against water penetration. Hinge edge shall be reinforced with a continuous, minimum 14-gauge steel channel or bar. Internal reinforcement for lock and exit hardware shall be box-type, minimum 16-gauge, with reinforcing plates on both sides of door. Internal reinforcement for closers and overhead holders shall be 12-gauge, located on both sides of door. Edge seams formed by face sheets at hinge and lock stiles shall be continuously arc-welded top to bottom and ground smooth.

3. Type and Gauges of Metal

    a. Metal for doors shall be cold-rolled sheets with clean smooth surfaces. The gauges of metal shall be as herein specified. Metal shall be phosphate treated prior to painting.

4. Workmanship

    a. The finished work shall be rigid, neat in appearance and free from defects. Form molded members shall be straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.

5. Door Sizes and Clearances

    a. Doors shall be of type, sizes and design indicated, 1¾-inch thick. The clearances for doors shall be 1/8-inch maximum at jambs and heads, 1/8-inch maximum at meeting stiles of pairs of doors, ¾-inch maximum at sills without thresholds, and ¼-inch maximum between threshold and door.

6. Stile Edges

    a. The lock edges of stiles shall be rounded for double-acting doors and beveled 1/8-inch in 2 inches for other hollow metal doors. Double beveled and straight edge doors are acceptable providing they will swing free under all operating conditions. Pairs of hollow metal doors shall have rebated edges at stiles. Pairs of doors, except for pairs of doors with vertical rod panic hardware, shall have a steel astragali attached to the inactive leaf for in-swinging doors and attached to the active leaf for out-swinging doors.

7. Weatherstripping

    a. Weatherstripping shall be furnished in accordance with the section titled “Door Hardware” of these Specifications.

8. Provisions for Hardware

    a. Mortise, reinforce, drill and tap doors at factory to receive all hardware specified in the section titled “Door Hardware” of these Specifications. Doors shall be field drilled and tapped for surface hardware. Provide metal reinforcing plates for locks and all mortised hardware as required. The gauges of metal for reinforcing plates shall comply with the manufacturer’s recommendations for the type of hardware used and the size required by commercial standard. All hardware preparation and reinforcement shall be in accordance with Steel Door Institute SDI-107.

9. Location of Hardware

    a. The location of hardware in connection with hinged and other swing-type hollow metal doors and frames shall be in accordance with the manufacturer’s current printed Specifications.

10. Louvers for Doors

    a. Louvers indicated for interior doors shall be stationary sight-proof type with a minimum of 60 percent of free air area. Make louvers for exterior doors weatherproof. Construct louvers of 18-gauge steel for interior doors and 16-gauge steel for exterior doors. Louvers for exterior doors shall be provided with aluminum insect screen. Louvers shall be of a fixed type of standard design and construction as produced by the door manufacturer. Louvers on UL-listed fire doors shall be UL approved, fusible link type designed to automatically lock closed at 135°F.

11. Doors requiring glass lights or vision panels shall be of types standard with the manufacturer. Muntins and glazing moldings shall be 18-gauge steel and arranged for glazing with glass ¼-inch thick. All glazing moldings on unlabeled doors shall be of the snap-on type with no exposed screws. Glazing shall be as indicated on the Drawings. Labeled doors shall be provided with metal sash frames for ¼-inch wire glass.

2.02 SHOP PAINTING

A. Primed Finish

1. Apply a primer finish to all ferrous metal surfaces furnished under this section. Clean and phosphatize metal surfaces to assure maximum paint adherence, follow with a dip or spray coat of rust-inhibitive primer on all exposed surfaces. Primer shall be oven-baked for maximum hardness and durability. Primer shall be capable of passing a 200-hour salt spray test in accordance with ASTM B 117.

B. Factory Finish

1. After cleaning and application of the prime coat, apply one coat of baked enamel to the primed surface. Finished surfaces shall be smooth and free from irregularities and rough spots. The time and temperature for drying shall be in accordance with manufacturer recommendations for developing maximum hardness and resistance to abrasion. Colors shall be selected by the Owner from the manufacturer's standard color chart. Painting should be protected with a plastic covering to be removed after installation and all other trades have completed their work.

C. Finish paint shall be capable of passing a 250-hour salt spray test in accordance with ASTM B 117, a 1,000-hour humidity test in accordance with ASTM D 1735, and a 1,000-hour weather exposure test in accordance with ASTM D 822. Finished paint shall have a dry film thickness of not less than 2 mils.

D. Factory finished doors shall be wrapped in a heavy polyethylene bag plus the normal corrugated carton for maximum shipping protection.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of Metal Framed

1. Set frames in position, plumb, align and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts, or with power fasteners. Build wall anchors into walls, or secure to adjoining construction as indicated or specified. Grout frames and transoms full in masonry walls. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to dealings, or

structural framing above. All methods shall be in conformance with the manufacturer's recommendations and Steel Door Institute SDI 105. Metal frames shall be field painted after installation to match door panels.

B. Installation of Metal Doors

1. Hang doors after frames are securely in place in conformity with the manufacturer's recommendations. Make necessary adjustments after door is installed so that it operates with maximum ease and efficiency. The manufacturer shall provide 1 pint of each finish color to the field for touch-up of all nicks, mars and other imperfections.

C. Installation of Prefinished Doors

1. Prefinished doors shall not be hung until all related construction and installation work which could result in damage to door finish is completed. Protective coverings shall remain in place until all other trades have completed their work.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Factory fitting flush wood doors to frames and factory machining for hardware.
3. Louvers for flush wood doors.

B. Related Sections include the following:

1. Division 6 Section "Finish Carpentry" for wood door frames.
2. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.03 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:

1. Factory-Finished Doors: Show the full range of colors available for opaque finishes.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches long, for each material and finish specified.

4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 International Building Code.

1. Test Pressure: Test at atmospheric pressure. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

2. Oversize, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.

3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450º F maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than ¼-inch in a 42 by 84 inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3 inch span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

   a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Wood Doors:

   a. Algoma Hardwoods Inc.

   b. Ampco Products, Inc.

   c. Buell Door Company.

   d. Chappell Door Co.

   e. Eagle Plywood & Door Manufacturing, Inc.

   f. Eggers Industries; Architectural Door Division.

   g. GRAHAM Manufacturing Corp.

   h. Haley Brothers, Inc.

   i. Ideal Wood Products, Inc.

   j. IPIK Door Company.

   k. Lambton Doors.

   l. Marlite.

   m. Mohawk Flush Doors, Inc.

   n. Oshkosh Architectural Door Co.

   o. Poncraft Door Co.

   p. Southwood Door Co.

   q. Vancouver Door Company, Inc.

   r. VT Industries Inc.

   s. Weyerhaeuser Company.

2. Metal Louvers for Doors:

   a. Air Louvers, Inc.

   b. Anemostat Door Products.

   c. Gulfport Industries, Inc.

   d. Hiawatha, Inc.

   e. Leslie-Locke, Inc.

2.02 DOOR CONSTRUCTION, GENERAL

A. Adhesives: Do not use adhesives containing urea formaldehyde.

B. Doors for Transparent Finish:

1. Grade: Premium, with Grade A faces.

2. Species and Cut: White birch, rotary cut.

3. Match between Veneer Leaves: Pleasing match.

4. Assembly of Veneer Leaves on Door Faces: Center balance match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 10 feet or more.

7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.

8. Stiles: Same species as faces.

2.03 SOLID-CORE DOORS

A. Interior Veneer-Faced Doors:

1. Core: Either glued block or structural composite lumber.

2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

3. Construction: Seven plies, either bonded or nonbonded construction.

B. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware. as follows:

3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.

2.04 LOUVERS AND LIGHT FRAMES

A. Wood Louvers: Door manufacturer's standard solid-wood louvers, unless otherwise indicated.

B. Metal Louvers:

1. Blade Type: Vision-proof, inverted V.

2. Metal and Finish: Galvanized steel, 0.0396-inch thick, hot-dip zinc coated and factory primed for paint finish.

C. Wood Beads for Light Openings in Wood Doors:

1. Wood Species: Same species as door faces.

2. Profile: Manufacturer's standard shape.

3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.

2.05 FABRICATION

A. Fabricate doors in sizes indicated for Project-site fitting.

B. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Louvers: Factory install louvers in prepared openings.

2.06 FACTORY FINISHING

A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:

1. Grade: Premium.

2. Finish: AWI System TR-6 catalyzed polyurethane.

3. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-6 catalyzed polyurethane.

4. Effect: Semifilled finish.

5. Sheen: Semigloss.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

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

3.02 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances: Provide 1/8-inch at heads, jambs, and between pairs of doors. Provide 1/8-inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide ¼-inch from bottom of door to top of threshold.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8-inch in 2 inches at lock and hinge edges.

3. Bevel fire-rated doors 1/8-inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 30 10

ALUMINUM HATCHES

PART 1 - GENERAL

1.01 SCOPE

A. The work covered by this section includes furnishing all labor, materials, and equipment required to install, test, and place into satisfactory operation aluminum hatches as shown on the Drawings and/or specified herein.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings and product data to the Engineer in accordance with the requirements of the Section 01 33 00 of these Specifications.

B. At a minimum, the submittals shall contain, but not be limited to, the following information to establish compliance with these Specifications.

C. Drawings showing plan, elevation, and appropriate cross sections of the equipment being provided.

D. Complete engineering data including, but not limited to, descriptive data and material specifications, as appropriate, to support the design of the equipment being approved.

E. A complete description of the warranty to be provided.

1.03 OPERATION AND MAINTENANCE DATA

A. The Contractor shall provide operation and maintenance data in accordance with the requirements of the section 01 70 00 of these Specifications.

1.04 STORAGE AND PROTECTION

A. Equipment shall be stored and protected in accordance with the requirements of the manufacturer and the section entitled “Storage and Protection” of these Specifications.

1.05 WARRANTIES AND BONDS

A. The Contractor shall provide a warranty against defective or deficient materials and workmanship in accordance with the requirements of the section entitled “Warranties and Bonds” of these Specifications.

B. The equipment manufacturer shall provide a warranty against defective or deficient equipment, workmanship and materials under normal use, operation and service. The warranty shall end five (5) years from completion of the project or from date of Engineer’s acceptance of the equipment for permanent operation. The warranty shall be in printed form and apply to all similar units.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Bilco

B. Syracuse Castings

C. Or an Engineer approved equal

2.02 DESIGN CRITERIA

A. Exterior floor doors shall be designed for a live load of 300 pounds per square foot with a maximum deflection of 1/150th of the span.

B. Interior floor doors shall be designed for a live load of 150 pounds per square foot with a maximum deflection of 1/150th of the span.

C. Aluminum hatches shall have the clear openings shown on the Drawings and shall be single-leaf or double-leaf as shown on the Drawings.

2.03 CONSTRUCTION

A. Exterior Floor Doors

1. Exterior floor doors shall be constructed of ¼-in aluminum diamond plate. Channel frame shall be ¼-inch aluminum with an anchor flange around the perimeter and have a minimum cross-sectional area of 7½ square inches to allow for adequate water drainage.

2. Door shall be equipped with heavy forged brass hinges with stainless steel pins. Spring operators shall be provided for smooth, easy, and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature.

3. The door shall automatically lock in the vertical position by means of a heavy steel hold-open arm with release handle. A type 316 stainless steel snap lock with a gasketed cover plug and removable handle shall be provided.

4. A 1½-in. drainage coupling shall be located in the front right corner of the channel frame.

5. All hardware shall be Type 316 stainless steel. Factory finish shall be mill finish with bituminous coating applied to all surfaces in contact with concrete.

B. Interior Floor Doors

1. Interior floor door frames shall be constructed of ¼-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to exterior. Door leafs shall be ¼-inch aluminum diamond plate.

2. Cast steel cam-action hinges shall be bolted to underside and pivot on torsion bars for smooth, easy, and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature.

3. Doors shall open to 90^{o} and automatically lock in that position. A vinyl grip handle shall be provided to release the cover from closing. A type 316

stainless steel snap lock and removable turn handle shall be provided with each hatch.

4. Doors shall be equipped with an outside flush lifting handle and holdback safety chains.

5. Hardware shall be zinc plated and chromate sealed. Factory finish shall be mill finish with bituminous coating applied to all surfaces in contact with concrete.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All hatches shall be installed in accordance with the Manufacturer's requirements to produce a finished product that is clean and demonstrates true craftsmanship.

B. All drains shall be piped to the locations indicated on the Drawings.

3.02 CERTIFICATION

A. A manufacturer's representative that is qualified in the particular equipment requirements shall fully inspect and certify the equipment installation. Written certifications shall be provided that state the equipment is installed properly and will be warranted as required by the Specifications.

END OF SECTION

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OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following types of electric-motor-operated overhead coiling doors:

1. Insulated service doors.

B. Related Sections include the following:

1. Division 5 Section "Miscellaneous Metals" for miscellaneous steel supports.

2. Division 9 Section "Painting and Coating" for field-applied paint finish.

3. Division 26 Sections for electrical service and connections for powered operators and accessories.

1.03 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 20 cycles per day.

1.05 SUBMITTALS

A. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

B. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below.

1. Curtain Slats: 12 inches long.

2. Bottom Bar: 6 inches long.

3. Guides: 6 inches long.

4. Brackets: 6 inches square.

5. Hood: 6 inches square.

C. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Alpine Overhead Doors, Inc.

2. Atlas Door; Div. of Clopay Building Products Company, Inc.

3. Cookson Company.

4. Cornell Iron Works Inc.

5. Dynamic Closures Corporation.

6. Mahon Door Corporation.

7. McKeon Rolling Steel Door Company, Inc.

8. Metro Door.

9. Overhead Door Corp.

10. Pacific Rolling Doors Co.

11. Raynor.

12. Southwestern Steel Rolling Door Co.

13. Wayne-Dalton Corp.

14. Windsor Door, a MAGNATRAX Corporation.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION-(STAINLESS STEEL BEING AN OPTION TO EPOXY COATED CURTAINS)

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A653/A653M, G90 (Z275) coating designation.
    a. Minimum Base-Metal (Uncoated) Thickness: 0.0209 inch.
    b. Flat profile slats.
2. Optional-(Stainless-Steel Door Curtain Slats): ASTM A666, Type 304.
    a. Minimum Specified Thickness: Not less than 0.025 inch.
    b. Flat profile slats.
3. Aluminum Door Curtain Slats: ASTM B209 or ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
    a. Aluminum Extrusion Thickness: Not less than 0.051 inch.
    b. Flat profile slats.
    c. Perforated slats, 25 percent of total door opening.
4. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84. Enclose insulation completely within metal slat faces.
5. Inside Curtain Slat Face: To match material of outside metal curtain slat, manufacturer’s standard.

B. Endlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1½-in x 1½-in x 1/8-in thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.

D. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16 inch thick galvanized steel sections complying with ASTM A36/A36M and ASTM A123/A123M. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.03 HOODS AND ACCESSORIES

A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Fabricate hoods for steel doors of minimum 0.028 inch thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

2. Fabricate hoods for stainless-steel doors of minimum 0.025 inch thick stainless-steel sheet, Type 304, complying with ASTM A666.

3. Fabricate hoods for aluminum doors, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; 0.032 inch minimum thickness, complying with ASTM B209.

4. Shape: Round.

B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8 inch- thick, replaceable, continuous sheet secured to inside of hood.

1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.

2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8 inch thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.

C. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

1. Provide pull-down straps or pole hooks for doors more than 84 inches high.

D. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

E. Chain Lock Keeper: Suitable for padlock.

F. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.04 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in/ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.05 EMERGENCY MANUAL DOOR OPERATORS

A. Provide manual chain hoist operators for emergency use.

B. Chain-Hoist Operator: Provide manual chain-hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and gear-reduction unit with a maximum 35-lbf (155-N) force for door operation. Provide alloy steel hand chain with chain holder secured to operator guide.

2.06 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. All electric door operators shall be wall mounted.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, worm-gear running-in-oil drive, and chain and sprocket secondary drive.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps , without exceeding nameplate ratings or service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
4. Provide totally enclosed, nonventilated or fan-cooled motor, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure where indicated.

H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

a. Provide electrically actuated automatic bottom bar.

1) Self-Monitoring Type: Four-wire configured device.

J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.

2.07 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Manufacturer's standard mill finish.

1. Color and Gloss: As selected by Owner from manufacturer's full range.

2.09 STEEL AND GALVANIZED STEEL FINISHES

A. Factory Primer for Field Finish: Manufacturer's standard primer, compatible with field-applied finish according to coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

1. Apply to ferrous surfaces except zinc-coated metal.

2. Epoxy paint required. See paint specification.

3. Color and Gloss: As selected by Owner from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.

3.02 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.03 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

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ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.

a. Glazing is retained mechanically with gaskets on four sides.

2. Exterior and interior manual-swing aluminum doors.

3. Exterior fixed windows.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.

2. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.

3. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.

2. Thermal movements.

3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

4. Dimensional tolerances of building frame and other adjacent construction.

5. Failure includes the following:

a. Deflection exceeding specified limits.

b. Thermal stresses transferred to building structure.

c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.

d. Glazing-to-glazing contact.

e. Noise or vibration created by wind and thermal and structural movements.

f. Loosening or weakening of fasteners, attachments, and other components.

g. Sealant failure.

h. Failure of operating units to function properly.

B. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. Provide sealant that fails cohesively before sealant releases from substrate when tested for adhesive compatibility with each substrate and joint condition required.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.

2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

C. Structural-Sealant Joints: Designed to produce tensile or shear stress in structural-sealant joints of less than 20 psi.

D. Structural Loads:

1. Wind Loads: 40 lbs. per sq. ft.

E. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13-ft 6-in.

2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.

F. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.

3. Test Durations: As required by design wind velocity but not less than 10 seconds.

G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 F, ambient; 180 F, material surfaces.

H. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

I. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1. Maximum Water Leakage: [According to AAMA 501.1] [No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation]. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

K. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.

3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery.

2. Anchorage.

3. Expansion provisions.

4. Glazing.

5. Flashing and drainage.

E. Welding certificates.

F. Qualification Data: For Installer and testing agency.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

H. Field quality-control test and inspection reports.

I. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

a. Include structural-sealant-glazing quality-control program development and reporting complying with ASTM C 1401 recommendations including, but not limited to, system material qualification procedures, preconstruction sealant-testing program, and procedures and intervals for system fabrication and installation reviews and checks.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Engineer, except with Engineer’s approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.

D. Accessible Entrances: Comply with Georgia ADA Barriers Compliance Board's "Americans with Disabilities Act, Accessibility Guidelines for Buildings and Facilities (ADAAG)."

E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

F. Structural-Sealant Glazing: Comply with recommendations in ASTM C1401, "Guide for Structural Sealant Glazing."

G. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems

without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.07 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.

b. Noise or vibration caused by thermal movements.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

d. Adhesive or cohesive sealant failures.

e. Water leakage through fixed glazing and framing areas.

f. Failure of operating components to function properly.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arch Aluminum & Glass Co., Inc.

2. CMI Architectural Products, Inc.

3. Commercial Architectural Products, Inc.

4. EFCO Corporation.

5. Kawneer.

6. Pittco Architectural Metals, Inc.

7. Tubelite Inc.

8. United States Aluminum.

9. Vistawall Architectural Products.

10. YKK AP America Inc.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B209 (ASTM B209M).

2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

3. Extruded Structural Pipe and Tubes: ASTM B429.

4. Structural Profiles: ASTM B308/B308M.

5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.03 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Nonthermal

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

E. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.05 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: 1¾-in thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3½-in nominal width.
    a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
    a. Provide nonremovable glazing stops on outside of door.

2.06 DOOR HARDWARE

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
    1. Opening-Force Requirements:
        a. Egress Doors: Not more than 30 ft-lb required to set door in motion and not more than 15 ft-lb required to open door to minimum required width.
        b. Accessible Interior Doors: Not more than 5 ft-lb.
    2. References to BHMA Standards: Provide products complying with standards referenced in this Article and with requirements for description, quality, type, and function listed in the Door Hardware Schedule at the end of Part 3.

B. Pivot Hinges:
    1. Standard: BHMA A156.4, Grade 1.
    2. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

C. Ball-Bearing Butts:
    1. Standard: BHMA A156.1, Grade 1, radius corner.
    2. Provide nonremovable pins at hinges exposed to outside of door.
    3. Provide nonferrous hinges where hinges are exposed to weather.
    4. Quantities:
        a. For doors with heights up to 87 inches, provide 3 hinges per leaf.

D. Locking Devices, General: Do not require use of key, tool, or special knowledge for operation.
    1. Opening-Force Requirements:
        a. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 ft-lb for not more than 3 seconds.
        b. Latches and Exit Devices: Not more than 15 ft-lb required to release latch.

E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

F. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

G. Cylinders: BHMA A156.5, Grade 1.

1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation ["DO NOT DUPLICATE"] to be furnished by Owner.

H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

I. Operating Trim: BHMA A156.6.

J. Closers: With accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use, and adjustable to meet field conditions and requirements for opening force.

1. Standard: BHMA A156.4, Grade 1.

K. Concealed Overhead Holders: BHMA A156.8, Grade 1.

L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

M. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000, molded neoprene, or ASTM D2287, molded PVC.

N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

O. Silencers: BHMA A156.16, Grade 1.

P. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of ½-in.

1. Standard: BHMA A156.21.

2.07 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Building Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.08 FABRICATION

A. Form aluminum shapes before finishing.

B. 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 fitted joints with ends coped or mitered.

3. Means to drain water passing joints, condensation occurring 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 from interior.

7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

D. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2. At exterior doors, provide weather sweeps applied to door bottoms.

F. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.09 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: As selected by Engineer from full range of industry colors and color densities.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.02 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.

2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

b. Install weatherseal sealant according to Division 7 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.

2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Building Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; ¼-in over total length.

2. Alignment:

   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.

   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 in.

3.03 FIELD QUALITY CONTROL

A. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

   1. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.04 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

   1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

(SCHEDULED BY NAMING PRODUCTS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.

b. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.

1.03 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.

1. Door Hardware: As follows:

a. Hinges.

b. Pivots.

c. Locks and latches.

d. Bolts.

e. Cylinders and keys.

f. Operating trim.

g. Closers.

h. Stops and holders.

i. Door gasketing.

j. Thresholds.

k. Weatherstripping.

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.

b. Manufacturer of each item.

c. Fastenings and other pertinent information.

d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

e. Explanation of abbreviations, symbols, and codes contained in schedule.

f. Mounting locations for door hardware.

g. Door and frame sizes and materials.

D. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

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

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

G. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

H. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Engineer, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)." as follows:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 ft-lb applied perpendicular to door.

c. Thresholds: Not more than ½ inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 ft-lb to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 ft-lb for not more than 3 seconds.

c. Door Closers: Not more than 30 ft-lb to set door in motion and not more than 15 ft-lb to open door to minimum required width.

d. Thresholds: Not more than ½ inch high.

3. Test Pressure: Test at atmospheric pressure.

F. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

2. Preliminary key system schematic diagram.

3. Requirements for key control system.

4. Address for delivery of keys.

G. Pre-installation Conference: Conduct conference at Project site. Retain paragraph above if requirements in Division 1 are adequate for Project. Retain paragraph below if additional requirements are necessary; include information about conference. Identify specific participants not mentioned in Division 1.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review required testing, inspecting, and certifying procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to manufacturer of key control system.

D. Deliver keys to Owner by registered mail or overnight package service.

1. City of Villa Rica.

1.06 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.07 WARRANTY

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

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of operators and door hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

C. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.

1.08 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, door hardware sets indicated in door and frame schedule, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

2. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

3. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.02 HINGES AND PIVOTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hinges:

a. Cal-Royal Products, Inc. (CRP).

b. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

c. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

d. Or equal.

C. Standards: Comply with the following:

1. Butts and Hinges: BHMA A156.1.

2. Template Hinge Dimensions: BHMA A156.7.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

E. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

F. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.

2. Doors with Closers: Antifriction-bearing hinges.

3. Interior Doors: Standard-weight hinges.

G. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

a. Outswinging exterior doors.

b. Outswinging corridor doors with locks.

H. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.

2. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

3. Screws: Phillips flat-head screws; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

2.03 LOCKS AND LATCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:

a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

b. Schlage Lock Company; an Ingersoll-Rand Company (SCH).

c. Yale Security Inc.; Div. of Williams Holdings (YAL).

d. Or equal.

C. Standards: Comply with the following:

1. Bored Locks and Latches: BHMA A156.2.

2. Auxiliary Locks: BHMA A156.5.

3. Exit Locks: BHMA A156.5.

D. Auxiliary Locks: BHMA Grade 2.

E. Lock Trim: Comply with the following:

1. Lever: cast.

2. Escutcheon (Rose): cast.

3. Dummy Trim: Match lever lock trim and escutcheons.

4. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:

a. Bored Locks: Corbin Russwin, “Armstrong AZD BHMA 625 finish with 217L13MLENFIN T-Strike, 680F06 deadlocking latchbolt and wrought strike box.

F. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Bored Locks: BHMA A156.2.

G. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Bored Locks: Minimum ½ inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

H. Backset: 2¾-in, unless otherwise indicated.

2.04 DOOR BOLTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Bolts:
   a. Cal-Royal Products, Inc. (CRP).
   b. Rockwood Manufacturing Company (RM).
   c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
   d. Trimco.
   e. Or equal.

C. Standards: Comply with the following:

1. Manual Flush Bolts: BHMA A156.16.

D. Flush Bolts: BHMA Grade 2, designed for mortising into door edge.

E. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Half-Round Surface Bolts: Minimum 7/8-inch throw.

2.05 CYLINDERS AND KEYING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders: Same manufacturer as for locks and latches.
2. Cylinders:
   a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
   b. Schlage Lock Company; an Ingersoll-Rand Company (SCH).
   c. Yale Security Inc.; Div. of Williams Holdings (YAL).
   d. Or equal.
3. Key Control Systems:
   a. Key Control Systems, Inc. (KCS).

b. Major Metalfab Co. (MM).

c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

d. Sunroc Corporation (SUN).

e. Corbin Ruswinn.

C. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.

2. Key Control System: BHMA A156.5.

D. Cylinder Grade: BHMA Grade 2.

E. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.

2. Bored-Lock Type: Cylinders with tailpieces to suit locks.

F. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key, and usable with other manufacturers' cylinders.

G. Construction Keying: Comply with the following:

1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores, as directed by Owner.

H. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.

2. Existing System: Re-key Owner's existing master key system into new keying system.

3. Keyed Alike: Key all cylinders to the same change key.

a. Cylinders shall be master keyed.

I. Keys: Provide nickel-silver keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE." Information to be furnished by Owner.

2. Quantity: In addition to one extra blank key for each lock, provide the following:

a. Cylinder Change Keys: Three.

b. Master Keys: Five.

c. Grand Master Keys: Five.

d. Great-Grand Master Keys: Five.

J. Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

1. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.

2. Capacity: Able to hold keys for 150 percent of the number of locks.

3. Cross-Index System: Set up by key control manufacturer, complying with the following:

a. Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.

2.06 STRIKES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

D. Dustproof Strikes: BHMA Grade 1.

2.07 OPERATING TRIM

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Rockwood Manufacturing Company (RM).

2. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

3. Or equal.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate from stainless steel, unless otherwise indicated.

2.08 ACCESSORIES FOR PAIRS OF DOORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Coordinators:

a. Hager Companies (HAG).

b. NT Monarch Hardware; an Ingersoll-Rand Company (NTM).

c. Rockwood Manufacturing Company (RM).

d. Or equal.

2. Astragals:

a. Hager Companies (HAG).

b. National Guard Products, Inc. (NGP).

c. Pemko Manufacturing Co., Inc. (PEM).

d. Or equal.

B. Standards: Comply with the following:

1. Coordinators: BHMA A156.3.

2.09 CLOSERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Surface-Mounted Closers:

a. Cal-Royal Products, Inc. (CRP).

b. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

c. Yale Security Inc.; Div. of Williams Holdings (YAL).

d. Or equal.

2. Closer Holder Release Devices:

a. LCN Closers; an Ingersoll-Rand Company (LCN).

b. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

c. Yale Security Inc.; Div. of Williams Holdings (YAL).

d. Or equal.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

2. Closer Holder Release Devices: BHMA A156.15.

C. Surface Closers: BHMA Grade 2.

D. Certified Products: Provide door closers listed in BHMA's "Directory of Certified Door Closers."

E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.10 STOPS AND HOLDERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Rockwood Manufacturing Company (RM).

2. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

3. Yale Security Inc.; Div. of Williams Holdings (YAL).

4. Or equal.

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.

2. Combination Overhead Holders and Stops: BHMA A156.8.

3. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 2.

D. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.

1. Where floor or wall stops are not appropriate, provide overhead holders.

E. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter ½ inch; fabricated for drilled-in application to frame.

2.11 DOOR GASKETING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Door Gasketing:

a. Hager Companies (HAG).

b. National Guard Products, Inc. (NGP).

c. Pemko Manufacturing Co., Inc. (PEM).

d. Or equal.

2. Door Bottoms:

a. Hager Companies (HAG).

b. National Guard Products, Inc. (NGP).

c. Pemko Manufacturing Co., Inc. (PEM).

d. Or equal.

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3. Door Bottoms-Shoe: Apply to bottom of door, forming seal with threshold when door is closed.

D. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E283.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Gasketing Materials: Comply with ASTM D2000 and AAMA701/702.

2.12 THRESHOLDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hager Companies (HAG).
2. National Guard Products, Inc. (NGP).
3. Pemko Manufacturing Co., Inc. (PEM).
4. Or equal.

B. Standard: Comply with BHMA A156.21.

2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow metal doors.
3. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.14 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 600: Primed for painting, over steel base metal.

2. BHMA 651: Bright chromium plated over nickel, over steel base metal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

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

3.02 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.04 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

2. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

2. Consult with and instruct Owner's personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.08 DOOR HARDWARE SCHEDULE USING THE FOLLOWING MANUFACTURERS AND THEIR MODEL NUMBERS AS BASIS OF DESIGN:

Note: Products that are designated as stainless steel shall be polished and stainless steel. Products that are not designated as stainless steel shall have a bright chrome finish.

A. Butts: Stanley No. FBB179, stainless steel.

B. Locksets: Corbin Ruswinn CL Series, bright chrome.

C. Closers: Corbin Ruswinn DC3200 Series, plastic cover and aluminum finish.

D. Double bolt: Trimco No. 3900.

E. Floor Stop: Trimco No.1210.

F. Wall Stop: Trimco No. 1270CV.

G. Silencers: Trimco No. 1229A.

H. Saddle Threshold: Pemko No. 276SS.

I. Perimeter Gasketing: Pemko No. 303PWS.

J. Door Shoe: Pemko No. 2211PWS Painted Finish.

K. Split Astragal: Pemko No. 303PWS.

DOOR HARDWARE SETS:

HARDWARE SCHEDULE

17-01, 17-03, 17-05,

16-01, 16-03, 16-04, 16-07,

15-02, 15-03

SET No. 1: 2-01, 9-01,

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3955
Closer:	1-DC2210
Silencers:	3-1129A
Perimeter Gasketing:	303APK
Shoe:	1-2211AV
Threshold:	1-276A

SET No. 2: 3-01, 6-01, 13-01, 13-03, 13-04, 13-06, 13-09

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3955 stainless steel construction
Silencers:	3-1129A

Perimeter Gasketing:	303APK
Shoe:	1-2211PW
Threshold:	1-276SS

SET No. 3: 9-02, 10-02, 13-10, 16-08, 16-10, 16-11

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3955
Silencers:	3-1129A
Floorstop:	1-1210

SET No. 4: 13-05, 15-04, 15-20, 16-06, 17-02, 17-04

Butts:	3 PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3955
Plunger Door Holder:	2-Trimco 1255 cast bronze
Double Bolt:	1-3900
Closer:	1-DC2210
Silencers:	2-1129A
Perimeter Gasketing:	303APK
Shoe:	2-2211AV
Threshold:	1-276A

SET No. 5: 15-06, 15-09, 15-10, 15-16, 15-17, 15-18, 15-19, 16-08, 16-10, 16-11, 17-03, 17-09

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3951
Wall Stop:	1-1270V
Silencers:	3-1129A

SET No. 6: 15-07, 15-08, 16-09, 16-13

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3957
Silencers:	3-1129A

SET No. 7: 15-12, 15-13

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3910
Silencers:	3-1129A
Wall Stop:	1-1270V

SET No. 8: 15-11, 15-15, 16-12, 16-14

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Pushplate:	1-Trimco 1001-3 stainless steel
Pulls:	1-Trimco 1010-3 stainless steel
Closer:	1-DC2210 stainless steel finish
Silencers:	3-1129A

SET No. 9: 15-14

Butts:	3 PR. 4 ½ "x 4 ½ " FBB179
Pushplate:	2-Trimco 1001-3 stainless steel
Pulls:	2-Trimco 1010-3 stainless steel
Closer:	2-DC2210 stainless steel finish
Silencers:	2-1129A

SET No. 10: 17-10, 17-11

Butts:	1 ½ PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3920 stainless steel finish
Floorstop:	1-1210 stainless steel finish
Silencers:	3-1129A

SET No. 11: 17-12

Butts:	3 PR. 4 ½ "x 4 ½ " FBB179
Lockset:	1-CL3951 stainless steel finish
Double Bolt:	1-3900 stainless steel finish

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1. Doors.

2. Aluminum Windows.

1.03 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in inches or millimeters according to ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

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 E1300, according to the following requirements:
    a. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
    b. Specified Design Snow Loads: As indicated, 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."
    c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
        1) Load Duration: 60 seconds or less.
    d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
        1) Load Duration: 30 days.
    e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
        1) For monolithic-glass lites heat treated to resist wind loads.
        2) For insulating glass.
        3) For laminated-glass lites.
    f. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
    1. Temperature Change (Range): 120° F, ambient; 180° F, material surfaces.

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 laminated-glass lites, properties are based on products of construction indicated.
    2. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal ½ inch wide interspace.
    3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
        a. U-Factors: NFRC 100 expressed as Btu/sq. ft. x h x deg F.
        b. Solar Heat Gain Coefficient: NFRC 200.
        c. Solar Optical Properties: NFRC 300.

1.05 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12 inch square Samples for glass and of 12 inch long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Samples: For the following products, in the form of 12 inch square Samples for glass.

1. Each color of tinted float glass.

2. Wired glass.

3. Each type of laminated glass with colored interlayer.

4. Insulating glass for each designation indicated.

5. For each color (except black) of exposed glazing sealant indicated.

D. 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.

E. 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 manufacturer of coated glass is certified by coating manufacturer.

F. Qualification Data: For installers.

G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

H. Product Test Reports: For each of the following types of glazing products:

1. Tinted float glass.

2. Insulating glass.

3. Glazing sealants.

4. Glazing gaskets.

I. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E548.

2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.

2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

E. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201and for wired glass, ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of manufacturer acceptable to authorities having jurisdiction.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

2. Associated Laboratories, Inc.

H. Preinstallation Conference: Conduct conference at Project site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40º F.

1.09 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Product: Subject to compliance with requirements, provide product specified.

4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

5. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

6. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

a. Products:

1) AFG Industries Inc.; Krystal Klear.

2) Pilkington Building Products North America; Optiwhite.

3) PPG Industries, Inc.; Starphire.

4) Schott Corporation; Amiran.

2. For uncoated glass, comply with requirements for Condition A.

B. Wired Glass: ASTM C1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.

1. Interlayer: Polyvinyl butral of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.

a. For cured-resin interlayers, laminate lites with laminated-glass manufacturer's standard cast-in-place and cured-transparent-resin interlayer.

C. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

3. Sealing System: Dual seal, with primary and secondary sealants as follows:

a. Manufacturer's standard sealants.

4. Spacer Specifications: Manufacturer's standard spacer material and construction.

5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

a. Corner Construction: Manufacturer's standard corner construction.

2.03 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C864.

2. EPDM, ASTM C864.

3. Silicone, ASTM C1115.

4. Thermoplastic polyolefin rubber, ASTM C1115.

5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.

2. EPDM.

3. Silicone.

4. Thermoplastic polyolefin rubber.

5. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C542, black.

2.04 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will 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.

3. Colors of Exposed Glazing Sealants: As selected by Owner from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants.

a. Products:

1) Dow Corning Corporation; 790.

2) GE Silicones; SilPruf LM SCS2700.

3) Tremco; Spectrem 1 (Basic).

4) GE Silicones; SilPruf SCS2000.

5) Pecora Corporation; 864.

6) Pecora Corporation; 890.

7) Polymeric Systems Inc.; PSI-641.

8) Sonneborn, Div. of ChemRex, Inc.; Omniseal.

9) Tremco; Spectrem 3.

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 100/50.

d. Use Related to Exposure: NT (nontraffic).

e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2.05 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with

or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.06 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

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

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85 ±5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

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

2.07 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.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.08 MONOLITHIC WIRED-GLASS UNITS

A. Polished Wired-Glass Units: Form 1 (wired glass, polished both sides), Quality-Q6, Mesh 2 (M2) (Square), thick.

1. Manufacturers:

a. Asahi/AMA Glass Corp.; affiliated with AFG Industries, Inc.

b. Central Glass Co., Ltd.; distributed by Northwestern Industries Inc.

c. Pilkington Sales (North America) Ltd.

2.09 INSULATING-GLASS UNITS

A. Clear Insulating-Glass Units IG-1 inch thick.

1. Basis-of-Design Product: PPG Azurlite Spectrally Selective Tinted Glass or a comparable product by one of the following:

a. Pilkington Building Products.

b. Visteon.

2. Products:

"Evergreen" by Pilkington Building Products

"Versalux Blue 2000" by Visteon

3. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.

4. Interspace Content: Air.

5. Outdoor Lite: Class 2 (tinted) float glass.

a. Tint Color: "Azurlite" by PPG Industries, Inc.

b. Kind FT (fully tempered).

6. Indoor Lite: Class 1 (clear) float glass.

a. Kind FT (fully tempered).

7. Visible Light Transmittance: 60 percent minimum.

8. Winter Nighttime U-Factor: 0.48 maximum.

9. Solar Heat Gain Coefficient: 1.58 percent maximum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

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

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.05 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do

come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 09 30 13

CERAMIC TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Ceramic mosaic tile.

2. Waterproof membrane for thin-set tile installations.

3. Crack-suppression membrane for thin-set tile installations.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.

1.03 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C499) plus joint width indicated.

B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C499).

C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.04 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C1028:

1. Level Surfaces: Minimum 0.6.

2. Step Treads: Minimum 0.6.

3. Ramp Surfaces: Minimum 0.8.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

2. Full-size units of each type of trim and accessory.

E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Installer.

H. Material Test Reports: For each tile-setting and -grouting product.

1.06 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

D. Pre-installation Conference: Conduct conference at Project site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.

B. Store tile and 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 liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units. Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.02 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. As indicated by manufacturer's designations. Match Engineer’s samples, as selected by Owner.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.03 TILE PRODUCTS

A. Manufacturers:

1. American Marazzi Tile, Inc.
2. American Olean; Div. of Dal-Tile International Corp.
3. Buchtal Corporation USA.
4. Cerim-Floor Gres Ceramiche.
5. Crossville Ceramics Company, L.P.
6. Daltile; Div. of Dal-Tile International Inc.
7. Florida Tile Industries, Inc.
8. GranitiFiandre.
9. Interceramic.
10. KPT, Inc.
11. Laufen USA.
12. Lone Star Ceramics Company.
13. Metropolitan Ceramics.
14. Monarch Tile, Inc.
15. Porcelanite, Inc.
16. Quarry Tile Company.
17. Seneca Tiles, Inc.
18. Summitville Tiles, Inc.
19. United States Ceramic Tile Company.
20. Winburn Tile Manufacturing Company.

B. Unglazed Ceramic Mosaic Tile: Factory-mounted flat tile as follows:

1. Composition: Vitreous or impervious natural clay or porcelain.
2. Surface: Slip-resistant, with abrasive admixture.
3. Module Size: 1-in x 1-in.
4. Nominal Thickness: ¼-in.
5. Face: Plain , with cushion edges.
6. Basis-of-Design Product: Unglazed Ceramic Mosaics.
    a. American Olean.
7. For furan-grouted quarry tile, precoat with temporary protective coating.

C. Ceramic Mosaic Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

1. Base Cove: Cove, module size 1-in x 1-in .

2. Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1-in x 1-in.

3. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1-in x 1-in.

4. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above.

5. Internal Corners: Cove, module size 1-in x 1-in.

D. Accessories for Glazed Wall Tile: Provide vitreous china accessories of type and size indicated, in color and finish to match adjoining wall tile, and intended for installing by same method as adjoining wall tile.

1. One soap holder for each shower indicated.

2.04 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to ½-in or less, and finish bevel to match face of threshold.

2.05 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.

B. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex-portland cement mortar; 60 inches wide by 0.030-inch nominal thickness.

1. Product: Noble Company (The); Nobleseal TS.

C. PVC-Sheet Product: Two layers of PVC sheet heat-fused together and to facings of bondable nonwoven polyester, for adhering to latex-portland cement mortar; 60-in wide by 0.040-in. nominal thickness.

1. Product: Compotite Corporation; Composeal Gold.

D. Polyethylene-Sheet Product: Polyethylene faced on both sides with fleece webbing for adhering to latex-portland cement mortar; 39-in wide by 0.008-in nominal thickness.

1. Product: Schluter Systems L.P.; KERDI.

E. Corrugated-Polyethylene Product: Corrugated polyethylene with dovetail-shaped corrugations for adhering to latex-portland cement mortar and with anchoring webbing on the underside; 39-in wide by 3/16-in nominal thickness.

1. Product: Schluter Systems L.P.; DITRA.

F. Fabric-Reinforced, Modified-Bituminous-Sheet Product: Self-adhering SBS-modified-bituminous sheet with woven reinforcement facing for adhering to latex-portland cement mortar; 36-in wide by 0.040-in nominal thickness.

1. Product: National Applied Construction Products, Inc.; Strataflex.

G. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR59, Subpart D (EPA Method 24), and fabric reinforcement.

1. Products:

a. Custom Building Products; Trowel & Seal Waterproofing and Anti-Fracture Membrane.

b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.

c. MAPEI Corporation; PRP M19.

d. Summitville Tiles, Inc.; S-9000.

H. Latex-Portland Cement Product: Flexible mortar consisting of cement-based mix and acrylic-latex additive.

1. Products:

a. Boiardi Products Corporation; Elastiment 323.

b. MAPEI Corporation; PRP 315.

c. Southern Grouts & Mortars, Inc.; Southcrete 1100.

d. TEC Specialty Products Inc.; TA-324, Triple Flex.

2.06 SETTING AND GROUTING MATERIALS

A. Manufacturers:

1. Atlas Minerals & Chemicals, Inc.

2. Boiardi Products Corporation.

3. Bonsal, W. R., Company.

4. Bostik.

5. C-Cure.

6. Custom Building Products.

7. DAP, Inc.

8. Jamo Inc.

9. LATICRETE International Inc.

10. MAPEI Corporation.

11. Southern Grouts & Mortars, Inc.

12. Summitville Tiles, Inc.

13. TEC Specialty Products Inc.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.

2. Prepackaged dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive.

    a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Chemical-Resistant, Water-Cleanable, Tile-Setting and -Grouting Epoxy: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140°F and 212°F, respectively, and certified by manufacturer for intended use.

E. Water-Cleanable, Tile-Setting Epoxy Adhesive: ANSI A118.3.

F. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler, unless otherwise indicated.

G. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.

1. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

    a. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.

H. Chemical-Resistant Furan Grout: ANSI A118.5.

I. Grout for Pregrouted Tile Sheets: Same silicone rubber used in factory to pregrout tile sheets.

2.07 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

1. Products:

    a. Dow Corning Corporation; Dow Corning 786.

    b. GE Silicones; Sanitary 1700.

    c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.

    d. Tremco, Inc.; Tremsil 600 White.

    e. C-CURE

2.08 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar,

and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

1. Products:

a. Bonsal, W. R., Company; Grout Sealer.

b. Bostik; CeramaSeal Grout Sealer.

c. C-Cure; Penetrating Sealer 978.

d. Custom Building Products; Grout Sealer.

e. Jamo Inc.; Penetrating Sealer.

f. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile

g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.

h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

i. TEC Specialty Products Inc.; TA-257 Silicone Grout Sealer.

2.09 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.02 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.

2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.03 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's “Handbook for Ceramic Tile Installation”. Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3. For chemical-resistant furan grouts, comply with ANSI A108.8.

3.04 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.

B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.05 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.

1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.

a. Tile floors in wet areas.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch .

C. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.06 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch

3.07 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection rinse neutral cleaner from tile surfaces.

3.08 FLOOR TILE INSTALLATION SCHEDULE

A. Tile Installation: Interior floor installation on waterproof crack-suppression membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.

1. Tile Type: Unglazed ceramic mosaic.

2. Thin-Set Mortar: Latex-portland cement mortar.

3. Grout: Polymer-modified sanded grout.

3.09 WALL TILE INSTALLATION SCHEDULE

A. Tile Installation: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202 and ANSI A108.5.

1. Tile Type: Unglazed ceramic mosaic.

2. Thin-Set Mortar: Dry-set portland cement mortar.

3. Grout: Sand-portland cement grout.

END OF SECTION

SECTION 09 51 23

ACOUSTICAL TILE CEILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:

1. Concealed suspension systems.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.03 DEFINITIONS

A. CAC: Ceiling Attenuation Class.

B. LR: Light Reflectance coefficient.

C. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

5. Minimum Drawing Scale: ¼ inch = 1 foot.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.

2. Suspension System Members: 12 inch long Sample of each type.

3. Exposed Moldings and Trim: Set of 12 inch long Samples of each type and color.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.

2. Suspension System: Obtain each type through one source from a single manufacturer.

a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

b. Identify materials with appropriate markings of applicable testing and inspecting agency.

3. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E1264 for Class A materials as determined by testing identical products per ASTM E84:

a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E580.

D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Administrative Requirements."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.08 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed.

2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 ACOUSTICAL TILES, GENERAL

A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15¾-in away from test surface per ASTM E795.

B. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

2.03 MINERAL-BASE ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING

A. Products:

1. Fine Fissured Ceramaguard Perforated 24-in x 24-in x 5/8-in as manufactured by Armstrong World Industries, Inc. specified to set requirements.

2. Pattern: C perforated, small holes.

B. Color: White.

C. LR: Not less than 0.80.

D. NRC: Not less than 0.55.

E. CAC: Not less than 38.

F. Edge Detail: Square.

G. Thickness: 5/8 inch.

H. Size: 24 by 24 inches.

2.04 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 inch diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.05 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. Available Products:

1. PRELUDE PLUS XL Fire Guard as manufactured by Armstrong World Industries is specified to set a standard.

B. Indirect-Hung, Fire-Rated Suspension System: Main and cross runners roll formed from hot-dip galvanized according to ASTM A653/A653M, G30) coating designation with aluminum cap.

1. Structural Classification: Intermediate-duty system.

2. Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

a. Initial Access Opening: In each module 24-in x 24-in.

2.06 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers:

1. Armstrong World Industries, Inc.

2. Chicago Metallic Corporation.

3. Fry Reglet Corporation.

4. Gordon, Inc.

5. MM Systems, Inc.

6. USG Interiors, Inc.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical tile edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. Baked polyester paint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.

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

3.02 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical tile ceilings to comply with ASTM C636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

6. Do not attach hangers to steel deck tabs.

7. Do not attach hangers to steel roof deck. Attach hangers to structural members.

8. Space hangers not more than 48-in o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8-in from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16-in o.c. and not more than 3-in from ends, leveling with ceiling suspension system to a tolerance of 1/8-in. in 10 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Arrange acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim.

3.04 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall, under this section, furnish all material, equipment, and labor to accomplish all painting necessary or convenient to the Contractor for the satisfactory completion of work included under these Contract Documents.

1.02 SCOPE OF WORK

A. In general, work included under this section shall include the surface preparation, shop priming, field priming, and/or field painting of all surfaces identified in the Painting Schedule, of this Specification section.

B. The scope of the painting and coating work shall include all surfaces requiring painting or coating for the proposed new work and recoating of all existing exterior building surfaces as indicated in this Specification section.

C. Surfaces of new equipment items including pumps, motors, blowers, drives, etc., which have a factory finish coating, shall be given a minimum of 2 field coats of the required type and color after installation. New electrical motor control centers, small ventilation fans, water coolers, and other small equipment with an approved factory finish are not to be given a field coat unless specifically stated.

D. Primed coats and surface preparation specified herein will not be required on items delivered with prime or shop coats already applied and still in a condition satisfactory to the Owner and whose prime coat is compatible with the finish coating specified herein.

E. Painting or coating will not be required on the following items:

1. Aluminum, bronze, copper, stainless steel, and/or corrosion-resistant metal products excluding piping, except as noted.

2. Asphalt surface, except any striping required.

3. Plastic, FRP, polypropylene, and similar materials, excluding piping.

4. All galvanized surfaces, except as noted.

1.03 SUBMITTALS

A. The Contractor shall submit to the Owner for his review the following information concerning materials the Contractor proposes to use in work covered by this item:

1. A list of all components (paints or other materials) to be used in each painting system required herein with brand, type and manufacturer including dry film thickness and volatile organic compound (VOC) limits.

2. A complete descriptive specification of each component which includes performance criteria, surface preparation, and application instructions, and safety requirements.

B. The Contractor shall submit to the Engineer, for review and color selection, color cards for all paints, stains, or other materials proposed. Only those colors which have been reviewed and

accepted by the Owner shall be utilized in work covered by this Specification section.

C. Samples:

1. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

2. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.

3. Rejected samples shall be resubmitted until approved.

D. VOC Requirements: Submit manufacturer's certification that paints and coatings comply with Federal, State, and Local, whichever is more stringent, requirements for VOC (Volatile Organic Compound).

E. Only those systems and components, which are judged acceptable by the Owner, shall be utilized in the work covered by this item. No materials shall be delivered to the job site until the Engineer has evaluated their acceptability.

1.04 QUALITY ASSURANCE

A. Workmanship shall be performed by skilled workmen thoroughly trained in necessary crafts and completely familiar with specific requirements and methods specified herein.

B. The following information shall be included on the label of all containers of materials supplied under this item:

1. Manufacturer’s name and color (if any)

2. Type of paint or other generic identification

3. Manufacturer’s stock number

4. Instructions for mixing, thinning, or reducing (as applicable)

5. Manufacturer’s application recommendations

6. Safety and storage information

C. Preapplication Meeting: Convene a pre-application meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, applicator, and manufacturer’s representative. Review the following:

1. Environmental requirements.

2. Protection of coating systems and surfaces not scheduled to be coated.

3. Surface preparation.

4. Application.

5. Disinfection.

6. Repair.

7. Field quality control.

8. Cleaning.

9. One-year inspection.

10. Coordination with other work.

D. Contractor shall obtain the Engineer's review of the first finished room, space, area, item or portion of work of each surface type and color specified. The first room, space, area, item, or portion or work that is acceptable to the Engineer shall serve as the project standard for all surfaces of similar type and color. Where spray application is utilized, the area to be reviewed shall not be smaller than 100 square feet.

1.05 MANUFACTURER'S REPRESENTATIVE DURING PAINTING OPERATIONS

A. An authorized representative of the coatings' manufacturer shall be present at the start up and periodically during painting operations. Such representative shall instruct and observe the Contractor's workmen and shall, at completion of the work, certify in writing to the Engineer that the manufacturer's application recommendations have been adhered to. Cost of this work shall be borne by the Contractor.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Unless otherwise specified herein, all paint, primers, varnishes, and sealers shall be delivered to the job site in their original, unbroken containers not exceeding 5-gallon capacity each. With permission of the Engineer, the manufacturer may use and ship in agitator barrels.

B. Paint and related materials and equipment shall be stored in a suitable location on the project site away from work areas and other storage areas. All applicable health, safety, and fire regulations controlling the storage of paint and related materials shall be strictly adhered to. All materials shall be stored and handled in accordance with the manufacturer's recommendations.

1.07 JOB CONDITIONS

A. The manufacturer's recommendations concerning environmental conditions under which a material can be applied shall be strictly followed. No finished shall be applied in areas where dust is being generated.

B. The Contractor shall cover or otherwise protect the finished work of other trades, surfaces not being painted concurrently, and/or surfaces, which are not to be painted. Any injury or damage to such surfaces shall be remedied to the satisfaction of the Owner at the expense of the Contractor before final acceptance, and no separate payment, therefore, will be made.

1.08 TESTING EQUIPMENT

A. The Contractor shall furnish and make available to the Engineer the following items of testing equipment for use in determining if requirements of this Specification section are being satisfied. Specified items of equipment shall be available for the Engineer's use at all times when field painting or surface preparation is in progress.

1. Wet film gauge
2. Surface thermometer
3. Keane-Tator surface profile comparator
4. Set of National Association of Corrosion Engineers (NACE) visual standards
5. Holiday (pin hole) detector (low voltage)

6. Sling-psychrometer
7. Magnetic dry film gauge

1.09 EXTRA STOCK

A. Upon completion of work, provide owner with at least one gallon of each type and color of product used.

B. Containers shall be tightly sealed and clearly labeled for identification.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The specific products and manufacturers listed for each general product classification in the "Materials List" of this Section, are given only to identify the generic type, quality, and general composition required for each product. The Contractor may furnish similar products of other manufacturers in accordance with provisions of "Quality Assurance" of this Specification.

B. Pre-approved manufacturers are Tnemec, Induron, Carboline, and Thoro. The utilization of named products as given in the "Materials List" of this section does not excuse the Contractor from complying with the provisions of said "Quality Assurance".

C. All materials used in successive field coats shall be produced by the same manufacturer. Material used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to underlying paint.

2.02 MIXING AND TINTING

A. When possible, all paints and other materials shall be mixed and tinted by the paint manufacturer prior to delivery to the job site.

B. When job site mixing and/or tinting is required, the manufacturer's recommendations shall be strictly adhered to. The Contractor shall be solely responsible for the proper conduct of all on-site mixing and/or tinting.

2.03 OSHA SAFETY COLOR USAGE GUIDE

A. OSHA Safety colors in accordance with ANSI Z53.1 shall be used for marking physical hazards and safety equipment and locations. The following OSHA Safety Color Usage Guide shall be used in determining the coating color and type of marking required.

B. Safety Red: Fire protection equipment, Fireboxes, Extinguishers, Exit Signs, Sprinkler piping, Portable containers of flammable liquids, Emergency stop bars.

C. Safety Orange: Exposed box housings, Exposed edges of pulleys, gears, etc., Safety starting buttons.

D. Safety Yellow – Physical Hazard - Caution (Generally used with black in checks or stripes): Unguarded edges of platforms, Elevator door edges, Bollards, Pulley blocks, Material handling equipment.

E. Safety Green – Safety Equipment and Locations: First aid kits and stretchers, First aid signs, dispensaries, and drinking water stations.

PART 3 – EXECUTION

3.01 CONTRACTOR'S INSPECTION

A. The Contractor shall examine all surfaces scheduled to receive paint or other finishes for conditions that will adversely affect execution, permanence, or quality of work covered by this item. Surfaces which cannot be put into an acceptable condition through preparatory work, as included in Preparation of Surfaces of this section, shall be immediately brought to the attention of the Owner.

B. The Contractor shall not proceed with surface preparation or coating application until surface conditions are suitable.

3.02 PROTECTION

A. Extreme diligence shall be taken to ensure that vehicles, equipment, hardware, fixtures, materials, etc., are protected against paint spillage, overspray, etc. Such damages shall be corrected at no expense to Owner.

B. Surfaces not to be coated shall be masked, removed, or otherwise covered to protect against cleaning and coating application procedures and weather. Drop cloths shall be used to protect floor, walls, machinery, equipment, and previously coated surfaces.

C. Exercise care in erecting, bracing, handling, and dismantling staging and scaffolding, to avoid scratching or damaging walls, floors, equipment, etc.

3.03 APPLICATION

A. Shop-Applied Prime Coats

1. Prime coats and surface preparation specified herein will not be required on items delivered with prime or shop coats already applied and still in a condition satisfactory to the Owner and whose prime coat is compatible with the finish coat.

2. It shall be the responsibility of the Contractor to coordinate work so that the shop primed items are primed and painted with compatible coatings form the same manufacturer.

3. All equipment shop primed shall be cleaned of grease, oil, and other contaminants prior to field top coating.

4. Shop-applied coatings, which are damaged during transit to the job site, during storage, and/or during installation, will be repaired to the satisfaction of the Owner. Damaged coatings will be redone in accordance with Paragraph 3.02 "Preparation of Surfaces" and reprimed in accordance with Paragraph 3.04 "Painting Schedule".

B. Apply finish coatings with suitable brushes, rollers, or spray equipment.

1. Rate of application shall not exceed the paint manufacturer's recommendation for the surface being coated.

2. Brushes, rollers, and spraying equipment shall be kept clean, dry, and free of contaminants at all times.

3. Stain shall be applied by brush or clean, dry cloth. Wipe or dry brush until desired toning is achieved. If deeper tone is required, repeat application after first coat is thoroughly dry.

C. Field painting shall be in the number of coats specified in the Painting Schedule of this section. Shop of field-applied priming coats shall not be considered as one of the required field finish coats.

1. Individual field finish coats shall be tinted differently in order to distinguish each coat from preceding or succeeding coats.

2. The coating manufacturer's recommendation for drying time between coats shall be strictly complied with.

3. The Engineer shall inspect each coat before additional coats are applied. Only inspected coats will be considered in determining the number of coats applied.

D. Finish coats shall be smooth, free of brush marks, streaks, runs, laps or pile-up of paint, and skipped or missed areas. Moldings, trim, and other ornaments shall be left clean and true to details with no undue amount of paint in corners and depressions. The edges of paint adjoining other materials or colors shall be clean and sharp with no overlapping. Where any portion of the finish of a wall has been damaged or is not acceptable, the entire wall shall be refinished.

E. Hardware, trim, and other items shall be removed, as required, for proper application of coatings.

3.04 CLEAN UP

A. Upon completion, painting contractor shall clean up and remove from site all surplus materials, tools, appliances, empty cans, cartons, and rubbish resulting from painting work. Site shall be left in neat, orderly condition.

B. Remove all protective drop cloths and masking from surfaces not being painted. Provide touch-up around same areas as directed by Owner's Representative.

C. Remove all misplaced paint splatters or drippings resulting from this work.

3.05 PAINTING SCHEDULE

A. Steel - Structural, Tanks, Pipes And Equipment

B. Exterior/Interior Exposure (Nonsubmerged) - Epoxy System

1. Surface Preparation
   a. SSPC-SP6 Commercial Blast Cleaning
2. Shop Coat
   a. TNEMEC Series 1 Omnithane
   b. 2.5 - 3.5 mils dft
3. 2nd Coat
   a. TNEMEC Series 135 Chembuild
   b. 3 - 4 dft
4. 3rd Coat
   a. (Interior) TNEMEC Series 66 Hi-Build Epoxoline
   b. (Exterior) TNEMEC Series 72 Endura-Shield
   c. 2 – 3 dft

C. Exterior/Interior Exposure - Non-Submerged; Equipment that comes with a Manufacturers Standard Paint

1. Surface Preparation

a. SSPC-SP6 Commercial Blast Cleaning or SSPC-SP3 Power Tool Cleaning
2. Shop Coat
   a. TNEMEC Series 1 Omnithane
   b. 2.5 – 3.5 dft
3. 2nd Coat
   a. TNEMEC Series 135 Chembuild
   b. 3 - 4 dft
4. 3rd Coat
   a. (Interior) TNEMEC Series 66 Hi-Build Epoxoline
   b. (Exterior) TNEMEC Series 72 Endura-Shield
   c. 2 – 3 dft

D. Submerged - Potable Water - Epoxy Polyamide System

1. Surface Preparation
   a. SSPC-SP10 Near White Blast Cleaning
2. Shop Coat
   a. TNEMEC Series 1 Omnithane
   b. 2.5 - 3.5 dft
3. 2nd Coat
   a. TNEMEC Series N140-1255 Pota Pox
   b. 4 – 5 dft
4. 3rd Coat
   a. TNEMEC Series N140-15BL Pota Pox
   b. 4 – 5 dft

E. Submerged - Non-Potable Water - Epoxy System

1. Surface Preparation
   a. SSPC-SP10 Near White Blast Cleaning
2. Shop Coat
   a. TNEMEC Series 1 Omnithane
   b. 2.5 - 3.5 dft
3. 2nd Coat
   a. TNEMEC Series 66 Hi-Build Epoxoline
   b. 4 – 5 mils dft
4. 3rd Coat
   a. TNEMEC Series 104 H.S. Epoxy
   b. 6 – 8 mils dft

F. Overhead Metal Decking, Joist - Interior Exposure

1. Surface Preparation
   a. Surfaces must be dry, clean, and free of oil, grease and other contaminants. Allow concrete to cure 28 days.
2. 1st Coat
   a. TNEMEC Series 115 Uni-Bond DF
   b. 2.5 - 3.5 mils dft
3. 2nd Coat
   a. TNEMEC Series 115 Uni-Bond DF
   b. 2.5 - 3.5 mils dft

G. Mill Coated Steel Pipe - Exterior/Interior Exposure (Nonsubmerged) – Epoxy System

1. Surface Preparation

a. Surface shall be clean and dry.
2. Shop Coat
   a. TNEMEC Series 1 Omnithane
   b. 2.5 - 3.5 mils dft
3. 2nd Coat
   a. TNEMEC Series 135 Chembuild
   b. 3 - 4 dft
4. 3rd Coat
   a. (Interior) TNEMEC Series 66 Hi-Build Epoxoline
   b. (Exterior) TNEMEC Series 72 Endura-Shield
   c. 2 – 3 dft

H. Galvanized Steel - Pipe And Miscellaneous Fabrications –

1. Exterior Exposure (Non-Submerged) – Epoxy, High-Build Acrylic System
   a. Surface Preparation
      1) SSPC-SP1 Solvent Cleaning. Exterior surfaces to be cleaned as required by manufacturer
   b. 1st Coat
      1) TNEMEC Series 66 Hi-Build Epoxoline
      2) 2 – 3 mils dft
   c. 2nd Coat
      1) TNEMEC Series 72 Endura Shield
      2) 2 – 3 mils dft
2. Interior Exposure (Non-Submerged) – Epoxy System
   a. Surface Preparation
      1) SSPC-SP1 Solvent Cleaning. Exterior surfaces to be cleaned as required by manufacturer.
   b. 1st Coat
      1) TNEMEC Series 66 Hi-Build Epoxoline
      2) 2 – 3 mils dft
   c. 2nd Coat
      1) TNEMEC Series 66 Hi-Build Epoxoline
      2) 2 – 3 mils dft

I. Ductile Iron Pipe

1. Exterior/Interior Exposure & Submerged – Epoxy System
   a. Surface Preparation:
      1) Surface shall be clean and dry
   b. Shop Coat
      1) TNEMEC Series 1 Omnithane
      2) 2.5 – 3.5 mils dft
   c. 2nd Coat
      1) TNEMEC Series 66 Hi-Build Epoxoline
      2) 3 – 4 mils dft

d. 3rd Coat
    1) TNEMEC Series 66 Hi-Build Epoxoline
    2) 3 – 4 mils dft

2. Exterior Buried
    a. Shop Coat
        1) TNEMEC Series 46H-413
        2) 8-10 mils DFT

J. PVC Pipe

1. Exterior Exposure – Epxoy, High-Build Acrylic System
    a. Surface Preparation
        1) Surface shall be clean, dry, and scarified
    b. 1st Coat
        1) TNEMEC Series 66 Hi-Build Epoxoline
        2) 2 – 3 mils dft
    c. 2nd Coat
        1) TNEMEC Series 72 Endura Shield
        2) 2 – 3 mils dft

2. Interior Exposure – Epoxy System
    a. Surface Preparation
        1) Surface shall be clean, dry, and scarified
    b. 1st Coat:
        1) TNEMEC Series 66 Hi-Build Epoxoline
        2) 2 – 3 mils dft
    c. 2nd Coat
        1) TNEMEC Series 66 Hi-Build Epoxoline
        2) 2 – 3 mils dft

K. Concrete

1. Exterior - Above Grade – Modified Waterborne Acrylate System
    a. Surface Preparation
        1) Surfaces must be dry, clean, and free of oil, grease and other contaminants.
        2) Allow concrete to cure 28 days.
    b. 1st Coat
        1) Tnemec Series 156 applied at 136 sq. ft. per gallon
    c. 2nd Coat
        1) Tnemec Series 156 applied at 136 sq. ft. per gallon

L. Masonry

1. Exterior Exposure – Siloxane/Silane System
    a. Surface Preparation:
        1) Surface shall be clean and dry

b. 1st Coat
    1) TNEMEC Series 662 Prime-A-Pell Plus
    2) Maximum Coverage: 75 sf/gal

2. Interior Exposure (Non-Submerged) – Epoxy System
    a. Surface Preparation
        1) Surface shall be clean and dry
    b. 1st Coat
        1) TNEMEC Series 130 Envirofill
        2) 70-80 sq ft/gal
    c. 2nd Coat
        1) TNEMEC Series 66 Hi-Build Epoxoline
        2) 3 – 4 mils dft
    d. 3rd Coat
        1) TNEMEC Series 66 Hi-Build Epoxoline
        2) 3 – 4 mils dft

M. Gypsum Wallboard

1. Interior Exposure – Acrylic Epoxy System
    a. Surface Preparation
        1) Surface shall be clean and dry
    b. 1st Coat
        1) TNEMEC Series 51 PVA Sealer
        2) 1-2 mil DFT
    c. 2nd Coat
        1) TNEMEC Series 113 H.B. Tneme-Tufcoat
        2) 2-3 mils DFT
    d. 3rd Coat
        1) TNEMEC Series 113 H.B. Tneme-Tufcoat
        2) 2-3 mils DFT

N. Wood

1. Exterior/Interior Exposure – Acrylic Epoxy System
    a. Surface Preparation
        1) Surface shall be clean and dry
    b. 1st Coat
        1) TNEMEC Series 10W
        2) 2.5 - 3.5 mils dft
    c. 2nd Coat
        1) TNEMEC Series 113 H.B. Tneme-Tufcoat
        2) 2 – 3 mils dft
    d. 3rd Coat

1) TNEMEC Series 113 H.B. Tneme-Tufcoat

2) 2 – 3 mils dft

O. Secondary Containment Areas

a. Preparation Scarify concrete to a CSP 3-5 minimum standard. Prior to coating, the substrate must be clean, dry and free of all contaminants.
b. Primer - Series 201 at 4.0 – 12.0 mils
c. Base Coat - Series 239 SC (Resin) at 6.0 – 12.0 mils
d. Fiberglass Reinforcement - ¾ oz. chopped strand fiberglass mat
e. Saturant Coat - Series 239 SC (Resin) at 6.0 – 12.0 mils
f. Topcoat - Series 282 at 4.0 – 8.0 mils
g. Total DFT - 65 mils

P. Concrete Floors

1. Preparation.....Scarify concrete to a CSP 3-5 minimum standard. Prior to coatings, the substrate must be clean, dry and free of all contaminants.
2. Primer .....Series 281 at 10.0 – 12.0 mils
3. Topcoat.....Series 281 at 10.0 – 12.0 mils
4. Total DFT .....20 – 24 mils

Q. Interior lining of lift stations, pump stations, wet wells, and metals associated in these areas – aggressive areas where ppm's over 50.

R. Interior Exposed Concrete and Metals

1. System Type: Fiber Reinforced Modified Polyamine Epoxy
2. Surface Preparation:
   a. Interior Steel – SSPC-SP10 Near White Metal Blast
   b. Concrete: SSPC-SP 13/NACE 6. Abrasive blast.
      1) 1st Coat: Series 436 Perma-Shield FR. DFT 80 mils minimum.
      2) 2nd Coat: Series 435 DFT 10 mils minimum.
      3) Total DFT: 94 mils minimum

3.06 PIPE AND EQUIPMENT IDENTIFICATION

A. Pipe Color Code

1. The Contractor shall color code all pipes, including insulated pipe, in accordance with the schedule given below. Where applicable, colors shall comply with the Specifications described in Section 3, "Color Definitions", of ANSI Z53.1. Other colors shall be selected by the Engineer or Owner in accordance with "Colors" of this section.

2. Stripes where required shall consist of 6-inch wide bands completely around the pipe located 36-inches on centers. On pipe runs less than 36-inches in length, one color band shall be located at the center of the run.

B. Color Schedule

1. <u>Hazardous Materials</u> <u>Color</u>

Acid.....Yellow with Black Stripes

Alum/Polyaluminum.....Orange

Caustic.....Yellow with Green Band

Chlorine/Hypochlorite..... Yellow

Hydraulic Fluid Piping..... Yellow with Blue Stripes

Lime Slurry..... Yellow with Green Stripes

Phosphate Compounds..... Light Green with Red Band

Polymers ..... Orange with Green Band

Bisulfite..... Yellow with Red Stripes

2. Air Systems — Color

Instrument Air..... Green with White Stripes

Process Air..... Dark Green

Vacuum..... Green with Red Stripes

3. Flammable Systems — Color

Digester Gas — Orange with Red Stripes

Fuel Oil — Orange with Blue Stripes

4. Process Water — Color

Plant Water ..... Red with Black Stripes

Seal Water..... Red

Wash Water (High Pressure) ..... Red with Yellow Stripes

Cooling Water..... Red with White Stripes

Reuse Water..... Purple

5. Sludge Systems — Color

Blended Sludge..... Tan with Blue Stripes

Digested Sludge ..... Tan with Green Stripes

Primary Sludge ..... Tan with Orange Stripes

Return or Recirculated Sludge... Tan

Transfer Piping ..... Tan with Red Stripes

Waste Activated Sludge..... Tan with Black Stripes

6. Vents — Color

Digester Gas Vents ..... Aluminum with Orange Stripes

Fuel Oil Vents..... Aluminum with Blue Stripes

Sanitary Vents..... Aluminum with Black Stripes

Other Vents..... Aluminum with Green Stripes

7. Process Piping — Color

Heating and Heat Recovery Piping (Steam)..... Gray with Red Stripes

Supernatant, Decant, or Filtrate ..... Gray

Overflow ..... Black or Gray

Raw Sewage (Sanitary) ..... Gray

Raw Water (Water) ..... Olive Green

Finished or Potable Water ..... Dark Blue

8. Miscellaneous — Color

Electrical Conduit ..... Aluminum*

Oxygen ..... White

Roof Drains ..... Gray with Blue Stripes

* Where electrical conduit is exposed in a finished room or area, the conduit shall be painted to match room finish.

C. Pipe Labels

1. After other painting of pipe work has been completed as provided for above, the Contractor shall label all pipe work with stenciled legends. Legends shall be descriptive of the function of the pipe, such as "ACID". Two legends, one legend on each side of the pipe, shall be provided at a suitable location along each pipe run.

2. For long runs of pipe, legends shall be provided at intervals not exceeding 50 feet and 20 feet in congested areas determined by the Engineer. The legend shall be so located on the pipe that it will be in direct line of vision. Legend may be omitted from one side if view is obstructed from that side. Where the flow in a pipe shall be at all times in one direction only; then a flow arrow shall be place in front of each legend on the pipe. The lettering and arrows shall be cut neatly into stencils, the arrows being the same height as the letters.

3. The size of lettering shall be as follows:

Outside Diameter of Pipe or Covering	Size of Letters
¾ to 2"	½"
2½" to 6"	1 ½"
8" to 10"	2 ½"
Over 10"	3 ½"

4. For pipes smaller than ¾" in outside diameter, use a laminated plastic or aluminum tag with the lettering etched or stamped and filled in with black or contracting enamel.

5. The legends and flow arrows shall be stenciled with approved black or contrasting stencil paint. The above outline of intent designates the general extent of the identification of pumps and other equipment as may be directed by the Engineer. Following the completion of the work under this item, the Contractor shall deliver to the Owner two sets of all stencils used.

6. See Section entitled "MECHANICAL INDETIFICATION" of these Specifications for additional information.

D. Equipment Labels

1. Where specified in these Contract Documents or directed by the Engineer, the Contractor shall paint stencil legends, in the same manner as a pipe, of appropriate size on the individual units of equipment such as blowers, pumps, collector drives, compressors, silencers, etc. All push buttons, starters, switches, etc., when remote from the equipment controlled and/or power packs, shall have labels of the engraved plastic type affixed to or adjacent to the remote switch, push button, starter, etc.

3.07 TRANSPARENT FINISH FOR ALL INTERIOR WOOD DOORS

A. Polyurethane Varnish System:

1. One Factory-applied Finish Coat; matching field-applied finish coats.
2. Two Field-applied Finish Coats; Interior, oil-modified, clear urethane, satin.

END OF SECTION

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid-phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for each exposed product and for each color and texture specified.

D. Product certificates.

E. Maintenance data.

1.03 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities"] [and] [ICC/ANSI A117.1] for toilet compartments designated as accessible.

PART 2 - PRODUCTS

2.01 MATERIALS

2.02 PHENOLIC-CORE UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Accurate Partitions Corporation.
2. American Sanitary Partition Corporation.
3. Ampco, Inc.
4. Bobrick Washroom Equipment, Inc.
5. Bradley Corporation; Mills Partitions.
6. Flush Metal Partition Corp.
7. General Partitions Mfg. Corp.
8. Global Steel Products Corp.
9. Knickerbocker Partition Corporation.
10. Metpar Corp.
11. Partition Systems Incorporated of South Carolina.
12. Rockville Partitions Incorporated.
13. Sanymetal; a Crane Plumbing company.
14. Shanahan's Limited.
15. Tex-Lam Manufacturing, Inc.
16. Weis-Robart Partitions, Inc.
17. Young Group Ltd. (The); Fabricated Products Division; DesignRite Partitions.

B. Toilet-Enclosure Style: Overhead braced Floor anchored.

C. Urinal-Screen Style: Wall hung Floor anchored Overhead braced.

D. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch thick doors and pilasters and minimum 1/2-inch thick panels.

E. Pilaster Shoes and Sleeves (Caps): Fabricated from stainless-steel sheet, not less than 3 inches high, finished to match hardware.

F. Urinal-Screen Post: Manufacturer's standard post design of monolithic phenolic urinal screen cut out at bottom to form a post material matching the thickness and construction of pilasters; with shoe and sleeve (cap) matching that on the pilaster.

G. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; **stainless steel**.

H. Phenolic-Panel Finish: Facing sheet of one color and pattern in each room.

1. Color and Pattern: As selected by The Owner from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.

2.03 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: **Stainless steel**.
2. Hinges: Manufacturer's standard **paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees**.
3. Latch and Keeper: Manufacturer's standard **recessed** latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.04 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at **tops and** bottoms of posts. Provide shoes **and sleeves (caps)** at posts to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch wide, in-swinging doors for standard toilet compartments and 36-inch wide, out-swinging doors with a minimum 32-inch wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Clearances: Maximum 1/2 inch between pilasters and panels; 1 inch between panels and walls.

3.02 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Public-use washroom accessories.
2. Underlavatory guards.
3. Custodial accessories.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule:

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

B. Toilet Tissue (Roll) Dispenser :

1. Basis-of-Design Product: Bobrick B-2730.

C. Paper Towel (Folded) Dispenser :

1. Basis-of-Design Product: Bobrick B-262.

D. Liquid-Soap Dispenser :

1. Basis-of-Design Product: Bobrick B-8221 and B-2112.

E. Grab Bar :

1. Basis-of-Design Product: Bobrick B-580699 36” and 42”.

F. Fold-Down Purse :

1. Basis-of-Design Product: Bobrick B-287.

G. Mirror Unit :

1. Basis-of-Design Product: Bobrick B-166.

2.2 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

B. Shower Curtain Rod :

1. Basis-of-Design Product: Bobrick B-6047.

C. Shower Curtain :

1. Basis-of-Design Product:
2. Size: Minimum 6 inches wider than opening by 72 inches high.
3. Material: Duck, minimum 8 oz. , white, 100 percent cotton .
4. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
5. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Utility Shelf at Showers:

1. Basis of Design: Bobrick B-296.

2.3 UNDERLAVATORY GUARDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

C. Underlavatory Guard:

1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.

2. Material and Finish: Antimicrobial, molded-plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

C. Utility Shelf :

1. Basis-of-Design Product: Bobrick B-296.

D. Mop and Broom Holder :

1. Basis-of-Design Product: Bobrick B-224.

2.5 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

END OF SECTION

SECTION 10 44 00

FIRE-PROTECTION SPECIALTIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Portable fire extinguishers.

a. Portable fire extinguishers, brackets and identifying signage.

b. Fire extinguishers shall be 10 lb., minimum, UL 4 A 60B:C

c. Provide a total of 20 fire extinguishers.

B. Related Sections include the following:

1. Section 01 33 00 for Shop Drawings submittals.

2. Section 01 70 00 Operation and Maintenance data.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles.

1. Fire extinguishers: Include rating and classification.

B. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, “Portable Fire Extinguishers”.

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.05 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Failure of hydrostatic test according to NFPA 10.
    b. Faulty operation of valve or release levels.
2. Warranty Period: Six years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
    1. Amerex Corporation
    2. Badger Fire Protection
    3. Or equal
B. Each extinguisher shall be provided with an aluminum or steel cylinder, squeeze handle with locking pin, nozzle assembly and pressure gauge and heavy duty wall bracket suitable for a vibrating environment.

2.02 IDENTIFYING SIGNAGE

A. A laminated plastic sign approximately 10 inches wide by 12 inches in height with a minimum thickness of 1/8 inch shall be provided for each extinguisher. The signage shall have contrasting white background with red lettering and installed with pressure sensitive tape.
B. Signage shall be installed directly over each fire extinguisher with the bottom of the sign 6 feet above the working surface or floor.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide twenty (20) fire extinguishers.
B. Install fire-protection specialties at heights acceptable to authorities having jurisdiction.
C. Extinguishers shall be wall mounted using the appropriate brackets. Fire extinguishers mounted to masonry tile, unfinished surface or concrete surfaces shall be secured using a wooden backer board, approximately, 24-in high and 12-in wide with a nominal thickness of 1-in. Wooden backer boards shall be painted and securely anchored to the wall
D. All fire extinguishers shall be fully charged at the date of Substantial Completion.

END OF SECTION

SECTION 12 35 53

LABORATORY CASEWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of furnishing all materials, accessories, equipment, tools, transportation, services, labor, and performing all operations to furnish and install laboratory casework, fume hoods, sinks, sink outlets, water and vacuum fixtures, deck mounted electrical receptacles, table frames, counter tops and associated equipment in accordance with this Section of the Specifications and the Contract Drawings.

B. The equipment shall conform to the specifications listed below. The specifications shall ensure that the equipment shall be of the highest grade in materials, finish, and workmanship. All materials used shall be the best of its kind and all construction details shall be in conformity with the best practices in the industry.

C. The Casework supplier shall coordinate with the General Contractor on final connections of all associated piping, electrical and ventilation equipment. It is the intent of this specification to have the casework supplier install the casework and accessories described herein. All work and materials not included in the casework suppliers' scope shall be provided by the General Contractor thus providing a complete functional laboratory. Refer to Part 3 of this Specification for final connection responsibility.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00, copies of all materials required to establish compliance with this Section. Submit 3-inch x 5in samples of each color of finish for casework, work surfaces and for other prefinished equipment and accessories. Submit counter top sample.

B. Certified shop and installation drawings showing materials, details of construction, dimensions and connections to work of other Sections.

C. Complete operating and maintenance instructions shall be furnished for all equipment included under these Specifications in accordance with Section 01 70 00.

1.03 QUALITY ASSURANCE

A. Qualifications

1. All equipment and appurtenances furnished under this Section shall be furnished by a single manufacturer who is fully experience, reputable and qualified in the manufacture of the equipment to be furnished.

2. All casework construction and performance characteristics shall be in full compliance with SEFA 8 standards.

3. Manufacturer shall have a minimum of ten years of experience in manufacturing the laboratory casework and equipment specified and has a minimum of ten installations of equal or larger size.

4. **Installers shall be factory trained and/or certified by the manufacturer**.

5. Cabinet identification: Cabinets are identified on drawings by manufacturer's catalog numbers. Unless otherwise modified on drawings or in specifications, catalog description constitutes specific requirements for each type of cabinet.

1.04 DELIVERY, STORAGE AND HANDLING

A. All equipment shall be crated and delivered to protect against damage during shipment.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Contractor.

1.05 GUARANTEE

A. The equipment and installation shall be fully guaranteed by the General Contractor for a period of one year from the date of substantial completion. The guarantee shall cover any and all defects in workmanship or materials that may develop in this specified time. Refer to the General Conditions and Division 1 of these specifications for additional information.

1.06 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the products specified herein shall be in accordance with the standards of the organizations listed below.

1. Scientific Equipment and Furniture Association (SEFA)

B. Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Approved manufactures for casework include the following:

1. Nycom
2. Magcor Lab Interiors LLC
3. Kewaunee

2.02 MATERIALS OF CONSTRUCTION FOR CASEWORK

A. Casework shall be manufactured from cold-rolled furniture stock sheet steel. Glass for glazed swinging and sliding doors shall be 7/32–in thick, clear float glass.

B. Structural performance requirement: Casework components shall withstand the following maximum loads without damage to the component or to the casework operation:

1. Steel base unit load capacity: up to 500 lbs. per lineal foot suspended across cabinet ends.
2. Suspended units: 300 lbs
3. Utility tables (4 legged): 300 lbs.
4. Drawers in a cabinet: 125 lbs.
5. Hanging wall cases: 300 lbs.

6. Load capacity for shelves of base units, wall cases and tall cases: 100 lbs.

C. Glass for glazed swinging and sliding doors and/or unframed doors: 6mm Clear Float Glass

2.03 CASEWORK CONSTRUCTION

A. All members die-formed, notched, assembled in fixtures; exposed welds polished smooth; face corner intersections of vertical and horizontal members in same plane, with joints welded and polished; doors and drawer heads in same plane.

B. Casework gauge schedule is prescribed below:

1. Drawer bodies and heads, shelves, interior door panels, security panels, and sloping tops – 20 gauge.

2. Ends, backs, case tops and bottoms, bases, exterior door panels, and vertical post – 18 gauge.

3. Top front and intermediate rails, gussets, table legs, frames, leg railed, and stretchers – 16 gauge.

4. Drawer suspensions, door and case hinge reinforcements, and L-shaped front corner gussets - 14 gauge.

5. Table leg corner brackets and leveler gussets – 11 gauge.

C. Base cabinets, three and four-foot with cupboards to open full width; center support posts not acceptable.

1. End panels and back, formed of one-piece, wraparound design; rear internal reinforcing channel with shelf-clip adjustment holes; front post to provide for rails, runs, hinges, and shelf clips; toe base structurally integral to cabinet body.

2. Top front rail to interlock and overlap end panels with rabbeted offset for dust resistance.

3. Horizontal intermediate cross rails required for locks, recessed and concealed.

4. All floor-mounted cabinets supported on four leveling screws adjustable from access in toe base; cupboard back access panels, when selected, removable with simple tools.

5. Drawer bodies of welded construction with cove at bottom sides and flanged at topsides for hand grip; suspension with rounded raceways and radiused, nylon-tired, ball-bearing rollers for self-centering operation, suspension to lock open, with automatic close last five inches; cushioned stop, in and out; drawer heads finished on all surfaces before assembly; sound-deadening material in head; friction centering spring not acceptable.

6. Bottoms of solid-panel, one-piece construction, front-formed for door and drawer dust resistance; holes or capped punch-outs for leveling screw access not acceptable.

D. Upper and tall cases with solid backs, welded, recessed ¾-inch for mounting.

1. Bottoms, one-piece, turned-up back and sides; front to fit door configuration and type.

2. Door, solid panel, with inner and outer heads protected form corrosion, structurally rigid with hat-channel reinforcement and sound deadening.

3. Unframed doors, 7/32-inch thick float glass with ground edges, set in extruded aluminum shoe with integral pulls and wheel assemblies; slides in top and bottom extruded aluminum track.

4. Framed glazed doors with 7/32-inch thick float glass set in plastic molding; solid exterior frame with all corners welded; interior frame members screwed in place.

2.04 VACUUM PUMP STORAGE CABINET

A. Casework Design Requirements

1. Surfaces of doors, flush panel faces shall align with cabinet fronts without overlap of case ends or top rail. Horizontal and vertical case shell members (panels and top rails) shall meet in the same plane without overlap.
2. Front width of end panels and top rail is ¾-inch
3. Completely welded shell assembly without applied panels at ends, backs or top panel, so cases can be used interchangeably or as a single stand-alone unit.
4. Acoustically treated sides, back and top panel with sound deadening materials. Base cabinets, 30-inch and wider, with double swinging doors shall provide full access to complete interior without center vertical post.

B. Vacuum Pump Cabinet Fabrication

1. Vacuum pump storage to provide a means to store and vent vacuum pumps and their emissions and heat loads.
2. Vacuum pump cabinet shall have hinged doors with integral toe space without a cabinet bottom. Vacuum pump cabinet shall have removable back panels for utility access and visual inspection. Back panel shall incorporate an integral 2½-inch vent hole for a separate vent assembly.
3. Vacuum pump cabinet shall incorporate acoustical insulation on the interior door panels, side, back and underside of the top panel. Insulation shall be open cell foam.
4. Storage unit shall incorporate an integral electrical switch (120V, 20amp) with pilot light to indicate the operational mode of the vacuum pump unit.
5. Storage unit shall have an electrical duplex outlet, located in the rear of the cabinet, for the vacuum pump plug end. Outlet to be accessible from the inside of the cabinet. Outlet shall be hard-wired to the electrical switch.
6. Separate mobile platform shall be capable of supporting 300lbs. Front two casters shall be locking/swivel models. Lipped construction shall safely contain any incidental spills.

2.05 SPECIALTY BASE CABINETS

A. Acid Storage

1. Acid storage base cabinets shall be used as fume hood base cabinet. Cabinet shall be of steel construction with the following features:
   a. Flush front top panel
   b. 3/16-inch chemical resistant molded polyethylene lining with coved corners and 2-inch lip at front of cabinet.
   c. All doors shall be lined with 1/8-inch thick polyethylene.
   d. Two 2-inch diameter vent holes in cabinet back.
   e. Removable back panel.

f. One half depth shelf and spill tray.

g. Vent piping shall be polyolefin

B. Flammable Liquid Storage

1. Flammable liquid storage base cabinets shall be of steel construction with the following features:

a. UL listed and FM approved.

b. Two 2 inch diameter vent pipes on rear of base cabinet.

c. Label.

d. Flush panel style.

e. 18 gallon minimum capacity.

f. manual door closure with lock included.

g. polyolefin vent pipes for venting through fume hood.

2.06 SPECIALTY TALL CABINETS

A. Flammable Storage

1. Tall flammable storage cabinets shall be of steel construction with a capacity of 45 gallons. Cabinet dimension shall be 65-inch high, 18-inch deep and 42-inch wide.

2. Provide the following features:

a. UL listed and FM approved

b. Manual double doors with lock included

c. Two side vents

2.07 HARDWARE

A. Hardware for the casework shall meet the following criteria:

1. Drawer and hinged door pulls: Screw attached on 4” centers (brushed aluminum rectangular).

a. Pull Location Horizontal at drawers, vertical at doors.

b. Pull Types – Available in configuration 1 & 2 only

Stainless steel wire finger pull (Option)

2. Sliding door pulls: Recessed stainless steel, styled and sized to harmonize with drawer pulls

3. Hinges: Institutional type, five knuckle projecting barrel hinges minimum 2½-inch long, type 302 or 304 stainless steel. Provide two hinges for doors up to 36-inch high; three hinges for doors over 36-inch high. Drill each leaf for three screw attachment to door and frame.

4. Door catches: Adjustable type, spring actuated nylon roller catches

5. Elbow catches: Spring type of cadmium plated steel, with strike of suitable design.

6. Locks: National Lock Remove-A-Core 5-disc tumbler, heavy-duty cylinder type. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers.
7. Keying: Locks shall have capacity for 225 primary key changes. Master key one level with the potential of 40 different, non-interchangeable master key groups.
8. Keys: Stamped brass available from manufacturer or local locksmith, and supplied in the following quantities unless otherwise specified:
    a. 2 for each keyed different lock.
    b. 3 for each group keyed alike locks.
    c. 2 for master keys for each system.
9. Label holders: [locations shown on drawings] Formed steel with satin chrome finish, 1" x 1-1/2", screw installed.
10. Shelf clips: Die formed steel, zinc plated, designed to engage in shelf adjustment holes.

2.08 CASEWORK FINISH

A. Owner shall select color for casework.

B. Casework finish shall consist of the following:

1. Metal preparation prior to application of finish, consisting of multiple-step process:
    a. Cleaner/phosphate spray
    b. Water rinse
    c. Passivating sealant spray
2. Parts to be dried at elevated temperatures and cooled prior to application of finish; finish to be applied in powder form, electrostatically charged, to all interior and exterior channel surfaces to minimum thickness of 1.5 mils; immediately after application, coated surfaces to be baked in high-temperature, continuous ovens to provide uniform curing for abrasion and chemical resistance as required for service in laboratory environment.

2.09 TABLE FRAMES

A. Table frames: 4½-inch high C-channel front and back aprons, end rails and cross rails.

B. Table drawers: Provide front and back rails; drawer unit, hardware and suspension same as specified for base unit drawers.

C. Legs: 2-inch x 2-inch steel tube legs with welded leg bracket. Attach legs with two bolts to front and back aprons and weld to end rails. Each leg shall have a recessed leveling screw and a black, coved vinyl or rubber leg shoe, 2-inch high.

2.10 COUNTERTOPS AND BACKSPLASH

A. All laboratory counter tops shall be molded from an epoxy resin that has been specifically designed to give optimum abrasion and chemical resistance. Tops shall be black, of ¾-inch

thick cast material of epoxy resins and inert products with a uniform non-glare black matte finish. Provide marine edge.

B. Backsplash curb: Same material as top, 4-inch high, butt jointed and cemented to top. Provide where indicated on drawings. Include end curb where top abuts end wall.

C. Performance Requirements

1. Test procedure: Apply five drops of each reagent to surface and cover with 25-mm watch glass, convex side down; test volatiles using one ounce bottle stuffed with saturated cotton. After 24-hr exposure flush surface, clean, rinse and wipe dry.

2. Evaluation ratings: Change in surface finish and function shall be described by the following ratings

   a. No Effect: No detectable change in surface material

   b. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.

   c. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.

   d. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.

   e. Poor: Pitting, cratering or permanently etching of work surface material; obvious and significant deterioration

3. Test Results - Epoxy Resin Work Surface (Black):

Chemical – Acids	Concentration	Rating
Hydrochloric Acid	20%	No Effect
Hydrochloric Acid	37%	No Effect
Nitric Acid	20%	Excellent
Nitric Acid	70%	Good
Sulfuric Acid	30%	No Effect
Sulfuric Acid	77%	No Effect
Sulfuric Acid	96%	Poor
Perchloric Acid	60%	No Effect
Aqua Regia	--	No Effect
Chromic Acid	60%	Good
Acetic Acid	98%	No Effect
Formic Acid	90%	No Effect
Boric Acid	Sat.	No Effect
Citric Acid	Sat.	No Effect
Oxalic Acid	Sat.	No Effect
Hydrobromic Acid	48%	No Effect
Hydroflouric Acid	48%	Good
Vinegar	--	No Effect

Chemical – Bases	Concentration	Rating
Ammonium Hydroxide	28%	No Effect
Sodium Hydroxide	10%	No Effect
Sodium Hydroxide	40%	No Effect
Sodium Hydroxide	Flake	No Effect
Potassium Hydroxide	10%	No Effect

Chemical – Salts	Concentration	Rating
Zinc Chloride	Sat.	No Effect
Calcium Hypochlorite	Sat.	No Effect
Clorox Bleach	--	No Effect
Silver Nitrate	10%	No Effect
Sodium Sulfide	Sat.	No Effect
Sodium Chloride	Sat.	No Effect
Iodine, Tincture	--	No Effect
Hydrogen Peroxide	--	No Effect
Phenol	80%	No Effect
Cresol	--	No Effect
Formaldehyde	40%	No Effect
Mineral Oil	100%	No Effect
Glycerin	100%	No Effect

Chemical – Dyes	Concentration	Rating
Congo Red	1%	No Effect
Eosin Y	0.5%	No Effect
Gentian Violet	1%	No Effect
Indigo Carmen	0.5%	No Effect
Methyl Green	0.5%	No Effect
Wrights Blood Stain	0.35%	No Effect

Chemical - Solvents	Concentration	Rating
Methyl Alcohol	100%	No Effect
Ethyl Alcohol	100%	No Effect
Buty Alcohol	100%	No Effect
Naphtha	100%	No Effect
Turpentine	100%	No Effect
Kerosine	100%	No Effect
Heptane	100%	No Effect
Gasoline	100%	No Effect
Benzene	100%	No Effect
Toluene	100%	No Effect

Chemical – Salts	Concentration	Rating
Xylene	100%	No Effect
Acetone	100%	No Effect
Methyl Ethyl Ketone	100%	No Effect
Methyl Isobutyl Ketone	100%	No Effect
Ethyl Acetate	100%	No Effect
Ethyl Ether	100%	No Effect
Chloroform	100%	No Effect
Methyl Chloride	100%	No Effect
Trichlorethylene	100%	No Effect
Carbon Tetrachloride	100%	Excellent
Monochloro Benzene	100%	No Effect
Dioxane	100%	No Effect
Furfural	--	No Effect

2.11 SINKS

A. Epoxy resin sinks: Integrally molded from modified thermosetting black epoxy resin, specially compounded and oven cured. Cove inside corners and pitch bottom to threaded drain outlet.

B. Sinks shall be manufactured of epoxy resin to match countertop and moulded as part of the countertop. Sink thickness shall be 1 inch.

C. The sinks shall be supplied with necessary sink supports and tailpiece. The Contractor shall be responsible for any additional piping or hardware associates with installing the sinks including plug, strainer, overflow piping and trap.

D. Sink Supports:

1. Cabinet Sinks: Support sinks on 11 gauge, adjustable, 1” x 2” x 1” channel with reagent resistant finish. Provide two channels across width of cabinet, attached to 3/8” diameter threaded hanger rods.

2. Table sinks: Support sinks on 2” wide, U-shaped steel straps screwed to cross rails. Straps shall be ¼” thick; ½” thick for sinks over 250 sq. in. in area. Straps shall have baked enamel finish.

3. Caulk joint between top and sink with non-hardening mastic.

2.12 FIXTURES

A. Water Service; Water fixtures shall be polished chrome, deck mounted, gooseneck style with swing action. Each fixture shall be provided with a mixing valve, hot and cold valve, anti-splash aerator and common vacuum breaker. Provide each fixture with a chrome plated hose connector, for installation by the Owner, if required Refer to the drawings for fixtures provided by the lab casework supplier.

B. Vacuum Service: Provide chrome plated service turret for deck mounting. Provide chrome plated straight serrated 3/8 – inch male threaded connector with each service Refer to the drawings for fixtures provided by the lab casework supplier.

C. All other fixtures shall be provided by the General Contractor.

D. Electrical fixtures and fittings: Flush, pedestal or line type, provided in strict accordance with the latest edition of the National Electric Code of the National Fire Protection Association, and with requirements of all local regulatory authorities.

1. Pedestal and line type housings: Heavy corrosion resistant aluminum alloy polished to chrome like color.

a. Pedestals: Provide with integral bases; low design for use on either single or double faces

2. Receptacles: Rated 120 volts AC at 20 amps, three wire grounding type with "Automatic Ground" feature. Provide single or duplex receptacles as required, with ivory or black colored molded thermo-set bodies.

3. Switches: Single pole, toggle type.

2.13 WALL CASES

A. The wall cases shall have glazed sliding doors and a minimum of two adjustable shelves. They shall be of steel construction and located as shown on the plans. The supplier shall furnish all connecting hardware. Construction shall be similar to the casework.

B. Wall cases, 25”, 31” and 49” high, formed of one-piece, wrap-around design, with rear internal reinforcing channels containing shelf clip adjustment holes.

2.14 FUME HOODS

A. Fume Hood Materials

1. Steel: High quality, cold rolled mild steel meeting requirements of ASTM A366.

2. Stainless Steel: Type 304

3. Ceiling enclosure panels: Minimum 18 gauge steel, upward directional louvers.

4. Bypass grills: Low resistant type, 18 gauge steel, upward directional louvers.

5. Safety glass: 7/32” thick laminated safety glass.

6. Sash cables: Stainless Steel, uncoated, 1/8” diameter.

7. Sash guides: Corrosion-resistant poly-vinyl chloride.

8. Pulley assembly for sash cable: 2-inch diameter, zinc dichromate finish, ball bearing type, with cable retaining device. (Nylon tire not acceptable.)

9. Sash Pull: Full width corrosion-resistant plastic, stainless steel or steel with chemical-resistant powder coating.

10. Gaskets: 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.

11. Fasteners:

a. Interior fastening devices concealed. Exposed screws not acceptable.

b. Exterior panel member fastening devices to be corrosion-resistant, non-metallic material. Exposed screws not acceptable.

12. Interior Liners: The liner consists of all interior surfaces, including sides, back, top, and baffles. All liner materials have low flame ratings and meet NFPA-45 standards below:

    a. White Polyresin – The preferred fume hood liner material, white polyresin is a press-molded, heat-converted catalyzed glass polyester sheet. A premium quality material, polyresin is excellent for use in high-abuse areas because of its excellent corrosion resistance. With a working temperature of 160ºC, polyresin is flame-retardant and self-extinguishing. Scratches are less obvious because of white color extends throughout the material thickness.

B. Fume Hood Construction

1. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4-7/8" thick. Panels must be attached to a full frame construction, minimum 14 gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior.

2. Exhaust outlet: Rectangular with ends radiused, shaped and flanged, 18 gauge [steel finished with Chameleon powder coating][stainless steel exhaust collars welded in place].

3. Access opening perimeter: Air foil or streamlined shape with all right angle corners radiused or angled. Bottom foil shall provide access areas for electrical cords.

4. Fume hood sash: Full view type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections.

    a. Counterbalance system: Single weight, pulley, cable, counter balance system. Maximum 7 lbs. pull required to raise or lower sash throughout its full length of travel. Life cycle test 100 lb., sash and weight to 100,000 cycles without sign of failure.

5. Fume hood liner: Polyresin reinforced polyester panel; smooth finish and white color in final appearance. Flexural strength: 14,000 psi. Flame spread: 25 or less per U.L. 723 and ASTM E84.

6. Baffles: Must be fabricated of the same material as the liner. Provide exhaust slots full height on vertical sides of the baffle with upper and lower slots adjustable. Minimum depth of 19-inch for interior work space is required at the extreme upper portion of the fume hood to provide maximum interior work area. All baffle supports/brackets to be non-metallic.

7. Electrical Services: Three wire grounding type receptacles rated at 120 VAC at 20 amperes. Unit shall be pre-wired at the factory. Provide 250 V.A.C. receptacles where specified. Flush plates: Black acid resistant thermoplastic.

8. Work surfaces: 1¼-inch thick surface dished a nominal ½-inch to contain spills, same material as counter top.

9. Safety Monitor/Alarm System:

    Where shown or specified provide Safety Monitor/Alarm System which monitors face velocity and provides audible and visible alarm if face velocity drops below safe levels. The technology used in the monitor will be based on thermally compensated thermistor based in the alarm module. As the internal fume hood pressure changes as the sash opening is closed and opened, the flow passing over the thermistor is calibrated to a face velocity which is displayed on the front of the monitor.

a. Safety Monitor: UL listed, tamper proof, with all alarm circuits, electric components, external components, external tubing, and manifolds furnished complete and factory installed. The monitor shall have light emitting diode display which provides clear indication of airflow conditions.

b. Calibration is the responsibility of the owner and is required once the hood is stationed and the hood exhaust and room supply systems are balanced. A secondary calibration has been factory set into the alarm's memory only to determine that the alarm is functional and ready for shipment. **The primary calibration must be completed in the field.**

c. Airflow Sensor:-Thermally compensated glass-beaded thermistor, factory connected to a side-wall port on the interior of the fume hood.

d. Alarm Signal: Audible Signal and a visual, red large light emitting diode:

1) Silence pushbutton, which disables the audible alarm, shall be accessible on the front of the safety monitor.

2) Provide alternate mode in which audible alarm is silenced indefinitely but visual alarm remains active until the alarm condition is corrected.

3) When alarm condition is corrected and face velocity and volume return to specified levels, the Safety Monitor will automatically be reset and begin routine monitoring.

e. Provide test circuit to verify proper Safety Monitor operation.

f. Electrical rating: Maximum 12 VDC, and maximum current rating of 200MA.

g. Fume Hood and all required associated equipment to be supplied by the Contractor

C. Bypass Type Fume Hoods

1. Constant volume type with built-in automatic compensating bypass to maintain constant exhaust volume regardless of sash position.

2. Bypass: Positive in action and controlled by the sash operation.

3. Low impedance, directionally louvered panel provided in the lintel bypass area and one inch bypass provided immediately above the work surface and directly below the bottom horizontal sash rail. Designs which require all bypass to enter hood over front solid panel – not acceptable.

4. Bypass shall be sufficient in size to allow sash as it is closed to provide no more than four times increase in face velocity as measured when the sash was full open.

D. Metal Finish

1. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pretreat with iron phosphate spray, water rinse and neutral final seal.

2. Application: Elctrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven.

a. Exterior and interior surfaces exposed to view: 1.5 mil average and 1.2 mil minimum.

b. Backs of cabinets and other surfaces not exposed to view: 1.0 mil average.

E. Hood Sizing and Accessories

1. Provide one (1) 72-inch wide x 31¼-inch deep fume hood, prewired, prepiped.
    a. Fume Hood Dimensions:

        Width: 72”
        Depth: 31-1/4”
        Height: 54-1/4” plus an enclosure to continue the hood up to the ceiling
2. Provide the following for each fume hood:
    a. Provide one (1) polyolefin oval cup sink with 1½-inch tailpipe. Overall diameter; 7½-inch x 4½-inch.
    b. Provide pre-piped cold water fixture with vacuum breaker (top vacuum style)
    c. Provide front mount vacuum fixture, 3/8-inch. Connect vacuum fixture to the adjacent vacuum cabinet.
    d. Provide fume hood alarm with analog meter display. Attach alarm to fume hood at the factory. Alarm consists of indicator lights based on pre-determined set point. Audible alarm and red indicator light to warn of low air flow conditions requires 115 volt power supply.
    e. Provide two tube fluorescent light fixture, light switch and two duplex 120 VAC receptacles.
3. Each fume hood shall be provided with a start/stop switch (starter) for the Fume hood blower. The switch shall be installed at the factory.
4. **Refer to the HVAC plans of the Control building for the exhaust fan sizing and installation requirements.**

F. Fume Hood Face Velocities

Face Velocity	Measured S.P.L. (W.G.)
75 F.P.M.	0.18 inches
100 F.P.M.	0.30 inches
125 F.P.M.	0.45 inches
150 F.P.M.	0.60 inches

2.15 RESTRICTED BYPASS FUME HOODS

A. Bypass shall be sufficient in size to allow 25% flow with sash closed. Bypass must be achieved through grill or louver on face of front lintel panel.

B. Sash: Standard vertical-rising.

2.16 PEGBOARD

A. Provide 1-inch thick, black epoxy pegboards with replaceable polypropylene pegs with glass protector base. Refer to the drawings for the number and location.

2.17 SAFETY SHOWER

A. Provide one (1) free standing body safety shower. **Refer to Section 22 45 00 of these Specifications**.

B. Provide one (1) dual purpose emergency eyewash and drench shower, deck mounted. The unit shall be manufactured by Bradley or approved.

2.18 UTILITY CHASE

A. Provide and install utility chases to each island as shown on the drawings. Chase shall be steel umbilical type, and shall run from counter top up through the ceiling grid.

2.19 ISLAND SHELVING

A. Provide 16 gauge steel upright support structure at each island. The upright supports shall mount directly to the counter top.

B. The upright support shall be 49-inch tall and allow for shelving to be attached in adjustable 1-inch increments. Width between vertical supports shall be 60-inch. Depth between supports shall be 12-inch.

C. Weight capacity for the upright support system shall be 1000 pounds.

D. Each island support structure will be provided with two inner shelves, 12 inches in width and manufactured of 18 gauge steel. A top shelf shall be provided for each support structure of 18 gauge steel, but not adjustable.

E. The finish for steel supports and shelving shall match that of casework.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Contractor shall perform all coordination between the supplier and subcontractors to provide a complete installation**.**

B. **All work not performed by the supplier shall be the responsibility of the Contractor and included in the bid price.**

C. Casework and fume hood installation

1. Set casework components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as required using concealed shims.

2. Bolt continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1/16-inch tolerance.

3. Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board.

4. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8-inch between top units.

5. Only factory prepared field joints, located per approved shop drawings, shall be permitted. Secure joints in field, where practicable, in the same manner as in factory, with dowels, splines, adhesive or fasteners recommended by the manufacturer.

6. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

D. Sinks which were not factory installed shall be set in chemical resistant sealing compound and secured and supported per the manufacturer's recommendations.

1. Accessory installation

    a. Install accessories and fittings in accordance with manufacturer's recommendations.

E. Vent flammable storage cabinets into adjacent fume hoods per manufacturer recommendation using polyolefin piping.

3.02 FINAL CONNECTIONS

A. General Contractor shall make all final plumbing connections for water, sink drains, vacuum, casework vents and electrical devices.

B. General Contractor shall provide all materials and labor to install the backer boards as shown on the plans. Contractor shall paint the backer boards. Contractor shall install all plumbing devices and storage containers required for connections to stills and deionizers. Refer to the Contract Drawings.

3.03 ADJUSTMENT

A. Repair or remove and replace defective work, as directed by Owner or the Engineer upon completion of installation.

B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly

3.04 CLEANING

A. Clean shop finished casework, touch up as required

B. Clean countertops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Do not use any wax or oils.

END OF SECTION

SECTION 12 56 53

LABORATORY FURNITURE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work covered by this section consists of furnishing all materials, accessories, equipment, tools, transportation, services, labor and performing all operations to furnish and install laboratory equipment in accordance with this Section of the Specifications and the Contract Drawings.

B. The equipment shall conform to the specifications listed below. The specifications shall ensure that the equipment shall be of the highest grade in materials, finish, and workmanship. All materials used shall be the best of its kind and all construction details shall be in conformity with the best practices in the industry.

1.02 SUBMITTALS

A. Submit in accordance with Section 01 33 00, copies of all materials required to establish compliance with this Section.

B. Certified shop and installation drawings showing materials, details of construction, dimensions and connections to work of other Sections.

C. Complete operating and maintenance instructions shall be furnished for all equipment included under these Specifications in accordance with Section 01 70 00.

1.03 QUALITY ASSURANCE

A. Qualifications

1. All equipment and appurtenances furnished under this Section shall be furnished by a single manufacturer who is fully experience, reputable and qualified in the manufacture of the equipment to be furnished.

2. The equipment shall be designed, constructed and installed in accordance with the best practices and methods.

1.04 DELIVERY, STORAGE AND HANDLING

A. All equipment shall be crated and delivered to protect against damage during shipment.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Contractor.

1.05 GUARANTEE

A. The equipment and installation shall be fully guaranteed by the Contractor for a period of one year from the date of substantial completion. The guarantee shall cover any and all defects in workmanship or materials that may develop in this specified time. Refer to the General Conditions and Division 01 of these specifications for additional information.

PART 2 – PRODUCTS

2.01 UNDER COUNTER LABORATORY GLASSWARE WASHER/DRYER

A. Provide one (1) under counter laboratory glassware washers.

B. Materials of construction are included below:

1. Tank and interior door shall be constructed of Type 304 stainless steel with mirror finish. Four leveling feet shall be provided. Tank shall have two rows of polypropylene rollers for the upper rack. Fiberglass blanket shall surround the tank. Aluminum-backed acoustic material shall be located at strategic locations.

2. Control panel shall be injection molded with microprocessor that shall store five factory preset programs (RINSE ONLY, PLASTIC, GLASS, GLASS PLUS AND SCIENTIFIC) and two user set programs (USER 1 SET and USER 2 SET). Program parameters shall be capable of alteration by the user. An LCD shall display the program selected or details of the program.

3. Steam generator shall produce steam before the second wash cycle of any program except RINSE ONLY and PLASTIC. Selection or cancellation of steam shall be from the control panel.

4. Purified water pump shall bring pressurized or non-pressurized purified water from the control panel.

5. Detergent dispenser shall hold powder or liquid detergent. An indentation on the door's interior shall accommodate additional detergent. Circulation pump shall have 1/3 hp motor and recirculates up to 60-gpm of water (at 60 Hz) throughout the tank during the wash cycle.

6. Purified water inlet valve shall be equipped with a plastic serrated hose connection to accommodate ¾ inch ID flexible plastic or rubber hose.

7. Particle filter shall be constructed of one-piece stainless steel fine mesh and removable for cleaning.

8. Units shall be 115 volts and be provided with a 750 watt sump heater and 700 watt steam heater. With a minimum inlet temperature of 120^{o} F, the sump heater shall elevate water temperature approximately 20^{o}F. Maximum water temperature shall be 140^{o}F.

9. Provide two wash arms, tower, side rails, Top Rack and Bottom Rack constructed of Type 304 stainless steel. Tower shall telescope and lock into two positions. Top rack may be positioned in either of two different height locations.

10. The overall sound level during operation shall be 62dBA or less.

C. Units shall be LABCONCO model 4400300 or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation, adjustment and protection of each installed item shall be in accordance with procedures recommended by the Manufacturer. Contractor shall perform all coordination between the supplier and subcontractors to provide a complete installation.

B. **All work not performed by the supplier shall be the responsibility of the Contractor to perform and included in the contractors bid price.**

3.02 FINAL CONNECTIONS

A. Contractor shall make all final plumbing connections and electrical connections.

3.03 ADJUSTMENT

A. Repair or remove and replace defective work, as directed by the Engineer upon completion of installation.

B. Adjust doors, hardware, fixtures and other moving or operating parts to function smoothly.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following domestic potable water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Temperature-actuated water mixing valves.
5. Strainers.
6. Hose bibbs.
7. Wall hydrants.
8. Drain valves.
9. Water hammer arresters.
10. Trap-seal primer valves.

1.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic potable water piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.adai

1.04 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic potable water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1001.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

2.02 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/2 (DN 15).
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
4. Size: As noted on drawings.
5. Design Flow Rate: As required.
6. Selected Unit Flow Range Limits: As required.
7. Pressure Loss at Design Flow Rate: 10 psig (69 kPa)> for sizes NPS 2 (DN 50) and smaller; 6 psig (42 kPa)> for NPS 2-1/2 (DN 65) and larger.
8. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 for NPS 2-1/2 (DN 65) and larger.
9. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
10. Configuration: Designed for horizontal, straight through flow.
11. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check Backflow-Prevention Assemblies:

1. Standard: ASSE 1015.

2. Operation: Continuous-pressure applications, unless otherwise indicated.

3. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.

4. Size: As noted on drawings.

5. Design Flow Rate: As required.

6. Selected Unit Flow Range Limits: As required.

7. Pressure Loss at Design Flow Rate: 8 psig (56 kPa)> for sizes NPS 2 (DN 50) and smaller; 6 psig (42 kPa)> for NPS 2-1/2 (DN 65) and larger.

8. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 for NPS 2-1/2 (DN 65) and larger.

9. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

10. Configuration: Designed for horizontal, straight through flow.

11. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

2.03 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Standard: ASSE 1003.

2. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).

3. Size: As noted on drawings.

4. Design Flow Rate: As required.

5. Design Inlet Pressure: 100 psig (690 kPa).

6. Design Outlet Pressure Setting: 50 psig (345 kPa).>

7. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

8. Valves for Booster Heater Water Supply: Include integral bypass.

9. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.04 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Standard: ASSE 1017.

2. Pressure Rating: 125 psig (860 kPa).

3. Type: Thermostatically controlled water mixing valve.

4. Material: Bronze body with corrosion-resistant interior components.

5. Connections: Union inlets and outlet.

6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

7. Tempered-Water Setting: 110 deg F (38 deg C).>

8. Tempered-Water Design Flow Rate: 20 gpm (1.3 L/s).>

9. Valve Finish: Rough bronze.

2.05 STRAINERS FOR DOMESTIC POTABLE WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.

2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550, epoxy coating and for NPS 2-1/2 (DN 65) and larger.

3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

4. Screen: Stainless steel with round perforations, unless otherwise indicated.

5. Perforation Size:

a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm).

b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).

6. Drain: Pipe plug.

2.06 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.

2. Body Material: Bronze.

3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.

5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle or Operating key].
13. Operation for Finished Rooms: Wheel handle or Operating key].
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome- or nickel-plated hose bibb.

2.07 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig (860 kPa).
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

2.08 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves <Insert drawing designation if any>:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.

6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.

8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.09 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.

2. Type: [Metal bellows] [Copper tube with piston].

3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves <Insert drawing designation if any>:

1. Standard: ASSE 1018.

2. Pressure Rating: 125 psig (860 kPa) minimum.

3. Body: Bronze.

4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.

5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.

6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install water hammer arresters in water piping according to PDI-WH 201.

G. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

H. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties.

I. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Intermediate atmospheric-vent backflow preventers.

2. Reduced-pressure-principle backflow preventers.

3. Double-check backflow-prevention assemblies.

4. Water pressure-reducing valves.

5. Primary, thermostatic, water mixing valves.

6. Supply-type, trap-seal primer valves.

J. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic potable water piping specialties and retest as specified above.

3.03 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:

1. Pipe, tube, and fittings.

2. Special pipe fittings.

1.02 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.03 SUBMITTALS

A. Field quality-control inspection and test reports.

1.04 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.

1. Gaskets: ASTM C 564, rubber.

B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Shielded Couplings: ASTM C 1277 fassembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.

2. Pressure Fittings:

a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.

b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.

c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

d. Cast-Iron Flanges: ASME B16.1, Class 125.

e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.

D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

E. Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.

2. Hubless cast-iron soil pipe and fittings; standard-duty shielded, stainless-steel couplings; and hubless-coupling joints.

3. Steel pipe, drainage fittings, and threaded joints.

4. Copper DWV tube, copper drainage fittings, and soldered joints.

5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.

2. Hubless cast-iron soil pipe and fittings; standard-duty shielded, stainless-steel couplings; and hubless-coupling joints.

3. [Solid-wall] [Cellular-core] ABS pipe, ABS socket fittings, and solvent-cemented joints.

4. [Solid-wall] [Cellular-core] PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.02 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.03 JOINT CONSTRUCTION

A. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.

2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.04 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.

2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

E. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.

2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.

3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.

4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.

5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.

6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.

7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

G. Install supports for vertical steel piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.

2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.

4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.

K. Install supports for vertical PVC piping every 48 inches (1200 mm).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.05 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.06 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

2. Prepare reports for tests and required corrective action.

3.07 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.08 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Faucets for lavatories, showers, and sinks.
2. Toilet seats.
3. Fixture supports.
4. Water closets.
5. Lavatories.
6. Individual showers.
7. Service sinks.

B. Related Sections include the following:

1. Division 22 Section "Emergency Plumbing Fixtures."

1.02 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.

F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and

Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Plastic Sinks: ANSI Z124.6.
3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
4. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
5. Stainless-Steel Residential Sinks: ASME A112.19.3.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.

3. Faucets: ASME A112.18.1.

4. Hand-Held Showers: ASSE 1014.

5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.

6. Hose-Coupling Threads: ASME B1.20.7.

7. Manual-Control Antiscald Faucets: ASTM F 444.

8. Pipe Threads: ASME B1.20.1.

9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.

11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.

2. Brass and Copper Supplies: ASME A112.18.1.

3. Dishwasher Air-Gap Fittings: ASSE 1021.

4. Manual-Operation Flushometers: ASSE 1037.

5. Plastic Tubular Fittings: ASTM F 409.

6. Brass Waste Fittings: ASME A112.18.2.

7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Dishwasher Air-Gap Fittings: ASSE 1021.

2. Flexible Water Connectors: ASME A112.18.6.

3. Hose-Coupling Threads: ASME B1.20.7.

4. Off-Floor Fixture Supports: ASME A112.6.1M.

5. Pipe Threads: ASME B1.20.1.

6. Plastic Toilet Seats: ANSI Z124.5.

7. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.01 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Description: Single-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.

b. Finish: Polished chrome plate.

c. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).

d. Maximum Flow: 0.25 gal. (0.95 L).

e. Centers: 3-3/8 inches (86 mm) Single hole.

f. Mounting: Deck, exposed.

g. Valve Handle(s): Lever and Wrist blade, 4 inches (102 mm).

h. Inlet(s): NPS 3/8 (DN 10) tubing, plain end.

i. Spout: Rigid, gooseneck and Swivel, gooseneck type.

j. Spout Outlet: Aerator.

k. Operation: Noncompression, manual.

l. Drain: Grid.

m. Tempering Device: Not required.

2.02 SHOWER FAUCETS

A. Shower Faucets:

1. Description: Single-handle thermostatic and pressure-balance valve. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.

a. Body Material: Solid brass.

b. Finish: Polished chrome plate.

c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.

d. Diverter Valve: Not required.

e. Mounting: Concealed.

f. Backflow Protection Device for Hand-Held Shower: Not required.

g. Operation: Noncompression, manual.

h. Antiscald Device: Integral with mixing valve.

i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

j. Supply Connections: NPS 1/2 (DN 15) Sweat.

k. Shower Head Type: Hand held, slide-bar mounted.

l. Shower Head Material: Combined, metallic and nonmetallic with chrome-plated finish.

m. Spray Pattern: Fixed.

n. Integral Volume Control: Not required.

o. Shower-Arm Flow-Control Fitting: Not required.

p. Temperature Indicator: Integral with faucet.

2.03 SINK FAUCETS

A. Sink Faucets:

1. Description: Kitchen faucet with spray, three-hole fixture and Service sink faucet with stops in shanks, vacuum breaker, hose-thread outlet, and pail hook. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

a. Body Material: Commercial, solid brass.

b. Finish: Polished chrome plate.

c. Maximum Flow Rate: 2.5 gpm (9.5 L/min.), unless otherwise indicated.

d. Mixing Valve: Single control.

e. Backflow Protection Device for Hose Outlet: Not required.

f. Backflow Protection Device for Side Spray: Not required.

g. Centers: 4 inches (102 mm).

h. Mounting: Deck.

i. Handle(s): Lever.

j. Inlet(s): NPS 3/8 (DN 10) plain-end tubing.

k. Spout Type: Swivel gooseneck.

l. Spout Outlet: Swivel aerator/spray.

m. Vacuum Breaker: Not required.

n. Operation: Noncompression, manual.

o. Drain: Lift and turn.

2.04 TOILET SEATS

A. Toilet Seats, :

1. Description: Toilet seat for water-closet-type fixture.

a. Material: Molded, solid plastic.

b. Configuration: Open front without cover.

c. Size: Elongated.

d. Hinge Type: SS, self-sustaining.

e. Class: Standard commercial.

f. Color: White.

2.05 FIXTURE SUPPORTS

A. Water-Closet Supports:

1. Description: Combination carrier designed for accessible and standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

B. Lavatory Supports:

1. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.

2. Accessible-Fixture Support: Include rectangular steel uprights.

C. Sink Supports:

1. Description: Type I, sink carrier with exposed arms and tie rods for sink-type fixture. Include steel uprights with feet.

2.06 WATER CLOSETS

A. Water Closets:

1. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.

2. Supply: NPS 1/2 (DN 15) chrome-plated brass or copper with wheel-handle stop.

3. Style: Flushometer valve.

a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.

b. Height: Standard and accessible.

c. Design Consumption: 1.6 gal./flush (6 L/flush).

d. Color: White.

4. Flushometer:

5. Toilet Seat:

2.07 LAVATORIES

A. Lavatories,:

1. Description: Accessible, wall-mounting, vitreous-china fixture.

a. Type: With back.

b. Size: 19 by 16 inches (483 by 406 mm) rectangular.

c. Faucet Hole Punching: One hole.

d. Faucet Hole Location: Top.

e. Pedestal: Not required.

f. Color: White.

g. Faucet: Lavatory.

h. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.

i. Drain: Grid with offset waste.

1) Location: Near back of bowl.

j. Drain Piping: NPS 1-1/4 (DN 32) chrome-plated, cast-brass P-trap; NPS 1-1/4 (DN 32) thick tubular brass waste to wall; and wall escutcheon.

k. Drain Piping: Schedule 40 ABS or PVC, NPS 1-1/4 (DN 32) P-trap; NPS 1-1/4 (DN 32), tubular waste to wall; and wall escutcheon.

2.08 INDIVIDUAL SHOWERS

A. Individual Showers:

1. Description: Accessible.

a. Surround: Not required

b. Drain Location: Center.

c. Accessibility Options: Include grab bar and bench.

d. Faucet: Shower.

e. Drain: Grid, NPS 2 (DN 50).

2.09 SERVICE SINKS

A. Service Sinks:

1. Description: Trap-standard- and wall-mounting, enameled, cast-iron fixture with roll-rim with plain back and rim guard on front and sides.

a. Size: 22 by 18 inches (560 by 460 mm) and 24 by 20 inches (610 by 510 mm).

b. Color: White.

c. Faucet: Sink.

d. Drain: Grid with NPS 3 (DN 80) outlet.

e. Trap Standard: NPS 3 (DN 80) enameled, cast iron with cleanout and floor flange.

f. Fixture Support: Sink.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install wall-mounting fixtures with tubular waste piping attached to supports.

E. Install fixtures level and plumb according to roughing-in drawings.

F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

I. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

J. Install toilet seats on water closets.

K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install shower flow-control fittings with specified maximum flow rates in shower arms.

O. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

P. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.

Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 15 Section "Basic Mechanical Materials and Methods."

R. Set showers in leveling bed of cement grout.

S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint Sealants."

3.02 CONNECTIONS

A. Piping installation requirements are specified in Division 40 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Sections.

D. Connect wiring according to Division 26 Sections.

3.03 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.04 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 45 00

EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following emergency plumbing fixtures:

1. Combination units.

1.02 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Tepid: Moderately warm.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.01 COMBINATION UNITS

A. Combination Units:

1. Description: Plumbed, freestanding, with emergency shower and eyewash equipment.

a. Piping: Chrome-plated brass or stainless steel.

1) Unit Supply: NPS 1-1/4 (DN 32) minimum from top.

2) Unit Drain: Outlet at side near bottom.

3) Shower Supply: NPS 1 (DN 25) with flow regulator and stay-open control valve.

4) Eyewash Supply: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.

b. Shower Capacity: Deliver potable water at rate not less than 20 gpm (76 L/min.) for at least 15 minutes.

1) Control-Valve Actuator: Pull chain.

2) Shower Head: 8-inch (200-mm) minimum diameter, plastic.

c. Eyewash Equipment: With capacity to deliver potable water at rate not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.

1) Control-Valve Actuator: Push bar.

2) Receptor: Plastic bowl.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 40 Section "Valves."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.

2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.

F. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

G. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.

H. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment.

I. Piping installation requirements are specified in Division 40 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

J. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.

K. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.

L. Adjust or replace fixture flow regulators for proper flow.

M. Adjust equipment temperature settings.

END OF SECTION

SECTION 22 47 00

DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Style F, freestanding drinking fountains.
2. Style W, wall-mounting drinking fountains.
3. Type PB, pressure with bubbler, Style F, freestanding water coolers.
4. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
5. Fixture supports.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.01 PRESSURE WATER COOLERS

A. Water Coolers:

1. Description: ARI 1010, Type PB, pressure with bubbler, Style F, freestanding water cooler.

a. Cabinet: All stainless steel.

b. Bubbler: One, with adjustable stream regulator, located on deck.

c. Control: Push button.

d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.

e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

f. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.

g. Cooling System: Electric, with precooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

1) Capacity: 5 gph (0.0053 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.

2) Electrical Characteristics: As noted on drawings.

B. Water Coolers:

1. Description: Accessible,]ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult-mounting height.

a. Cabinet: Single or Bilevel with two attached cabinets.

b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.

c. Control: Push bar.

d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.

e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

f. Drain(s): Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.

g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

1) Capacity: 5 gph (0.0053 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.

2) Electrical Characteristics: As noted on drawings.

h. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.

2.02 FIXTURE SUPPORTS

A. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.

2. Type II: Bilevel, hanger-type carrier with three vertical uprights.

3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Set freestanding and pedestal drinking fountains on floor.

C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.02 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 40 Section "Valves."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 Section "Joint sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Ground equipment according to Division 26.

C. Connect wiring according to Division 26.

3.04 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.

2. Report test results in writing.

3.05 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

END OF SECTION

SECTION 21 31 00

DUCTWORK

PART 1 GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of rectangular, round and flat-oval ducts and plenums. The ducts shall be supplied for heating, ventilating and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gage. All systems shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the Fabricator's recommendations and as shown on the Drawings.

B. Contract drawings show only functional features and some of the required external connections. They do not show all components required for a complete installation nor exact dimensions particular to any specific material. Contractor shall supply all parts, devices and equipment necessary to meet the requirements of the Contract Documents and shall make all dimensional adjustments particular to the material being furnished. All costs associated with such changes and adjustments shall be included in the price bid for the Work shown and specified.

C. Definitions
   1. Sealing Requirements: For the purposes of duct system sealing requirements specified in this Section the following definitions apply:
      a. A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
      b. Joints include girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to duct; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:
   1. Product data including details of construction relative to material, dimensions of individual components, profiles, and finishes for the following items:
      a. Duct liner.
      b. Sealing materials.
      c. Fire-stopping materials.
   2. Shop drawings from duct fabrication shop, drawn to scale not smaller than ¼-inch equals 1 foot, on drawing sheets same size as the Contract Drawings detailing:
      a. Fabrication, assembly and installation details for metal and glass fiber ducts, including plans, elevations, section, details of components and attachments to other Work.

b. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled.

c. Fittings.

d. Reinforcing details and spacing.

e. Seam and joint construction details.

f. Penetrations through fire-rated and other partitions.

g. Terminal unit, coil and humidifier installations.

h. Hangers and supports, including methods for building attachment, vibration isolation and duct attachment.

3. Coordination drawings for ductwork installation shall show the following:

a. Coordination with ceiling suspension members.

b. Spatial coordination with other systems installed in the same space with the duct systems.

c. Coordination of ceiling and wall mounted access doors and panels required to provide access to dampers and other operating devices.

4. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets. Record drawings including duct systems routing, fittings, details, reinforcing, support and installed accessories and devices.
5. Maintenance data for volume control devices, fire dampers and smoke dampers.

1.03 QUALITY ASSURANCE

A. Reference Standards: Comply with all Federal and State laws or ordinances, as well as the latest edition of all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
1. ASTM, American Society for Testing Materials.
2. ASME, American Society of Mechanical Engineers.
3. OSHA, Occupational Safety and Health Act.
4. ANSI, American National Standards Institute.
5. NFPA, National Fire Protection Association.
6. UL, Underwriters Laboratories, Inc.
7. ASHRAE, American Society of Heating, Refrigerating and Air Conditioning Engineers.
8. SMACNA, Sheet Metal and Air Conditioning Contractors' National Association.
9. TIMA, Thermal Insulation Manufacturer's Association.
10. ICBO, International Conference of Building Officials.

1.04 QUALITY STANDARDS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing by the engineer. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

B. Manufacturer shall provide written certification that the equipment provided under this Specification has been designed in accordance with these specifications and is suitable for these service conditions.

1.05 STORAGE AND HANDLING

A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

B. Store and handle sealant fire-stopping materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperature, contaminants or other causes.

C. Deliver and store stainless steel sheet with mill-applied adhesive protective paper, maintained through fabrication and installation.

1.06 WARRANTY

A. Provide a warranty against defective equipment and workmanship in accordance with the requirements of the General Conditions of the Contract Documents.

PART 2 PRODUCTS

2.01 METAL DUCT MATERIALS

A. Provide sheet metal in thicknesses indicated, packaged and marked as specified in ASTM A 700.
   1. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
   2. Carbon Steel Sheets: ASTM A 366, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
   3. Stainless Steel: ASTM A 480, Type 316, sheet form, with No. 4 finish on exposed surface for ducts exposed to views; Type 304, sheet form, with No. 1 finish for concealed ducts.

B. Reinforced shapes and plates, unless otherwise indicated, shall be galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.

C. Tie-rods shall be galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer that 36 inches.

2.02 DUCT LINER FOR METAL DUCT

A. Metal duct liners shall comply with NFPA Standard 90A and TIMA Standard AHC-101.
   1. Materials: ASTM C 1071, Type II, with coated surface exposed to air stream to prevent erosion of glass fibers.
   2. Thickness: 1- inch.
   3. Density: 3 pounds.
   4. Thermal Performance: K-Factor shall be equal to 0.28 or better, at a mean temperature of 75^{o}F.
   5. Fire Hazard Classification: Flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM C 411.
   6. Liner Adhesive: Comply with NFPA Standard 90A and ASTM C 916.

7. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.
   a. Fastener pin length shall be as required for thickness of insulation and without projecting more that 1/8-inch into the air stream.
   b. Adhesive for attachment of mechanical fasteners shall comply with Fire Hazard Classification of duct liner system.

2.03 SEALING MATERIALS

A. Joint and Seam Sealants: The term sealant used in this Section is not limited to material of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.
   1. Joint and Seam Tape: 2-inch wide, glass-fiber-fabric reinforced.
   2. Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant; formulated with a minimum of 75 percent solids.
   3. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
   4. Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

2.04 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder actuated fasteners or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concrete or for slabs less than 4-inch thick.

B. Hangers: Galvanized sheet steel or round, uncoated steel, threaded rod.

C. Hangers Installed in Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.

D. Straps and Rod Sizes: Conform with Table 4-1 SMACNA HVAC Duct Construction Standards for sheet steel width and gage and steel rod diameters.

E. 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.

F. Sleeves:
   1. Sleeves for round ductwork: Form with galvanized steel.
   2. Sleeves for rectangular ductwork: Form with wood or galvanized steel.
   3. Size sleeves large enough to allow for movement due to expansion and contraction.

G. For galvanized steel ducts provide hot-dipped galvanized steel support materials. For stainless steel provide stainless steel support materials. For aluminum provide aluminum support materials, except where materials are electrolytically separated form ductwork.

2.05 RECTANGULAR DUCT FABRICATION

A. Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA HVAC Duct Construction Standards. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications and joint types and intervals.

B. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.

C. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains and discoloration.

D. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:
   1. Supply Ducts: 3 inches water gage, positive pressure
   2. Return Ducts: 2 inches water gage, negative pressure.
   3. Exhaust Ducts Building Internal: 2 inches water gage, negative pressure.
   4. Exhaust Ducts Building External: 4 inches water gage, positive pressure

E. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA HVAC Duct Construction Standards, unless they are lined or are externally insulated.

2.06 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections and other duct construction in accordance with SMACNA HVAC Duct Construction Standard.

2.07 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve necessary thickness are prohibited.

B. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing.
   1. Butt transverse joints without gaps and coat joint with adhesive.
   2. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.

C. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary.

D. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12-inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

E. Secure transversely oriented liner edges facing the air stream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:
   1. Fan discharge.
   2. Intervals of lined duct preceding unlined duct.

2.08 ROUND AND FLAT OVAL DUCT FABRICATION

A. Basic round diameter as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given size of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.
   1. Round Ducts: Fabricate round supply ducts with spiral lock seam construction, except where diameters exceed 72 inches. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams. Comply with SMACNA HVAC Duct Construction Standards for galvanized steel gages.

B. Double-Wall (Insulated) Ducts: Fabricate double-wall insulated ducts with an outer shell, insulation and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.
   1. Thermal Conductivity: 0.27 Btu/sq. ft./F/inch thickness at 75ºF mean temperature.
   2. Outer Shell: Base outer shell gage on actual outer shell dimensions. Provide outer shell lengths 2 inches longer than inner shell and insulation and in gages specified above for single-wall duct.

C. Insulation: Unless otherwise indicated, provide 1-inch thick fiberglass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or non-insulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the inner liner diameter.

D. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gages listed below. For flat oval ducts, the diameter indicated in the table below is the basic round diameter.

2.09 ROUND AND FLAT OVAL SUPPLY AND EXHAUST FITTINGS FABRICATION

A. 90-Degree Tees and Lateral and Conical Tees: Fabricate to conform to SMACNA HVAC Duct Construction Standards with metal thicknesses specified for longitudinal seam straight duct.

B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting form the body onto branch tap entrance.

C. Elbows: Fabricate in die-formed, gored, pleated or mitered construction with bend radius of 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:
   1. Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.
   2. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA HVAC Duct Construction Standards Table 3-1.
   3. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
      a. 3 to 26 inches: 24 gage.
      b. 27 to 36 inches: 22 gage.
      c. 37 to 50 inches: 20 gage.
      d. 52 to 60 inches: 18 gage.
   4. Round Mitered Elbows: Solid welded and with metal thickness listed for pressure classes from 2 inches to 10 inches:
      a. 3 to 14 inches: 24 gage.
      b. 15 to 66 inches: 22 gage.

c. 27 to 50 inches: 20 gage.
d. 52 to 60 inches: 18 gage.
e. 62 to 84 inches: 16 gage.

5. Round Elbows 8 inches and smaller: Die-formed elbows for 45° and 90° elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate non-standard bend angle configurations or 1/2-inch diameter (e.g. 3-1/2 and 4-1/2 inch) elbows with gored construction.
6. Round Elbows- 9 through 14 inches: Gored or pleated elbows for 30, 45, 60 and 90 degrees, except where space restrictions require a mitered elbow. Fabricate non-standard bend angle configurations or 1/2-inch diameter (e.g. 9-1/2 and 10-1/2 inch) elbows with gored construction.
7. Round Elbows Larger than 14 inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.
8. Die-Formed Elbows for Sizes through 8 inches and All Pressures: 20 gage with 2-piece welded construction.
9. Round Gored Elbows Gages: Same as non-elbow fittings specified above.
10. Flat Oval Elbows Gages: Same as longitudinal seam flat oval duct.
11. Pleated Elbows Sizes through 14 inches and Pressures through 10 inches: 26 gage.

D. Double-Wall (Insulated) Fittings: Fabricate double-wall insulated fittings with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.
1. Thermal Conductivity: 0.27 Btu/sq. ft./F/inch thickness at 75°F mean temperature.
2. Outer Shell: Base outer shell gage on actual outer shell dimensions. Provide outer shell lengths 2 inches longer than inner shell and insulation and in gages as specified above for un-insulated fittings.

E. Insulation: Unless otherwise indicated, provide 1-inch thick fiberglass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or non-insulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.

F. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gages listed below. For flat oval ducts, the diameter indicated in the table below is the basic round diameter.
1. 3 to 34 inches: 24 gage.
2. 35 to 58 inches: 22 gage.
3. 60 to 88 inches: 20 gage.
4. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation form dislocation by mechanical means.

G. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:
1. Round Elbows 4 to 8 inches: 2-piece, die stamped, with longitudinal seams spot welded, bonded and painted with a PVC aerosol spray.
2. Round Elbows 9 to 26 inches: Standard seam construction.
3. Round Elbows 28 to 60 inches: Standard gore construction, riveted and bonded.
4. Other Fittings: Riveted and bonded joints.
5. Couplings: Slop-joint construction with a minimum of 2-inch insertion length.

2.10 FIBERGLASS REINFORCED PLASTIC (FRP):

1. Material shall comply with ASTM D2310-2006, ASTM D2992-2006, and ASTM D2996-2001 (2007) e1.

2. Ductwork shall have a flame spread rating of 25 or less and a smoke contribution of less than 25 on its exterior surface in accordance with ASTM E84-2008.
3. Ductwork shall be Factory Mutual (FM) approved for use without internal fire protection sprinklers, and shall also be FM approved as a smoke removal duct.
4. Duct and standard fittings shall be filament wound. Specialty fittings may be fabricated using hand lay-up methods.
5. Standard elbows shall be made with a centerline radius of 1.5 times the duct diameter.
6. Resins and Reinforcements:
   a. Resin system shall be designed for the chemical and temperature environment of the application. Resin shall be selected on the resin manufacturer's recommendation based on tests conducted in accordance with ASTM C581-2003.
   b. Fillers shall be allowed if required for viscosity control and fire retardancy. Fillers shall be limited to a maximum of 5% by weight and shall not interfere with the operator's ability to visually inspect the duct.
   c. Resins shall contain ultraviolet inhibitors and absorbers, 0.25% of resin weight, for ultraviolet protection.
7. Duct shall be machine made filament wound reinforced thermosetting resin.
   a. Duct shall conform to the requirements of ASTM D2310-2006, and shall be Type 1, Grade 2 Class E per ASTM D2996-2001 (2007)e1.
   b. Duct shall consist of an inner surface, an interior layer, and a structural or outer layer.
   c. Inner surface including flange faces, shall be lined with 90 mil thick Tefzel CTFE corrosion-resistant lining, with fabric backing.
   d. The interior layer shall consist of 2 layers of 1.5 oz/ft2 fiberglass mat, 0.1" thick, and shall contain between 25% to 35% by weight of glass reinforcement.
   e. The structural layer shall consist of filament wound construction. The filament wound layers shall be of continuous E glass fibers wound onto the fully cured inner layers at a uniform helix angle under controlled between 65% and 75% by weight.
   f. The exterior surface shall be covered with a finished layer of chopped mat and surfacing veil containing ultraviolet inhibitors and absorbers, and containing 75% resin maximum.
8. Fittings:
   a. Fittings shall be either one piece molded construction or mitered using filament wound duct stock for the mitered sections.
9. Joints:
   a. Factory Welds:
      1) The fabricator shall have established quality control standards and procedures implemented by an experienced and established quality control staff.
      2) The minimum standard shall be per ASTM C582-2002 Table V, Visual Acceptance Criteria.
      3) Inner welds shall be checked for soundness with a spark tester.
      4) Liner shall be hot air welded at seams. Welds shall be backed with a conductive graphite filled putty so that quality of welds can be checked.
   b. Field Flanges:
      1) The use of flanges shall be kept to a minimum. Typically, flanges shall only be used where necessary to connect the duct to equipment or to dissimilar material interfaces.
      2) Gaskets shall be a minimum of 0.125" thickness black neoprene with a shore of "A" hardness of 40 to 70.
10. Laminate Quality:

a. The fabrication shall be free from foreign inclusions, dry spots, air voids, pin holes, delaminations, blisters and resin burns.
b. The inner surface shall be free of cracks or crazing with a smooth resin rich surface. Wrinkling shall be smooth, contain no pits, and shall not cover more than 1% of the surface.
c. The exterior surface shall be relatively smooth with no exposed reinforcing fibers. The resin concentration on the surface shall be sufficient to prevent fiber bloom.

11. Manufacturer: ATS 4910 CR with ATS ChemBond Joining System, or Industrial Plastic Systems.

PART 3 EXECUTION

3.01 INSTALLATION

A. Construct and install each duct system for the specific duct pressure classification indicated. Provide openings in ductwork where required to accommodate thermometers and controllers.

B. Install ducts with fewest possible joints.

C. Use fabricated fittings for all changes in directions, changes in size and shape and connections.

D. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.

E. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building line; avoid diagonal runs. Install duct systems in shortest route that does not obstruct usable space or block access for servicing building and its equipment.
1. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partition, except as specifically shown.
2. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
3. Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Provide clearance of 1-inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.

H. Install insulated ducts with 1-inch clearance outside of insulation.

I. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

J. Connections to HVAC equipment such air handling units, fans, heaters, heat exchangers and coils, etc., shall be provided with fabric or rubber expansion joints, rated for the duct

pressure class, to allow for movement and reduction in vibration and noise. All ducts shall be self supporting using the methods in the SMACNA HVAC Duct Construction Standards. No static or dynamic loads from the ductwork shall be transferred to the above listed equipment.

3.02 SEAM AND JOINT SEALANT

A. Seal duct seams and joints as follows:
   1. Pressure Classifications Greater than 3 Inches Water Gage: All transverse joints, longitudinal seams and duct penetrations.
   2. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams.
   3. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only.
   4. Pressure Classification Greater than 2 Inches Water Gage: All transverse joints and longitudinal seams.
   5. Seal externally insulated ducts prior to insulation installation.

3.03 HANGING AND SUPPORTING

A. Install rigid, round, rectangular and flat oval duct with support systems indicated in SMACNA HVAC Duct Construction Standards.
   1. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
   2. Support vertical ducts at a maximum interval of 16 feet and at each floor.

B. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.

C. Install concrete insert prior to placing concrete.

D. Install powder actuated concrete fasteners after concrete is placed and completely cured.

3.04 CONNECTIONS

A. Connect equipment with flexible connectors in accordance with Section 15910 Ductwork Accessories.

B. All duct connections shall comply with SMACNA HVAC Duct Construction Standards.

3.05 ADJUSTING AND CLEANING

A. Adjust volume control devices as required by the testing and balancing procedures to achieve required airflow. Adjustments shall be in accordance with Section 15990 Testing, Adjusting and Balancing Air Systems.

B. Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION