Engberg Anderson

Project Manual BID PLU 14-01

Waukesha County Parks
Minooka & Mukwonago Park Restrooms

1927 E. Sunset Drive, Waukesha, WI 53186
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Contract 14-01
Volume 02 Contract Documents

Waukesha County Parks & Land Use
515 West Moreland Boulevard, Rm. AC230
Waukesha, Wisconsin 53188

Engberg Anderson Project No. **122219** February 4, 2014

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WAUKESHA COUNTY PARKS - MINOOKA & MUKWONAGO PARK RESTROOMS

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SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.

B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.02 PROJECT INFORMATION

A. Project Identification: Waukesha County Parks, Minooka & Mukwonago Park Restrooms

1. Project Location:
   a. Minooka County Park; 1927 East Sunset Drive; Waukesha, Wisconsin.
   b. Mukwonago County Park; W325 S9945 Beulah Rd., Mukwonago, Wisconsin.

B. Owner: Waukesha County Parks & Land Use; 515 West Moreland Boulevard, Waukesha, Wisconsin 53188.

C. Architect: Engberg Anderson, Incorporated; 320 East Buffalo Street; Suite 500, Milwaukee, Wisconsin 53202.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

1. Park Restrooms and associated Septic Utility and Site Work for:
   a. Minooka Park Areas 1/2 and Area 5.
   b. Mukwonago Park Area 2/3.

B. Type of Contract

1. Project will be constructed under a single prime contract.

1.04 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Furnish and install cedar shake roofing.

2. Cut down or trim necessary trees, not including grubbing of stump and roots.

3. Furnish and install all plant materials including seeding, bushes, trees and shrubs.

1.05 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

C. Prohibit access to site under existing Oak trees. Coordinate Tree protection plan with Park Superintendant and County Landscape Architect.

D. Nonsmoking Construction Site: Smoking is not permitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Owner.

1.3 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Addendum for changes in the Contract Documentation.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Convenience: Architect will consider requests for substitution prior to acceptance of bids by Owner. Requests received after that time may be considered or rejected at discretion of Owner and Architect.

1. Conditions: Architect will consider request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

   a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   b. Requested substitution does not require extensive revisions to the Contract Documents.
   c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   d. Substitution request is fully documented and properly submitted.
   e. Requested substitution will not adversely affect Contractor's construction schedule.
   f. Requested substitution has received necessary approvals of authorities having jurisdiction.
   g. Requested substitution is compatible with other portions of the Work.
   h. Requested substitution has been coordinated with other portions of the Work.
   i. Requested substitution provides specified warranty.
   j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

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SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.02 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.03 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.04 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.05 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.02 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:

   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703 .
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Change Orders (numbers) that affect value.

e. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.03 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.

2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

   a. Materials previously stored and included in previous Applications for Payment.
   b. Work completed for this Application utilizing previously stored materials.
   c. Additional materials stored with this Application.
   d. Total materials remaining stored, including materials with this Application.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.

2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Coordination drawings.
4. Requests for Information (RFIs).
5. Project meetings.

1.02 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.03 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.04 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect. Submit sample form to Architect for Approval prior to use.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly, with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.05 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Agenda: Discuss items of significance that could affect progress, including the following:

   a. Tentative construction schedule.
   b. Critical work sequencing and long-lead items.
   c. Designation of key personnel and their duties.
   d. Lines of communications.
   e. Procedures for processing field decisions and Change Orders.
   f. Procedures for RFIs.
   g. Procedures for testing and inspecting.
   h. Procedures for processing Applications for Payment.
   i. Distribution of the Contract Documents.
   j. Submittal procedures.
   k. Preparation of record documents.
   l. Use of the premises and existing building.
   m. Responsibility for temporary facilities and controls.
   n. Procedures for moisture and mold control.
   o. Construction waste management and recycling.
   p. Office, work, and storage areas.
   q. Equipment deliveries and priorities.
   r. Security.
   s. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Review of mockups.
   b. Possible conflicts.
   c. Time schedules.
   d. Weather limitations.

e. Compatibility of materials.
f. Acceptability of substrates.
g. Coordination with other work.
h. Protection of adjacent work.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 15 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for demonstration and training.
f. Preparation of Contractor's punch list.
g. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
h. Submittal procedures.
i. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:
1) Status of submittals.
2) Status of correction of deficient items.
3) Field observations.
4) Status of RFIs.
5) Status of proposal requests.
6) Pending changes.
7) Status of Change Orders.
8) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Field condition reports.
   3. Special reports.

1.02 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

   1. PDF electronic file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Field Condition Reports: Submit at time of discovery of differing conditions.

D. Special Reports: Submit at time of unusual event.

1.03 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.

   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Architect.

2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
3. Startup and Testing Time: Include not less than **15** days for startup and testing.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed . Base schedule on the start-up construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

2.03 REPORTS

A. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.03 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 15 days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

C. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Include the following information for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Name of subcontractor.
    f. Name of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).

    i. Number and title of appropriate Specification Section.

j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

D. Options: Identify options requiring selection by the Architect.

E. Deviations: Identify deviations from the Contract Documents on submittals.

F. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

G. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Indication of full or partial submittal.
j. Drawing number and detail references, as appropriate.
k. Transmittal number, numbered consecutively.
l. Submittal and transmittal distribution record.
m. Remarks.
n. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect'saction stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit three paper copies of each submittal, unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

6. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's product specifications.
    b. Standard color charts.
    c. Statement of compliance with specified referenced standards.

d. Testing by recognized testing agency.
e. Application of testing agency labels and seals.
f. Notation of coordination requirements.

4. For equipment, include the following in addition to the above, as applicable:
   a. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

   a. PDF electronic file.
   b. Three paper copies of Product Data, unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches .
3. Submit Shop Drawings in the following format:

   a. PDF electronic file.
   b. Two opaque (bond) copies of each submittal. Architect will return one

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit one full set available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three sets of Samples. Architect will retain one sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

   a. PDF electronic file.
   b. Three paper copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Submit subcontract list in the following format:

   a. PDF electronic file.
   b. Number of Copies: Three paper copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

J. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.02 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.02 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

D. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

E. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

H. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.03 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.04 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.05 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.06 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.08 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.09 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.01 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

F. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

G. "Provide": Furnish and install, complete and ready for the intended use.

H. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for temporary utilities and security and protection facilities.

1.02 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

1.03 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of the Waukesha County Storm Water Management and Erosion Control Ordinance.

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage; including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

1.04 QUALITY ASSURANCE

A. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch , 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide bases for supporting posts.

2.02 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

2. Toilets: Where available, use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

B. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

C. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction

from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

D. Electrical Service:
   1. Existing picnic shelters adjacent to building construction areas:
      a. On weekends, maintain power at existing outlets or provide equivalent temporary electrical outlets for public use.

E. Telephone Service:

   1. Provide superintendent with cellular telephone.

3.03 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Comply with requirements of Waukesha County Storm Water Management and Erosion Control Ordinance.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
   5. Minimize the time disturbed soil surfaces are exposed to erosive forces through project phasing and construction sequencing.
   6. Minimize soil compaction, loss of trees and other natural vegetation and the size of the disturbed area at any one time.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install and maintain temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

1. Coordinate location with Park Superintendant and County Landscape Architects.
2. Limit construction activity under driplines of Oak trees.

3.04 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.02 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.03 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable

product request within 15 number days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.06 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Refer to Divisions 02 through 16. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Products:

a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

3. Manufacturers:
   a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Field engineering and surveying.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

1.02 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.03 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

1.04 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

E. Surface and Substrate Preparation: Comply with manufacturer's recommendations for preparation of substrates to receive subsequent work.

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Owner and Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible

as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.08 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F .
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Utilize containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.09 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

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SECTION 01 74 10

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.03 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1. Demolition Waste.
2. Construction Waste.
3. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.04 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

1.05 INFORMATIONAL SUBMITTALS

A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Qualification Data: For refrigerant recovery technician.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.06 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.07 RECYCLING RECEIVERS AND PROCESSORS:

A. List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

1. Waste Cap Wisconsin Inc.
   131 West Seeboth Street; Suite 220
   Milwaukee, WI 53204-4300
   wastecap@wastecapwi.org

   a. Waste Cap Direct: A searchable database of haulers, processors and end markets for Wisconsin's construction and demolition debris: http://www.wastecapwi.org

1.08 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

   a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.03 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 4-inch size.

   a. Crush masonry and screen to for use as general fill satisfactory soil for fill or sub base.
   b. Crush masonry and screen to for use as mineral mulch.

2. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

H. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

I. Conduit: Reduce conduit to straight lengths and store by type and size.

3.04 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.05 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 10

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

1.02 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Results of completed inspection will form the basis of requirements for final completion.

1.03 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

   1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
   2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

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

   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

   1. Organize list of spaces in sequential order, starting with exterior areas first.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:

      a. Project name.
      b. Date.
      c. Name of Contractor.
      d. Page number.

   4. Submit list of incomplete items in the following format:

a. PDF electronic file.

1.05 WARRANTIES

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

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

1. Complete the following cleaning operations before requesting inspection for certification of Final Acceptance for entire Project or for a portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   g. Sweep concrete floors broom clean in unoccupied spaces.
   h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
   i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   j. Remove labels that are not permanent.
   k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

      1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.

   l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
   n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
   q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
   r. Leave Project clean and ready for occupancy.

B. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION 01 77 00

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SECTION 01 78 20

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation manuals for systems, subsystems, and equipment.

1.02 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or modify each manual to comply with Architect's Comments. Submit copies of each corrected manual within 15 days of receipt of Architect's Comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.

4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

F. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in

manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.02 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Division 01 Section "Project Record Documents."

E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 20

SECTION 01 78 30

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal: Submit one paper copy set of marked-up record prints and set(s) of plots from corrected record digital data files. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
b. Final Submittal: Submit one paper copy set PDF electronic files of marked-up record prints. Print each Drawing, whether or not changes and additional information were recorded.

B. Reports: Submit written report indicating items incorporated in Project record documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Locations and depths of underground utilities.
d. Revisions to routing of piping and conduits.
e. Revisions to electrical circuitry.
f. Actual equipment locations.
g. Duct size and routing.
h. Locations of concealed internal utilities.
i. Changes made by Change Order or Construction Change Directive.
j. Changes made following Architect's written orders.
k. Details not on the original Contract Drawings.
l. Field records for variable and concealed conditions.
m. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with Comment function enabled.
3. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 30

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SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

1.02 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.03 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will describe Owner's operational philosophy.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

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SECTION 02 41 16

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of buildings and site improvements.
2. Abandoning in-place below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place site utilities.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS

A. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

C. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.

1.6 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner. Hazardous materials will be removed by Owner under a separate contract.

E. On-site storage or sale of removed items or materials is not permitted.

1.7 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31 "Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 "Temporary Facilities and Controls."

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least four hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.

1. Remove below-grade construction, including foundation walls and footings, to at least 30 inches below grade.

E. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.

1. Fill abandoned utility structures with satisfactory soil materials or recycled pulverized concrete according to backfill requirements in Division 31 "Earthwork."
2. Piping: Disconnect piping at unions, flanges, valves, or fittings.

3.6 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 "Earthwork."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site. See Division 01 "Construction Waste Management and Disposal" for recycling and disposal of demolition waste.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16

SECTION 03 31 00

STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Structural Concrete.
2. Admixtures.
3. Curing and Treatment Requirements.
4. Floor flatness and levelness.
5. Formwork, shoring, bracing, and anchorage.
6. Concrete reinforcement and accessories.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Division 07 – Thermal and Moisture Protection: Backer rod and sealant for construction joints.
3. Section 31 23 17 – Site Excavation, Backfill and Compaction.

1.02 REFERENCES

A. Incorporated Guides and References
1. American Concrete Institute (ACI):
a. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
b. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
c. ACI 304.2R - Placing Concrete by Pumping Methods.
d. ACI 305R - Hot Weather Concreting.
e. ACI 309R – Guide for the Consolidation of Concrete.
f. ACI 347 – Guide to Formwork for Concrete.
g. ACI SP-66 – ACI Detailing Manual.

B. Specifications
1. American Concrete Institute (ACI):
a. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
b. ACI 301 - Specifications for Structural Concrete.
c. ACI 303.1 – Specification for Cast-In-Place Architectural Concrete.
d. ACI 306.1 – Specification for Cold Weather Concreting.
e. ACI 308.1 – Specification for Curing Concrete.
f. ACI 315 - Details and Detailing of Concrete Reinforcement.
g. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
2. ASTM International (ASTM):
a. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

b. ASTM A820 – Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
c. ASTM C33 – Standard Specification for Concrete Aggregates.
d. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
e. ASTM C150 – Standard Specification for Portland Cement.
f. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
g. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
h. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
i. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete.
j. ASTM C989 – Standard Specification for Slag Cement for Use in Concrete and Mortars.
k. ASTM C1059 – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
l. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
m. ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.
n. ASTM C1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
o. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
p. ASTM E1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.
q. ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
r. ASTM E1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.03 SUBMITTALS

A. Submit proposed mix design of each class of concrete to Engineer not later than 10 days after Notice to Proceed or 15 days prior to the first concrete placement, whichever comes first.

B. Submit shop drawings of reinforcing steel under provisions of Division 01 – General Requirements.
1. Initial submittal of reinforcement shop drawings shall be complete. No partial submittals will be accepted.
2. Indicate reinforcement sizes, spacings, locations and quantities of reinforcing steel, bending and cutting schedules, splicing, supporting and spacing devices.
3. Reinforcement placement shop drawings for foundations and walls shall conform to ACI SP-66 providing full wall elevations.

C. Material Certificates: For each of the following, signed by the manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Waterstops.

4. Curing compounds.
5. Bonding agents.
6. Vapor retarders.

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

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301, 305R, and 306.1.

B. Maintain copy of ACI 301 on site.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of local, state and federal rules and regulations applicable to Work and Project location.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Concreting
1. Placement and curing of concrete where (1) average daily temperature for three consecutive days is less than 40 degrees F, and (2) air temperature is not greater than 50 degrees F for more than one-half of a 24-hour period from midnight to midnight shall be in accordance with ACI 306.1.

B. Hot Weather Concreting
1. Placement and curing of concrete subject to a combination of (1) rising air temperature (generally greater than 75 degrees F) and (2) wind and low relative humidity shall be in accordance with ACI 305R.
2. Contractor shall provide plan for minimizing exposure of concrete to adverse conditions due to combinations of high air temperature, direct sunlight, drying winds, and high concrete temperature.
3. Protect concrete from rapid temperature drop.
4. Pre-wet subgrade and forms.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Plywood Forms: Douglas Fir or Spruce-Pine-Fir species: Sound, undamaged sheets with clean true edges, exterior glue, facing material to provide finish specified.

B. Lumber: Douglas Fir or Spruce species; construction grade or better; with grade stamp clearly visible.

C. Preformed Steel Wall Forms: Minimum 16 gage thick, Vertically and horizontally matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and surface appearance.

D. Form Ties For Exposed Surfaces: Plastic cone snap ties with 1-inch outside diameter by 1-inch (nominal) long cones, with no metal within 1-inch of concrete face after removal;
   1. Manufacturers:
      a. Advance Concrete Formwork, Inc.
      b. Dayton Superior.
      c. Symons - A Dayton Superior Company.
      d. Williams Form Engineering Corporation.
      e. Substitutions: As approved by Engineer.

E. Form Ties For Hidden Surfaces: Metal spreader type, removable to a depth of 1-inch from concrete face;
   1. Manufacturers:
      a. Advance Concrete Formwork, Inc.
      b. Dayton Superior.
      c. Williams Form Engineering Corporation.
      d. Substitutions: As approved by Engineer.
   2. Contractor shall use formwork, form components and accessories provided by a single manufacturer. Intermixing of formwork, components and accessories shall not be allowed.

2.02 REINFORCING STEEL

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade carbon steel deformed bars; uncoated finish.

B. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.

2.03 FIBER REINFORCEMENT

A. As indicated on Drawings.

2.04 CONCRETE MATERIALS

A. Cementitious Materials
   1. Portland Cement: ASTM C150, gray color, Type I except as specified below.
   2. Fly Ash: ASTM C618, Class C.
   3. Ground Granulated Blast Furnace Slag: ASTM C989, Grade 100 or 120.
   4. Silica Fume: ASTM C1240.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: ASTM C1602, clean and not detrimental to concrete.

2.05 ADMIXTURES

A. Admixtures to be used in the concrete mixture shall be submitted to the Engineer for approval as part of the mixture design.

B. Chemical admixtures shall be in accordance with ASTM C494.

C. Admixtures shall be used in accordance with manufacturer's written recommendations.

D. Admixtures containing chlorides, sulfides, or nitrides are not permitted.

E. Admixtures permitted shall be supplied by a single manufacturer for project.

F. Air Entrainment Admixture: ASTM C260;
   1. Manufacturers:
      a. Axim Italcementi Group.
      b. BASF Admixtures, Inc.
      c. Grace Construction Products.
      d. The Euclid Chemical Company
      e. Substitutions: As approved by Engineer.

2.06 ACCESSORIES

A. Vapor Retarder: ASTM E1745; Class C, 10 mil minimum thickness, water vapor permeance rating of 0.050 perms or less;
   1. Manufacturers:
      a. Americover - Vapor Block VB 10.
      b. Fortifiber - Moistop Ultra 10
      c. Stego Industries - Stego Wrap 10-mil
      d. W.R. Meadows - Perminator.
      e. Substitutions: As approved by Engineer.

B. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi.

C. Joint Filler: ASTM D1751, Bituminous fiber, 1/2-inch wide by depth of concrete less 1/8-inch.

D. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating, intended for use on concrete;
   1. Manufacturers:
      a. BASF Construction Chemicals, LLC - Building Systems: Castoff
      b. Dayton Superior - Clean Strip Ultra (J-3).
      c. W.R. Meadows - Duogard.
      d. Substitutions: As approved by Engineer.

2.07 CURING AND TREATMENT MATERIALS

A. Water: Potable and clean.

B. Evaporation Reducer: Thin monomolecular film to reduce rapid moisture loss from the concrete surfaces prior to curing;
   1. Manufacturers:
      a. BASF Admixtures, Inc. - Master Builders - Confilm.
      b. Dayton Superior - Sure Film J-74
      c. W.R. Meadows - Evapre.
      d. Substitutions: As approved by Engineer.

C. Curing and Sealing Compound: ASTM C309; Type I free of oil, wax, or grease;
   1. Manufacturers:
      a. BASF Building Systems, Inc. - Sonneborn Kure-N-Seal WB.
      b. Dayton Superior - Safe Cure & Seal (J-18).
      c. The Euclid Chemical Company - Aqua-Cure VOX
      d. W. R. Meadows - Sealtight - VOCOMP-20.
      e. Substitutions: As approved by Engineer.
   2. Hardeners and sealer used shall be of same manufacturer.

D. Curing Compound (Exterior Use Only): ASTM C309; Type II white pigmented;
   1. Manufacturers:
      a. ChemMasters - SafeCure 3000.
      b. Dayton Superior - Day-Chem City White Cure (J-8).
      c. W. R. Meadows - 1200 White Series.
      d. Substitutions: As approved by Engineer.

E. Liquid Hardener and Densifiers:
   1. Manufacturers:
      a. BASF Building Systems, Inc. - Sonneborn Kure-N-Harden.
      b. Dayton Superior - Day-Chem Sure Hard (J-17).
      c. The Euclid Chemical Company - Euco Diamond Hard.
      d. W.R. Meadows - Liqui-Hard.
      e. Substitutions: As approved by Engineer.
   2. Hardeners and sealer used shall be of same manufacturer.

2.08 CONCRETE MIXTURE

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture of field test data, or both, according to ACI 301.

B. Mix concrete in accordance with ASTM C94.

C. Concrete mix designs shall be designed and submitted in accordance with Division 01 and included as part of cost of this Work.

D. Mix designs shall be prepared by a qualified agency acceptable to Engineer. An electronic copy of mix designs shall be submitted for Engineer's review prior to placing any concrete.

E. Mix design shall indicate brands, types, and quantities of admixtures included, compressive strength, slump, sieve analysis for fine and coarse aggregate, quantities of all ingredients, type and brand of cement, source of aggregate, whether fine aggregate is natural or manufactured.

F. Design of mix shall assure placing and finishing characteristics that meet Project requirements.

G. Mix designs contained in the Schedule of Mixes may be modified and submitted to Engineer for approval, by use of mid or high range water reducing admixtures to control slumps required for pumping of concrete. Strength, placing and finishing requirements shall be maintained.

H. Concrete mixtures placed directly over vapor retarders shall be designed to have low shrinkage characteristics and designed to minimize slab curling.

I. Initial and final set times of concrete mix designs shall be coordinated between the contractor and concrete supplier.

2.09 SCHEDULE OF MIXES

A. Footings: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi.
   2. Maximum Aggregate Size: 1-1/2 inches.
   3. Maximum Water-Cement Ratio: 0.50.

B. Foundation Walls, Grade Beams: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi.
   2. Maximum Aggregate Size: 3/4 - inch.
   3. Air Entrainment: 6 percent air content is required with an acceptable air content of plus or minus 1.5 percent.

C. Interior Slab-on-Ground, Equipment Pads: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi.
   2. Aggregate Size: Use maximum size applicable to slab thickness and reinforcement placement in order to control shrinkage and curing.

D. Exterior Slab-on-Ground, Walks, Paving, Curbs, Equipment Pads: Proportion normal-weight concrete mix as follows:
   1. Compressive Strength (28 Days): 3000 psi.
   2. Aggregate Size: Use maximum size applicable to slab thickness and reinforcement placement in order to control shrinkage and curing.
   3. Air Entrainment: 6 percent air content is required with an acceptable air content of plus or minus 1.5 percent.

PART 3 - EXECUTION

3.01 FORMWORK

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

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits stated below.

C. Verify lines, levels, and measurement before proceeding with formwork.

D. Earth forms are not permitted.

E. Align form joints.

F. Do not apply form release agent where concrete surfaces receive special finishes or applied coatings which may be affected by agent.

G. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.02 REINFORCEMENT

A. Place, support, and secure reinforcement against displacement.

B. Locate reinforcing splices as shown on Drawings.

C. Damage to rebar coating as a result of bending shall be repaired with equivalent coating.

3.03 VAPOR RETARDERS

A. Vapor retarders shall be provided where slabs will receive vapor-sensitive floor coverings or in humidity-controlled areas or as indicated on drawings.
   1. Install vapor retarders directly under concrete slab-on-ground at areas with vapor-sensitive floor coverings and where subgrade granular material is subject to future moisture infiltration.
   2. Where subgrade material is dry, and will not be subject to future moisture infiltration and where humidity will be controlled, place the vapor retarder beneath the dry granular material and the concrete slab-on-ground directly on the dry granular material.

B. Installation of Water Vapor Retarders shall be in accordance with ASTM E1643.

C. Edges shall be lapped 6 inches and sealed.

D. Contractor is responsible for maintaining conditions to provide a dry subgrade material where the slab is cast on top of granular material.

E. Contractor is responsible for maintaining a puncture free vapor retarder. Any punctures shall be sealed appropriately to prevent vapor transmission.

F. Do not disturb vapor retarder while placing reinforcement.

3.04 PLACING CONCRETE

A. Notify Engineer a minimum of 48 hours prior to commencement of concreting operations.

B. Failure to notify Engineer may result in rejection of concrete placed without observation.

C. Place concrete in accordance with ACI 301.

D. Place pumped concrete in accordance with ACI 304.2R. Line coating mix to initiate pumping shall not be used in pour but shall be wasted.

E. Ensure reinforcement and embedded items are not disturbed during concrete placement.

F. Concrete with excessive honeycomb or embedded debris shall be rejected and replaced at no cost to OWNER.

G. Application of surface retarders and sawcutting of joints shall be planned in advance.

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

I. Placing During Hot Weather:
   1. Place concrete during hot weather conditions in accordance with ACI 305R.

J. Placing During Cold Weather:
   1. Place concrete during cold weather conditions in accordance with ACI 306.1.

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

3.05 FLOOR SLABS

A. Place floor slabs-on-ground with contraction and construction joints as indicated on Drawings.

B. Saw cut contraction joints as soon as possible, without raveling, after placement of concrete, but within 24 hours.

C. Cut slabs with 3/16-inch thick blade, cutting one-fourth depth of slab thickness.

D. Separate slabs on fill from vertical surfaces with a joint filler.

E. Extend joint filler from bottom of slab to within 1/8-inch of finished slab surface.

F. Floor Finishes shall be in accordance with ACI 302.1R. Immediately after finishing, begin curing. Also, see Finish and Cure Schedule at the end of this Section.
   1. Interior Concrete Finish: Steel troweled finish, Class A tolerance, ACI 117.
   2. Exterior Concrete Finish: Magnesium float and trowel finish only. No steel troweling. Finish with a light broom texture with troweled edges and control joints. All joints to be tooled, no saw cut joints permitted.

3.06 FLOOR CURING AND TREATMENT

A. Curing shall begin promptly to prevent drying of concrete. Curing shall continue for 7 days after placing.

B. Curing methods shall not be changed until after the third day, and then only with written approval of the Engineer.

C. Do not allow concrete to cool rapidly.

D. Keep forms covered and moist during the first 3 days of the curing period.

E. Verify compatibility of floor treatment materials with mastics and finish materials to be applied to floor.

F. Where floors are to be covered, apply one coat of dissipating curing compound, applied immediately after finishing.

G. Where floors are not scheduled to be covered, apply two coats of curing and sealing compound, with first coat applied immediately after finishing and second coat just before final acceptance of building except where floor covering materials are to be applied.

3.07 REPAIR OF VERTICAL SURFACE DEFECTS

A. Upon stripping of forms, vertical surfaces shall be inspected for defects caused by surface air voids, honeycombing, form tie holes, peeling, and fins.

B. Surface air voids shall be repaired with a unit packaged mixture of sand and cement mixed on job site with water and a unit of acrylic. Mixture shall be brushed uniformly on to surface and into voids. Where surface is to be exposed, surface finish of repair shall match adjacent surface.

C. Honeycombed and other defective concrete shall be removed down to sound concrete and patched to match adjacent surfaces.

3.08 FINISHING OF FORMED SURFACES

A. After removal of forms and repair of defects, surfaces of concrete shall be given finishes specified below.

B. Rough Form Finish at All Concrete Covered by Backfill: Surface left with texture imparted by forms; form facing material not specified; tie holes and defects shall be patched; fins exceeding 1/4-inch shall be chipped or rubbed off.

C. Smooth Form Finish at All Concrete Exposed to View: Surface produced by form facing material shall be a smooth, hard, uniform texture on concrete; forms may be plywood, tempered form grade hardboard, metal, plastic, paper or other acceptable material capable of producing finish; arrangement of facing material shall be orderly and symmetrical with number of seams kept to practical minimum; forms supported to prevent deflection and to maintain tolerances; tie holes and defects shall be patched; all fins shall be removed.

1. Smooth Rubbed Finish: produced on newly hardened concrete no later than day following form removal and after defects repaired; surface wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced; no cement grout used other than cement paste drawn from concrete itself by rubbing process.

D. Tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of formed surface.

E. Final finish on formed surfaces shall continue uniformly across unformed surfaces.

3.09 TOLERANCES

A. All tolerances for concrete work shall be in accordance with ACI 117.

B. Contractor shall employ construction techniques to provide the following tolerances:

	Overall		Local Minimum	
	FF	FL	FF	FL
1. Interior Slabs on Ground	20	15	15	10

C. Contractor shall set forms consistent with and is solely responsible for meeting requirements of F-numbers specified above.

D. Testing:
1. Floor tolerances will be tested by an independent testing agency paid for by Owner. Testing will be performed under provisions of Division 01.
2. Contractor shall conduct its own F-number tests within 72 hours of placing each slab section to determine adequacy of placing operations.
3. All tests performed shall conform to ASTM E1155. Equipment to be used for testing shall be dipstick.

E. All floors not conforming to these requirements shall be corrected by replacement or other methods approved by Structural Engineer.

3.10 FIELD QUALITY CONTROL

A. Testing and analysis of concrete shall be performed under provisions of Division 01.

B. Testing firm will cast test cylinders and perform slump and air entrainment tests in accordance with ACI 301.

C. Concrete test cylinders shall be cast per the following schedule for each building:
1. Footings.: 3
2. Foundation walls (if concrete): 3.
3. Piers: 3.
4. Slabs-on-grade: 3.

D. During hot or cold weather, as defined in Section 1.6, one additional test cylinder shall be cast from each increment of 100 cubic yards of each class of concrete placed each day or from each pour of each class if less than 100 cubic yards and be cured on site under same conditions as concrete it represents.

E. One slump test will be taken for each set of tests cylinders cast and whenever consistency of concrete appears to vary.

F. No water may be added to the concrete at the site unless pre-approved in writing by the Engineer for that specific mix. If pre-approved, the mix ticket must state how much water may be added.

3.11 PREPARATION OF EXISTING WORK

A. Drill holes in existing concrete, insert steel dowels and pack with non-shrink grout where new concrete is doweled to existing concrete work.

B. Prior to placement of new concrete clean with steel brush and apply bonding agent in accordance with manufacturer's instructions.

3.12 FINISH AND CURE SCHEDULE

CLASS	TYPE OF FINISH	AREA DESIGNATION	TYPE OF CURE
1	Single trowel	Interior slabs	Cure and sealing compound and liquid hardener.
3	Float, trowel and broom finish	Exterior slabs	Cure and sealing compound

END OF SECTION 03 31 00

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Masonry joint reinforcement.
4. Embedded flashing.

1.2 QUALITY ASSURANCE

A. 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, from single source from single manufacturer for each product required.

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

C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

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

1.4 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 of walls and hold cover securely in place.

B. Do not apply roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be 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 ACI 530.1/ASCE 6/TMS 602.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.
3. Provide standard shapes for interior window sills as noted on drawings.

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

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 according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C 90.

1. Density Classification: Normal weight.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 GLASS BLOCK UNITS

1. Pittsburgh Corning Glass Block

   a. Premier Series Icescapes Pattern.

2. Glass Block Accessories

   a. Foam expansion strips
   b. Panel anchors as job conditions require.
   c. Anodized aluminum frame.

2.4 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. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404 – fine and coarse.

F. Water: Clean and potable.

2.5 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 EMBEDDED FLASHING MATERIALS

A. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

2.7 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. For exterior masonry, use portland cement-lime mortar.

B. Mortar for Unit Masonry: Comply with ASTM C 270, 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.

C. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi .
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that foundations are within tolerances specified.

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

3.2 INSTALLATION, GENERAL

A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

B. 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.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet , 3/8 inch in 20 feet , or 1/2 inch maximum.
3. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:

1. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 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.

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 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. 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.
2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs 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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Provide continuity at wall intersections by using prefabricated T-shaped units.

C. Provide continuity at corners by using prefabricated L-shaped units.

D. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

3.7 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

3.8 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. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.9 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.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31.
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 43 13

ADHERED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stone masonry adhered to wood framing and sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples for Initial Selection:
1. For each stone type indicated.
2. For each mortar color indicated.

C. Samples for Verification:

1. For each stone type indicated. Include at least three Samples in each set and show the full range of color and other visual characteristics in completed Work.
2. For each color of mortar required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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

1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

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

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

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

1.7 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone 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. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

C. 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 stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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 seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.8 COORDINATION

A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain stone, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 LIMESTONE

A. Material Standard: Comply with ASTM C 568.

B. Provide solid stone where indicated on drawings.

2.3 FIELDSTONE

A. Material Standard: Comply with ASTM C 568.

B. Thinstone:

1. Match Park's existing beach house for color, finish, and other stone characteristics relating to aesthetic effects.
2. Halquist Stone Company; Wisconsin Splitface Fieldstone.

   a. 1-1/2 inch thinstone.

C. Dampcourse:
1. Provide solid cut stone dampcourse where indicated on drawings.

2. Halquist Stone Company; field-collected Wisconsin Granite Fieldstone or other solid granite stone of comparable color and tone to the selected Fieldstone approved by Architect.
   a. Wall Base: 4" x 8" x 24"-60" (random lengths), with thermal finish.
   b. Pier Base: 1-1/2" x 8" x 12"-30" (random lengths), with thermal finish.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

   1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

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

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in stone masonry mortar.

D. Aggregate: ASTM C 144 and as follows:

   1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.

E. Water: Potable.

2.5 STONE TRIM ANCHORS

A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated.

B. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.

C. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors torque-controlled expansion anchors or undercut anchors made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or Type 316, for anchors.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Cementitious Dampproofing: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.

C. Weep Products: Use the following unless otherwise indicated:

1. Mesh Weep Holes: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of stone masonry; in color selected from manufacturer's standard.

D. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653, G60.

E. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

2.7 FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings.

C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.

D. Cut and drill sinkages and holes in stone for anchors and supports.

E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.

F. Gage backs of stones for adhered veneer if more than 81 sq. in. in area.

G. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Veneer Thickness: 1 inch plus or minus 1/8 inch.
2. Solid Stone Thickness: As noted on drawings.

2.8 MORTAR 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.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.

1. Mortar for Setting Stone: Type N.

2. Color: Match Western Lime color W-5 or Ultralite as selected by Architect.

C. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.

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

3.2 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
3. Pitch face at field-split edges as needed to match stones that are not field split.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication or that is otherwise unsuitable for intended use.

C. Arrange stones in tight cobblestone pattern

D. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

E. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 3/8 inch at widest points.

G. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet , 3/8 inch in 20 feet , or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.

E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ADHERED STONE MASONRY VENEER

A. Install lath over sheathing installation by fastening through sheathing into framing to comply with ASTM C 1063.

B. Install scratch coat over metal lath 3/8 inch thick to comply with ASTM C 926.

C. Coat backs of stone units and face of scratch coat with cement-paste bond coat, then butter both surfaces with setting mortar. Use sufficient setting mortar so a slight excess will be forced out

the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.

D. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Smooth, flat face slightly below edges of stone as indicated.

3.7 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
3. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.8 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste; including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches in greatest dimension.

2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste.
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 04 43 13

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes shop fabricated metal items.
   1. Anchor bolts for sill plates and column base connections.
   2. Heavy timber related-steel plates, see Section 06 13 00.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 03 31 00 - Structural Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
   3. Section 04 22 00 – Concrete Unit Masonry: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in masonry.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   5. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   6. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   7. ASTM F436 - Standard Specification for Hardened Steel Washers.
   8. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

C. The Society for Protective Coatings:
   1. SSPC - Steel Structures Painting Manual.
   2. SSPC Paint 15 - Steel Joist Shop Paint.

1.03 SUBMITTALS

A. Division 01 – General Requirements : Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Division 01 – General Requirements: Product storage and handling requirements.

1.05 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.01 MATERIALS - STEEL

A. Bolts: ASTM A307; Grade A or B.
   1. Finish: Hot dipped galvanized.

B. Nuts: ASTM A563 heavy hex type.
   1. Finish: Hot dipped galvanized.

C. Washers: ASTM F436; Type 1.
   1. Finish: Hot dipped galvanized.

D. Welding Materials: AWS D1.1; type required for materials being welded.

E. Shop Primer: SSPC Paint 15, Type 1, red oxide.

F. Touch-Up Primer: Match shop primer.
   1. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.

2.02 ANCHOR BOLTS

A. Anchor Rods: ASTM F1554; Grade 36, weldable.
   1. Shape: Hooked.
   2. Furnish with nut and washer.
   3. Galvanized in accordance with ASTM A153.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive Work.

3.02 PREPARATION

A. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on Drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.04 ERECTION TOLERANCES

A. Division 01 – General Requirements: Tolerances.

3.05 FIELD QUALITY CONTROL

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

END OF SECTION 05 50 00

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Preservative treatment of wood.
2. Miscellaneous framing.

B. Related Sections:
1. Applicable provision of Division 01 shall govern all work under this Section.
2. Section 03 31 00 – Structural Concrete: Setting anchors in concrete.
3. Section 04 22 00 – Concrete Unit Masonry: Setting anchors in masonry.
4. Section 06 10 53 – Miscellaneous Rough Carpentry.

1.02 REFERENCES

A. American Wood-Preservers' Association (AWPA):
1. AWPA U1 – Use Category System: User Specification for Treated Wood.
2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.
3. AWPA C27 – Plywood – Fire-Retardant Treatment by Pressure Processes.

B. ASTM International (ASTM):
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

C. U.S. Department of Commerce National Institute of Standards and Technology (DOC):
1. DOC PS 20 - American Softwood Lumber Standard.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Product Data: Submit technical data on wood preservative materials and application instructions.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by DOC PS 20.
2. Lumber: DOC PS 20.

B. Surface Burning Characteristics:
   1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated material.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Division 01 – General Requirements: Product storage and handling requirements.

PART 2 - PRODUCTS

2.01 LUMBER MATERIALS

A. Lumber Grading Rules: NLGA.

B. Miscellaneous Framing: Stress Group D, Spruce, Pine, Fir species, 19 percent maximum moisture content, pressure preservative treat when designated on Drawings.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and Staples: ASTM F1667.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

B. Structural Framing Connectors: Galvanized steel, sized to suit framing conditions, as shown on Drawings, manufactured by Simpson.

2.03 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA Standard U1 using water borne preservative with 0.25 percent retainage.

B. Fire Retardant Treatment: Pressure treatment, AWPA C20 for lumber and AWPA C27 for plywood, Interior Type, chemically treated and pressure impregnated.

C. Moisture Content after Treatment:
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

PART 3 - EXECUTION

3.01 FRAMING

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

B. Fasten framing in accordance with applicable code.

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

D. Coordinate installation of wood decking and wood trusses.

3.02 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment.

B. Brush apply one coat of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.03 TOLERANCES

A. Division 01 – General Requirements: Tolerances.

B. Framing Members: 1/4 inch from indicated position, maximum.

END OF SECTION 06 10 00

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SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood furring.
3. Attic Access Hatch framing.

1.2 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.

1.3 ACTION 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. 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 and net amount of preservative retained.
2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 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. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 DIMENSION LUMBER FRAMING

A. Interior framing: Construction or No. 2 grade of any species.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Furring.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Eastern softwoods, No. 2 Common grade; NELMA.

D. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where 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. Wood Screws: ASME B18.6.1.

C. Lag Bolts: ASME B18.2.1 .

D. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers.

E. 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 E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to receive Sheathing: Install 2-by-2-inch nominal-size furring vertically at 24 inches o.c.

3.3 ATTIC ACCESS HATCH

A. Rough frame for nominal opening size indicated on drawings.

3.4 PROTECTION

A. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 13 00

HEAVY TIMBER

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes;
   1. Heavy structural timber for posts, beams, and trusses.
   2. Connection hardware.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 03 31 00 – Structural Concrete: Placement of steel support fabrications to be cast in concrete.
   3. Section 04 22 00 – Concrete Unit Masonry: Steel support fabrications bearing upon and anchored into masonry.
   4. Section 05 50 00 - Metal Fabrications: Structural steel connectors.
   5. Section 06 10 00 - Rough Carpentry: Structural dimension lumber framing.

1.02 REFERENCES

A. American Institute of Timber Construction (AITC):
   1. AITC 108 - Standard For Heavy Timber Construction.

B. ASTM International (ASTM):
   1. ASTM A36 – Standard Specification for Carbon Structural Steel.
   2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi tensile strength.

C. American Wood-Preservers' Association (AWPA):
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.

D. Forest Stewardship Council (FSC):
   1. FSC Guidelines - Forest Stewardship Council Guidelines.

E. U.S. Department of Commerce National Institute of Standards and Technology (DOC):
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

F. West Coast Lumber Inspection Bureau (WCLIB):
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

G. Western Wood Products Association (WWPA):
   1. WWPA G-5 - Western Lumber Grading Rules.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Product Data: Submit technical data on wood preservative materials.

C. Shop Drawings: Indicate dimensions, wood species and grades, component profiles, drilled holes, fasteners, connectors, erection details.

1.04 QUALITY ASSURANCE

A. Lumber Grading Agency: Certified by DOC PS 20.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of heavy timber framing with five (5) years minimum experience.

PART 2 - PRODUCTS

2.01 HEAVY TIMBER FRAMING

A. Manufacturers:
   1. Georgia Pacific Corp.
   2. Louisiana-Pacific Corp.
   3. Weyerhaeuser Engineered Stand Products.
   4. Substitutions: Division 01 – General Requirements.

B. Lumber Grading Rules: WWPA G-5.

C. Lumber: Western Cedars species; No. 2 or better grade; maximum moisture content of 19 percent.

2.02 ACCESSORIES

A. Connectors: Specified in Section 05 50 00 – Metal Fabrications.

B. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; galvanized coating; see drawings for sizes. Provide bolts and flat washers complying with ASTM A307.

C. Structural Steel Shapes and Plates: Complying with ASTM A36.

D. Zinc Rich Primer.

2.03 FABRICATION

A. Fabricate components in accordance with AITC 108, with joints neatly fitted, welded and ground smooth. Account for shrinkage of timber in design and arrangement of fasteners for connections.

2.04 FINISHES

A. Timber Surfaces Exposed to View: Finish exposed surfaces to remove plane or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

B. Prime connectors, except where cast in concrete.

C. Galvanizing for Nuts, Bolts and Washers: ASTM A153.

2.05 WOOD TREATMENT

A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

PART 3 - EXECUTION

3.01 ERECTION

A. Set structural timber framing level and plumb, in correct position.

B. Install structural timbers with minimum 1/2 inch clearance around timbers set into concrete or masonry for air circulation.

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

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. After erection, touch-up primed surfaces with zinc primer.

END OF SECTION 06 13 00

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SECTION 06 15 00

WOOD DECKING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Softwood lumber structural wood decking.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 03 31 00 - Structural Concrete: Bearing support.
   3. Section 04 22 00 – Concrete Unit Masonry: Bearing support.

C. REFERENCES

D. American Institute of Timber Construction:
   1. AITC 112 - Standard for Tongue and Groove Heavy Timber Decking.

E. American Lumber Standards Committee (ALSC):
   1. ALSC - Softwood Lumber Standards.

F. ASTM International (ASTM):
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM F1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

G. South Coast Air Quality Management District (SCAQMD):
   1. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

H. Southern Pine Inspection Bureau (SPIB):
   1. SPIB - Lumber Grading Rules.

I. U.S. Department of Commerce National Institute of Standards and Technology (DOC):
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

J. West Coast Lumber Inspection Bureau (WCLIB):
   1. WCLIB - Lumber Grading Rules.

K. Western Wood Products Association (WWPA):
   1. WWPA - Lumber Grading Rules.

1.02 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Shop Drawings: Indicate deck framing system, loads and cambers, bearing details, and framed openings.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Lumber Grading Agency: Certified by ALSC.
   2. Lumber: DOC PS 20.
   3. Wood Structural Panels: DOC PS 1 or DOC PS 2.

B. In lieu of grade stamping exposed to view lumber and plywood, submit manufacturer's certificate certifying Products meet or exceed specified requirements.

1.04 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum five years experience.

C. Design decking under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Wisconsin.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Division 01 – General Requirements: Product storage and handling requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
   1. LP Building Products.
   2. Weyerhaeuser Engineered Stand Products.
   3. Lock-Deck.
   4. Substitutions: In accordance with Division 01 – Product Requirements.

2.02 MATERIALS

A. Lumber Grading Rules: AITC 112.

B. Lumber Decking: 3 x 6 tongue and groove, beveled joint on exposed face, smooth faced one side, rough sawn on side exposed to view, Douglas Fir or Red Cedar, kiln dried.

2.03 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot dipped galvanized steel.
   2. Nails and Staples: ASTM F1667.

2.04 SOURCE QUALITY CONTROL

A. Division 01 – General Requirements: Testing, inspection and analysis requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Division 01 – General Requirements: Coordination and project conditions.

B. Verify support framing is ready to receive decking.

3.02 PREPARATION

A. Coordinate placement of support items.

3.03 INSTALLATION - LUMBER DECKING

A. Install decking perpendicular to framing members. On sloped surfaces, lay decking with tongue upward.

B. Fit butt end deck joints occurring between support members with metal splines to maintain tight, aligned joints.

C. Engage decking tongue and groove edges.

D. Secure with fasteners. Side spike planks together, through pre-drilled holes.

E. Maintain decking joint space of 1/16 inch maximum.

F. Cut decking to accommodate roof drain and flange.

3.04 TOLERANCES

A. Division 01 – General Requirements: Tolerances.

B. Surface Flatness of Decking without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

END OF SECTION 06 15 00

SECTION 06 16 00

SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

1.2 ACTION 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. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Plywood: DOC PS 1Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b for exterior construction not in contact with the ground.

2.3 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior sheathing.

1. Nominal Thickness: Not less than 1/2 inch.

B. Cementitious Backer Units: ASTM C 1325, Type A.

1. Thickness: 5/8 inch.

2.4 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, EWA Rated sheathing.

1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 5/16 inch.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

2.6 MISCELLANEOUS SHEATHING ACCESSORIES

A. Drainage Mat: Manufacturer's standard, compression-resisting, three-dimensional, nonwoven, entangled filament, nylon mat with geo-textile fabric on one side designed to drain incidental moisture by gravity.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Colbond Building Products; Roof Underlayment EnkaDrain 9714 or comparable product.

B. Water-Resistive Barrier

1. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
2. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - EXECUTION

3.1 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. Arrange joints so that pieces do not span between fewer than three support members.

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."
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

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 wall 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.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Nail to wood framing. Space panels 1/8 inch apart at edges and ends.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 DRAINAGE MAT INSTALLATION

A. Install drainage mat full height of wall on exterior side of sheathing installation with geo-textile fabric to exterior, according to manufacturer’s recommended fastening pattern.

B. Install drainage mat to shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

3.5 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 06 16 00

SECTION 06 20 13

EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior wood trim.
2. Lumber siding.

1.2 ACTION SUBMITTALS

A. Samples for Verification:

1. For each species and cut of lumber and panel products, with 1/2 of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.

2. Fasteners.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber and plywood with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
2. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
3. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
4. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. 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.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. 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.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
   a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece .
6. Application: All exterior lumber and plywood .

2.3 EXTERIOR TRIM

A. Lumber Trim for Semitransparent-Stained Finish :

1. Species and Grade: Western red cedar, Grade A; NLGA, WCLIB, or WWPA.
2. Maximum Moisture Content: 19 percent.

3. Finger Jointing: Not allowed.
4. Face Surface: Saw textured.

2.4 BATTEN-ON-BOARD LUMBER SIDING

A. Provide kiln-dried lumber siding complying with DOC PS 20.

B. Species and Grade: Grade A western red cedar; NLGA, WCLIB, or WWPA.

C. Board: Board siding, S1S2E, actual overall dimensions of 11-1/2 by 3/4 inch (1 by 12 inch nominal) measured on the face and thick edge at 19 percent moisture content.

D. Battern: Board siding, S1S2E, actual overall dimensions of 2-1/2 by 3/4 inch (1 by 3 inch nominal) measured on the face and thick edge at 19 percent moisture content.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

1. For face-fastening siding, provide ringed-shank, hot-dip galvanized-steel siding nails unless otherwise indicated.
2. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.

B. Flashing: Comply with requirements in Section 07 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

2.6 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 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 exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install flat-grain lumber with rough side exposed to weather.

B. Install trim 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.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

3.5 SIDING INSTALLATION

A. Install siding to comply with manufacturer's written instructions.

B. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

C. Finish: Apply finish within two weeks of installation.

3.6 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior 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.

3.7 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 13

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SECTION 06 20 23

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior ceiling paneling and associated trim.
2. Attic Access Hatch panel and trim.

B. Related Requirements:

1. Division 06 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 09 "Staining and Finishing" for priming and back-priming of interior finish carpentry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.

C. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials 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. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

1. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. 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.

C. Softwood Plywood: DOC PS 1.

2.2 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain Finish):

1. Species and Grade: Western Red Cedar, Grade A ; NLGA, WCLIB, or WWPA.
2. Maximum Moisture Content: 19 percent with at least 85 percent of shipment at 12 percent or less.
3. Finger Jointing: Allowed.
4. Face Surface: Saw textured.

2.3 CEILING PANELING

A. Softwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1, made without urea-formaldehyde adhesive (Stain Finish).

1. Face Veneer Species and Cut: Western Red Cedar, Plain-sliced, Rough-sawn Clear, Select Knotty.
2. Veneer Matching: Selected for similar color and grain.
3. Backing Veneer Species: Any hardwood compatible with face species.
4. Construction: Veneer core with shiplap edges.
5. Thickness: 5/8 inch.
6. Panel Size: 48 by 120 inches, trimmed to size as single panel.
7. Glue Bond: Type II (interior).
8. Face Pattern: V-grooved pattern, with grooves at edges, center, and third points of panels.
9. Finish: Manufacturer's standard, transparent, UV-resistant, protective finish.

2.4 MISCELLANEOUS MATERIALS

A. 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.

B. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.5 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:

1. Interior standing and running trim.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

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

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 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 running trim. Cope at returns, miter at outside corners, and cope at inside 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 of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum-board joint finishing operations are completed.
3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.

1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners. Space fasteners and adhesive as recommended by panel manufacturer.
2. Conceal fasteners to greatest practical extent.
3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

3.6 ATTIC ACCESS HATCH

A. Construct and install hatch panel and trim for nominal 24-inch by 36-inch opening size where indicated on drawings.

B. Adhere two layer of Foam-plastic board insulation as specified in Division 07 Thermal Insulation.

3.7 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior 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.

3.8 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.9 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Spray polyurethane foam insulation.
4. Vapor retarders.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Type IV, 25 psi.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 GLASS-FIBER BLANKET INSULATION

A. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.3 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

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

   a. BASF Corporation.
   b. Dow Chemical Company (The).
   c. Henry Company.

2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.4 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

C. Extend insulation 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. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.3 INSTALLATION OF INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

D. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of ceiling openings; and at lap joints. Space fasteners 16 inches o.c.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.5 PROTECTION

A. Protect installed insulation and 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 07 21 00

SECTION 07 31 29

WOOD SHINGLES AND SHAKES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Owner provided and installed Wood roof shakes.
2. Underlayment.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

1.5 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.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit related work to be performed according to manufacturer's written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 ROOF SHAKES

A. Cedar Roof Shakes: Owner Provided.

2.2 UNDERLAYMENT MATERIALS

A. Felt Underlayment: ASTM D 226 or ASTM D 4869, Type II, 15 pound, asphalt-saturated organic felt.

2.3 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Drainage Mat: Manufacturer's standard, compression-resisting, three-dimensional, nonwoven, entangled filament, nylon mat designed to permit air movement and drain incidental moisture by gravity.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Colbond Building Products; Roof Underlayment 7010 Enkamat or comparable product.

2.4 METAL FLASHING AND TRIM

A. General: Comply with requirements in Division 07 "Sheet Metal Flashing and Trim."

B. Fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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 wood roofing.

B. Prepare written report listing conditions detrimental to performance of the Work.

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

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt underlayment nails.

1. Install felt underlayment on roof deck not covered by self-adhering sheet underlayment. Lap sides of felt over self-adhering sheet underlayment not less than 3 inches in direction to shed water. Lap ends of felt not less than 6 inches over self-adhering sheet underlayment.

C. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a continuous layer, overlap metal flashing installations and fasten to roof deck.

3.3 VENT FLASHING AND METAL FLASHING INSTALLATION

A. General: Install vent flashing and metal flashings and other sheet metal to comply with requirements in Division 07 "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations for wood roofing in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Tubular Skylight Flashings: Extend lower flange over and beyond each side of downslope wood roofing and up the vertical surface.

C. Rake Drip Edges: Install over underlayment and fasten to roof deck.

D. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.

E. Vent Flashings: Form flashing around penetrations and wood roofing. Fasten and seal to wood roofing.

3.4 ROOF-SHAKE INSTALLATION

A. General: Owner’s forces will install.

END OF SECTION 07 31 29

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof sheet metal fabrications.
2. Formed wall sheet metal fabrications.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak-proof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Samples for Verification: For each type of exposed finish.

1. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
2. Painted Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

   a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Colors:
   a. Pac-Clad; Mansard Brown – at roof edges
   b. Pac-Clad; Colonial Red – At base of wood siding
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.

C. Solder:

1. For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF SHEET METAL FABRICATIONS

A. Eave and Rake Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

B. Roof-Penetration Flashing: Fabricate from the following materials:

1. Zinc-Tin Alloy-Coated Stainless Steel: 0.018 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot-long, sections, at locations indicated on drawings Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

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

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

C. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws. Do not penetrate through or deform timber decking.

D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

E. Seal joints as required for watertight construction.

F. Rivets: Rivet joints in where necessary for strength.

3.3 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.

1.2 ACTION 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.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

B. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.5 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 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace 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 warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
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

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Non-staining, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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

a. Dow Corning Corporation; 799.
b. GE Advanced Materials - Silicones; .
c. Tremco Incorporated; Tremsil 600.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Non-staining Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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

a. BASF Building Systems; Sonolastic NP1 .
b. Bostik, Inc.; Chem-Calk 900 .
c. Pecora Corporation; Dynatrol I-XL.
d. Sika Corporation, Construction Products Division; Sikaflex - 1a.
e. Tremco Incorporated; Dymonic or Vulkem 116.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material 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. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.5 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.

PART 3 - EXECUTION

3.1 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.

3.2 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 repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, 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.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer 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.

3.3 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 C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind 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, tool sealants according to requirements specified in subparagraphs 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 profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

3.4 FIELD QUALITY CONTROL

A. Evaluation of Field-Adhesion 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.

3.5 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.

3.6 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.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Control and expansion joints in unit masonry.
   b. Joints in dimension stone cladding.
   c. Joints in glass unit masonry assemblies.
   d. Perimeter joints between materials listed above and frames of doors.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 25.
3. Urethane Joint Sealant: Single component, nonsag, Class 25.

B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone

END OF SECTION 07 92 00

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.

B. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door Products; an Assa Abloy Group company.
2. LaForce, Inc.
3. Republic Doors and Frames.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
   d. Edge Construction: Model 1, Full Flush.
   e. Core: Vertical steel stiffener.

      1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
   b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
2. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
3. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.5 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.6 ACCESSORIES

A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    c. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    d. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.

2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
3. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Steel Doors:
    a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    b. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
    c. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 62 50

TUBULAR SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Self-flashing tubular skylights with integral curbs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of unit skylight.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For unit skylights to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Yellow or breakage of glazing

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following :

1. Solatube International.

2.2 TUBULAR SKYLIGHT

A. General: Provide factory-assembled tubular skylights that include glazing, extruded-aluminum glazing retainers, gaskets, inner frames and flashings.

1. 290 DS Daylighting System with Opti-View diffuser and stainless trim.

2.3 ACCESSORY MATERIALS

A. Flashings: Manufacturer provided integral flashing unit appropriate for roof pitch and roofing material.

B. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

C. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, drainage mat, felt underlayment, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Coordinate installation of skylight with Owner's carpenters installing Wood Roof Shakes.

C. Comply with recommendations in AAMA 1607 and with manufacturer's written instructions for installing unit skylights.

D. Install unit skylights level, plumb, and true to line, without distortion.

E. Anchor unit skylights securely to supporting substrates.

F. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.3 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been damaged during construction period.

D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION 08 62 50

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SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
c. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Fastenings and other pertinent information.
5) Explanation of abbreviations, symbols, and codes contained in schedule.
6) Mounting locations for door hardware.
7) List of related door devices specified in other Sections for each door and frame.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1.5 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 coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

2.2 CONTINUOUS HINGES

A. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Bommer Industries, Inc.
b. Hager Companies.
c. IVES Hardware; an Ingersoll-Rand company.
d. Select Products Limited.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Deadbolts: Minimum 1-inch 1.25-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:

1. Levers: Wrought Forged Cast.
2. Escutcheons (Roses): Wrought Forged Cast.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2.4 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1 1A 2; permanent cores that are removable; face finished to match lockset.

2.5 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Existing System:

a. Key locks to Owner's existing system.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2.6 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Hager Companies.
b. Hiawatha, Inc.
c. IVES Hardware; an Ingersoll-Rand company.
d. Rockwood Manufacturing Company.

2.7 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. 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.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings schedule or comparable product by one of the following:

   a. DORMA Architectural Hardware; Member of The DORMA Group North America.
   b. LCN Closers; an Ingersoll-Rand company.
   c. Norton Door Controls; an ASSA ABLOY Group company.
   d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.8 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

   a. Hager Companies.
   b. National Guard Products.
   c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
   d. Reese Enterprises, Inc.

2.9 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

   a. Hager Companies.
   b. National Guard Products.
   c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
   d. Reese Enterprises, Inc.

2.10 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

2.11 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, 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.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. 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 in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.12 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

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. 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. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 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. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 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 that door hardware is without damage or deterioration at time of Substantial Completion.

DOOR HARDWARE SCHEDULE

DOOR HARDWARE SET NO. HG-01

Locations: Exterior Toilet Room Doors.

Item	Manufacturer	Product	Finish
Continuous Hinges	Hagar	ROTON	US 26D
Dead Bolt Lock	Best	83T7S-STK-626	US 26D
Push Plate	Hiawatha	200D	US 32D
Pull Handle	Hiawatha	200DX523A	US 32D
Closer	Norton	7500 BF w/ cushioned stop	US 26D
Kickplate	Hiawatha	8 x 34 ; 0.050 thick	US 32D
Threshold	Reese	S204A	
Jamb/ Head Seals	Reese	DS78C	
Sweep	Reese	602C	

DOOR HARDWARE SET NO. HG-02

Locations: Exterior Mechanical Room Door.

Item	Manufacturer	Product	Finish
Continuous Hinges	Hagar	ROTON	US 26D
Dead Bolt Lock	Best	83T7S-STK-626	US 26D
Push Plate	Hiawatha	200D	US 32D
Pull Handle	Hiawatha	200DX523A	US 32D
Closer	Norton	7500 BF w/ cushioned stop and hold open	US 26D
Kickplate	Hiawatha	8 x 34 ; 0.050 thick	US 32D
Threshold	Reese	S204A	
Jamb/ Head Seals	Reese	DS78C	
Sweep	Reese	602C	

END OF SECTION 08 71 00

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Galvanized metal.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.3 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following :

1. ICI Paints.
2. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide product provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

C. Colors: Waukesha County Color Selections and Color Standards apply.

2.3 SOLVENT-BASED PAINTS

A. Alkyd, Interior/ Exterior, Gloss

1. All Surface Enamel A11 series.

2.4 METAL PRIMERS

A. Primer, Alkyd, Anti-Corrosive for Metal:

1. Kem Kromik Universal Metal Primer

B. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
2. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following: SSPC-SP 3, "Power Tool Cleaning."

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats, as recommended by manufacturer, same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same

material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting of exposed miscellaneous Plumbing, HVAC and Electrical Work:

1. Paint the following work where exposed to normal view:

a. Plumbing vents through roof.
b. Wall Louvers.
c. Electrical Meter.
d. Exposed miscellaneous metal surfaces.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from exterior spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates

1. Enamel over Alkyd Primer System:
   a. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
   b. Intermediate Coat: All Surface Enamel.
   c. Topcoat: All Surface Enamel.

B. Galvanized-Metal Substrates including Hollow Metal Doors and Frames (interior and exterior surfaces)::

1. Enamel over Galvanized Metal Primer System:
   a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
   b. Intermediate Coat: All Surface Enamel, matching topcoat.
   c. Topcoat: All Surface Enamel.

C. Color Schedule

1. Metal Doors and Frames

   a. Sherwin Williams "Rocky Coast" SW2001
   b. ICI Dulux "Rocky Coast"
      1) Base: 4216-0200
      2) Additives: BLK 2 P52; YOX 2 P12; OXR 0P48

2. Exposed Metal Exterior Hardware on Beams
   a. ICI "Dark Secret: 1673 00NN 05/00

3. Metal Roof Flashing
   a. Match "Pac Clad" Mansard Brown.

END OF SECTION 09 91 13

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SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMU).
2. Miscellaneous exposed metals.

B. Related Requirements:

1. Division 09 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
2. Division 09 "Staining" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following :

1. ICI Paints.
2. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.3 BLOCK FILLERS

A. Block Filler, Acrylic Resin, Interior:

1. Heavy Duty Block Filler (B42W46)

2.4 PRIMERS/SEALERS

A. Metal Primers; Primer, Alkyd, Anti-Corrosive, For Metal:

1. Kem Kromik Universal Metal Primer

2.5 SOLVENT-BASED PAINTS

A. Alkyd, Interior/ Exterior, Gloss

1. All Surface Enamel A11 series.

2.6 CATALYZED EPOXY, WATER BASED

A. Catalyzed Epoxy, Interior, Semi-Gloss:

1. Water-based Tile-Clad Epoxy Finish.

2.7 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat, as recommended by manufacturer, a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Plumbing, HVAC and Electrical:

1. Paint the following work where exposed to normal view:
   a. Equipment, including panelboards.
   b. Uninsulated metal piping.

c. Pipe hangers and supports.
d. Metal conduit.
e. Ventilation grilles which factory color does not match adjacent surface color.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Catalyzed Epoxy over Acrylic Resin Block Filler System:

a. Block Filler: Block filler.
b. Intermediate Coat: Catalyzed Epoxy.
c. Topcoat: Catalyzed Epoxy.

B. Steel Substrates:

1. Enamel over Alkyd Primer System:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal.

b. Intermediate Coat: All Surface Enamel matching topcoat.
c. Topcoat: All Surface Enamel.

C. Color Schedule:

1. Interior Concrete Unit Masonry Walls and Partitions:

a. ICI Dulux: "China White" 45YY 74/073.

END OF SECTION 09 91 23

SECTION 09 93 00

STAINING FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood finishes. on the following substrates:

1. Exterior Substrates:

   a. Exposed glued-laminated beams, decking and columns.
   b. Dressed lumber (finish carpentry).

2. Interior Finish Carpentry:

   a. Ceilings and Trim.

B. Related Requirements:

1. Division 09 "Exterior Painting" for standard paint systems on exterior substrates.

1.2 ACTION SUBMITTALS

A. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
2. Label each Sample for location and application area.

1.3 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.

2. Final approval of stain color selections will be based on mockups.

   a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F .

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following :

1. Sherwin-Williams Company (The).

2.2 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

2.3 WOOD FILLERS

A. Wood Filler Paste:

1. Sherwin Williams

   a. Sher-Wood Natural Wood Filler.
   b. Tinted per manufacturer's recommendations to approximate top coat.

2.4 PRIMERS AND SEALERS

A. Primer, Oil for Exterior Wood:

1. Sherwin Williams

   a. Exterior Oil-based Wood Primer (Y24W20); A-100 series.
   b. Tinted per manufacturer's recommendations to approximate top coat.

2.5 STAINS

A. Stain, Exterior, Water Based, Solid Hide:

1. Sherwin Williams

   a. WoodScapes Solid Color Stain; A15 series

2.6 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:

1. Owner may engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Exterior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Prime edges, ends, faces, undersides, and backsides of wood.
3. Countersink steel nails, if used, and fill with wood filler tinted to final color. Sand smooth when dried.

E. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view and dust off.
3. After priming, fill nail holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 EXTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood substrates, nontraffic surfaces, including wood siding glued-laminated construction exposed beams and decking.

1. Solid Hide, Water-Based Stain System:

a. Prime Coat: Primer, oil for exterior wood.
b. Intermediate Coat: Stain, exterior, water based, solid hide, matching topcoat.
c. Topcoat: Stain, exterior, water based, solid hide

3.6 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood substrates, nontraffic surfaces, including interior ceiling panel and trim .

1. Solid-Color Water-Based Stain System:

a. Prime Coat: Primer, Oil for exterior wood.
b. Intermediate Coat: Stain, exterior, water based, solid hide, matching topcoat.
c. Topcoat: Stain, exterior, water based, solid hide.

PART 4 - COLOR SCHEDULE

A. Exterior:

1. Rustic Redwood: Exterior Siding.
2. Fox Brook Park Gold: Exterior exposed soffit decking.
3. Cumberland Cocoa: Exterior wood truss tails, timber framed counter, timbers and fascia boards.

B. Interior:

1. Extreme White; A41W00200.

END OF SECTION 09 93 00

SECTION 10 14 23

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1.5 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for signs.

2.2 SIGNS

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

1. ASI Sign Systems, Inc.
2. InPro Corporation.
3. Poblocki Sign Company, LLC.

B. Panel Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Composite Phenolic-Core Sign: Solid phenolic panel core with integral subsurface graphic image covered with integral, polymeric face layer.
   a. Composite-Sheet Thickness: Manufacturer's standard for size of sign .
2. Panel Size: Nine-inches wide by 12-inches high.
3. Sign-Panel Perimeter: Finish edges smooth.
   a. Edge Condition: Square cut.
4. Text and Typeface: Accessible raised characters and Braille. Typeface and colors matching Owner's standards. Finish raised characters to contrast with background color, and finish Braille to match background color.
5. Flatness Tolerance: Sign panel shall remain flat under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
2. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

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

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

3.4 SIGNAGE SCHEDULE

A. “MEN” with universal barrier-free accessible symbol, three-inch letter heights and raised Braille characters.

1. Font: Helvetica.

B. "WOMEN" with universal barrier-free accessible symbol, three-inch letter heights and raised Braille characters.

1. Font: Helvetica.

END OF SECTION 10 14 23

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:

1. Division 10 "Toilet Accessories" for toilet tissue dispensers, grab bars, and similar accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of reinforcements for compartment-mounted grab bars.
2. Show locations of centerlines of toilet fixtures.
3. Show overhead support or bracing locations.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221.

B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

C. Stainless-Steel Castings: ASTM A 743/A 743M.

2.2 SOLID-POLYMER UNITS

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

1. Accurate Partitions Corporation.
2. Metpar Corp.
3. Santana Products, Inc.
4. Solid Partitions.

B. Color and Pattern:

1. Match "Canyon Granite" by Solid Partitions.

C. Toilet-Enclosure Style: Overhead braced.

D. Urinal-Screen Style: Post to ceiling.

E. Door, Panel, Screen and Pilaster Construction: Solid high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.

F. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

G. Urinal-Screen Post: Manufacturer's standard post design of 1-3/4-inch- square, aluminum tube with satin finish; with shoe and sleeve (cap) matching that on the pilaster.

H. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 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 surface-mounted 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.

    a. Provide two per door at barrier free accessible compartments.

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 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.

2.4 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. 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.

C. 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

3.1 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.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 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 10 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13

SECTION 10 28 00

TOILET AND MECHANICAL ROOM ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Mechanical Room accessories.

B. Owner-Furnished Material & installed by contractor:

1. Liquid-Soap Dispenser

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Manufacturer's warranty.

1.3 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

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

1. American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corporation.

B. Surface Mounted Toilet Tissue Dispenser :

1. Product: San Jamar SAN R3590TBK- Dual Roll Holder.
2. No substitutions.

C. Recessed Waste Receptacle :

1. Basis-of-Design Product: Bradley 344; Stainless steel, 12 gallon capacity.

D. Grab Bars:

1. Basis-of-Design Product: Bradley 832 series, No. 4 Satin Finish
2. Outside Diameter: 1-1/2 inches.
3. Configuration and Lengths: As indicated on Drawings.

E. Surface Mounted Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: Bradley 4722-15; stainless steel fabrication; flap style self - closing door and locking bottom panel.

F. Mirror Unit with Stainless Steel Channel Frame:

1. Basis-of-Design Product: Bradley 781, No 4 Satin Finish.
2. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

   a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
   b. Provide adjustable shim for mounting to masonry partition.

3. Size: 24-inches wide by 36-inches high.

G. Surface mounted Electric Hand Dryer:

1. Basis-of-Design Product:

   a. Dyson Airblade- AB04 Series.
   b. ASI Specialties- Triumph.
   c. or approved substitute.

H. Surface mounted Baby Change Station:

1. Basis-of-Design Product: Koala Bear KB108. PVC, oval shaped fold down unit.

   a. Provide mounting hardware, protection straps, diaper bag hooks, built-in liner dispensers and 2,500 liners.
   b. Color: Grey

2.3 MECHANICAL ROOM ACCESSORIES

A. Mop Holder:

1. Basis-of-Design Product: Bradley 9953 Mop and Broom Holder.

B. Fire Extinguisher and Bracket:
1. Basis-of-Design Product: Larsen MP5 with Standard Bracket.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. 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 COORDINATION

A. Coordinate blocking for secure mounting.

3.2 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.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

1.02 REFERENCES

A. American Concrete Institute: (ACI)
   1. ACI 614 - Recommended Practice for Measuring, Mixing and Placing of Concrete

B. ASTM International: (ASTM)
   1. ASTM D1557 - Test Method for Moisture-Density Relations of Soils
   2. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
   3. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
   4. ASTM E814 - Test Method for Fire Tests of Through-Penetration Fire Stops

C. State of Wisconsin Department of Transportation: (WISDOT)
   1. Standard Specifications for Highway and Structure Construction, Current Edition, including latest supplements.

D. Underwriters Laboratories, Inc.: (UL)
   1. UL1479 - Fire Tests of Through-Penetration Firestops.
   2. UL723 - Surface Burning Characteristics of Building Materials.

1.03 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ABMA: American Boiler Manufacturers Association.
   2. ACPA: American Concrete Pipe Association.
   3. AGA: American Gas Association.
   4. AMCA: Air Movement and Control Association.
   5. ANSI: American National Standards Institute.
   6. ARI: Air Conditioning and Refrigeration Institute.
   7. ASME: American Society of Mechanical Engineers.
   8. ASPE: American society of Plumbing Engineers.
   9. ASSE: American Society of Sanitary Engineering.
   10. ASTM: American Society for Testing and Materials.
   11. AWWA: American Water Works Association.
   12. AWS: American Welding Society.
   13. CISPI: Cast Iron Soil Pipe Institute.
   14. CGA: Compressed Gas Association.
   15. CS: Commercial Standards, Products Standards Sections, Office of Engineering Standards Service, NBS.
   16. EPA: Environmental Protection Agency.
   17. FS: Federal Specifications, Superintendent of Documents, U.S. Government Printing Office.
   18. GAMA: Gas Appliance Manufacturers Association.
   19. IAPMO: International Association of Plumbing & Mechanical Officials.
   20. IEEE: Institute of Electrical and Electronics Engineers.
   21. ISA: Instrument Society of America.
   22. MCA: Mechanical Contractors Association.
   23. MICA: Midwest Insulation Contractors Association.
   24. MSS: Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
   25. NBS: National Bureau of Standards.

26. NEC: National Electric Code.
27. NEMA: National Electrical Manufacturers Association.
28. NFPA: National Fire Protection Association.
29. NSF: National Sanitation Foundation.
30. PDI: Plumbing and Drainage Institute.
31. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association. Inc.
32. STI: Steel Tank Institute.
33. UL: Underwriters Laboratories Inc.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01 – General Requirements.

B. Products and materials used are to be new, undamaged, clean and in good condition.

C. Existing products and materials are not to be reused unless specifically indicated.

D. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, Contractor is responsible for all costs involved in integrating equipment or accessories into system and for obtaining intended performance from system into which these items are placed.

1.05 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from Owner's Project Representative.

B. When interruption is required, coordinate scheduling of down-time with Owner to minimize disruption to his activities.

C. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

1.06 PROTECTION OF FINISHED SURFACES

A. Division 01 – General Requirements: Protection of Finished Surfaces.

1.07 SLEEVES AND OPENINGS

A. Division 01 – General Requirements: Sleeves and Openings.

1.08 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves and related openings between piping and sleeve and structural opening shall be responsibility of Contractor whose work penetrates opening.

B. Contractor responsible shall provide individuals skilled in such work to do sealing and fireproofing.

1.09 GOVERNING AGENCIES

A. Comply with requirements of State and local plumbing codes.

1.10 CERTIFICATES AND INSPECTIONS

A. Division 00 – General Conditions: Permits, Regulations, Utilities and Taxes.

1.11 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Shop Drawing submittals are to be bound, labeled, contain Project Manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with installation.

C. Submit for all equipment and systems as indicated in respective specification sections, marking each submittal with that specification section number.

D. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and number, as indicated in contract documents. Include wiring diagrams of electrically powered equipment.

E. Firestopping System Submittals:
   1. Contractor shall submit product data for each firestop system.
   2. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project.
   3. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Division 01 – General Requirements: Operating and maintenance instructions.

B. Assemble material in three-ring or post binders, using an index at front of each volume and tabs for each system or type of equipment.

C. In addition to data indicated in the General Requirements, include the following information:
   1. Copies of all approved shop drawings.
   2. Manufacturer's wiring diagrams for electrically powered equipment.
   3. Records of tests performed to certify compliance with system requirements.
   4. Certificates of inspection by regulatory agencies.

5. Parts lists for fixtures, equipment, valves and specialties.
6. Manufacturers' installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
7. Valve schedules.
8. Lubrication instructions, including parts list and frequency of lubrication.
9. Warranties.
10. Additional information as indicated in technical specification sections.

1.13 TRAINING OF OWNER PERSONNEL

A. Instruct Owner personnel in proper operation and maintenance of systems and equipment provided as part of this project.

B. Include not less than four (4) hours of instruction, using Operation and Maintenance manuals during this instruction.

C. Demonstrate startup, operation, and shutdown procedures for all equipment. All training to be during normal working hours. Videotape all instructions and provide Owner with copy.

1.14 PROJECT RECORD DOCUMENTS

A. Division 01 – General Requirements: Record Drawings.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Plaster Walls and Ceilings:
   1. Provide minimum 16-gauge frame with not less than a 20-gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by application.
   2. Provide largest size access opening possible, consistent with space and item needing service; minimum size is 12-inch x 12-inch.

2.02 IDENTIFICATION

A. Stencils: Provide not less than one-inch high letters and numbers for marking pipe and equipment.

B. Engraved Name Plates: Provide white letters on a black background, 1/16-inch thick plastic laminate, beveled edges, screw mounting.
   1. Manufacturers:
      a. Setonply Style 2060 by Seton Name Plate Company.
      b. Emedolite Style EIP by EMED Company.

c. W. H. Brady.
d. Or approved equal.

C. Snap-Around Pipe Markers: Provide one-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, 3/4-inch minimum size for lettering. Provide nylon ties on each end of pipe markers.
1. Manufacturers:
a. Seton Setmark.
b. Or approved equal.

D. Valve Tags: Provide round brass tags with 1/2-inch numbers, 1/4-inch system identification abbreviation, 1-1/4-inch minimum diameter, with brass jack chains, brass "S" hooks or one-piece nylon ties around valve stem.
1. Manufacturers:
a. EMED Company.
b. Seton Name Plate Company.
c. W. H. Brady.
d. Or approved equal.

E. Underground Warning Tape: Detectable underground warning tape, 5.0-mil overall thickness, 6-inch width, 0.0035-inch thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape.
1. Manufacturers:
a. Thor Enterprises.
b. Magnatec by Carlton.
c. MSI Marking Services.
d. Seton.
e. Or approved equal.

2.03 BEDDING, COVER AND BACKFILL

A. Place and compact bedding and cover 12 inches above top of pipe, compacted to 95 percent modified proctor.

B. Bedding, cover and backfill shall meet the following gradations:

Gradation for Bedding Sand		Gradation for Crushed Stone Chip Bedding	
Sieve Size	% Passing (by Wt)	Sieve Size	% Passing (by Wt)
1 inch	100	1/2 inch	100
No. 16	45 - 80	No. 4	75 - 100
No. 200	2 - 10	No. 100	10 - 25

C. Backfill above bedding and cover material in lawn areas shall be thoroughly compacted to density equal to adjacent soil and excavated material shall be free of large rocks, perishable, and frozen materials.

D. Backfill above bedding and cover material under existing and future utilities, paving, sidewalks, curbs, roads, and buildings shall be approved aggregate materials such as sand, gravel, or crushed stone and shall be compacted to 95 percent modified proctor.

E. Backfill material shall be free of large rocks, organic, perishable, and frozen materials.

2.04 SEALING AND FIRESTOPPING

A. FIRESTOPPING SYSTEMS:
1. Manufacturers:
   a. 3M.
   b. Hilti.
   c. Rectorseal.
   d. STI/SpecSeal.
   e. Tremco.
   f. Or approved equal.
2. Firestopping systems shall be provided by same manufacturer.
3. Fire stop systems shall be UL listed, and tested by an independent testing laboratory and approved by authorities having jurisdiction.
4. Use a product that has a rating not less than rating of wall or floor being penetrated.
5. Reference architectural drawings for identification of fire and smoke rated walls and floors.
6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project.
7. Provide mineral wool backing where specified in firestopping manufacturer's application detail.

B. NON-RATED PENETRATIONS:
1. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between uninsulated pipe and cored opening or a water-stop type wall sleeve.
2. Operating bolts of mechanical type seal shall be accessible from interior of building.
3. At pipe penetrations of non-rated interior partitions, floors and exterior walls, use polyurethane caulk in annular space between pipe insulation and sleeve.
4. For non-rated drywall, plaster, or wood partitions where sleeve is not required use polyurethane caulk in annular space between pipe insulation and wall material

PART 3 - EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on Drawings to accomplish new work.

B. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize extent of contamination of occupied space.

C. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with Owner to minimize disruption to existing building occupants.

D. Pipe, fixtures, equipment, wiring and associated conduit, insulation, and similar items demolished, abandoned, or deactivated are to be removed from site by Contractor except as specifically noted otherwise.

E. Designated equipment is to be turned over to Owner for use at a place and time so designated.

F. Maintain condition of material and equipment that is indicated to be reused equal to that existing before work began.

3.02 EXCAVATION AND BACKFILL

A. Perform excavation and backfill work necessary to accomplish indicated plumbing systems installation.

B. Excavate to bottom of pipe and structure bedding, provide minimum of 4 inches in stable soils, 6 inches in rock or wet trenches, and 8 inches in unstable soil. Prepare bottoms of excavations to true, level surface.

C. At no time place excavated materials where materials will impede surface drainage unless such drainage is being safely rerouted away from excavation.

D. Verify locations of any water, drainage, gas, sewer, electric, telephone, or steam lines which may be encountered during excavation.

E. Underpin and support all lines. Cut off service connections encountered which are to be removed at limits of excavation and cap.

F. Elevations shown on Drawings are subject to such revisions as may be necessary to fit field conditions.

G. No adjustment in compensation will be made for adjustments up to two (2) feet above or below grades indicated on Drawings.

H. Bed pipe up to 12 inches above top of pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

I. Mechanically compact bedding and backfill to prevent settlement.

J. Initial loose backfill lift to not exceed 24 inches, compacted to 95 percent modified proctor density in accordance with ASTM D1557.

K. Subsequent loose lifts under pavements, curbs, walks, and structures are not to exceed 12 inches and be compacted to 95 percent modified proctor density.

L. In all other areas where construction above excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24 inches to 95 percent modified proctor density.

M. Place compaction equipment over each lift of material so that compaction equipment contacts all areas of surface of lift.

N. Excavate whatever materials are encountered as required to place pipe, manholes, and other work at elevations shown.

O. Remove debris and rubbish from excavations before placing bedding and backfill material.

3.03 SHEETING, SHORING AND BRACING

A. Provide shoring, sheet piling, and bracing in conformance with State and local codes to prevent earth from caving or washing into excavation.

B. Shore and underpin to properly support adjacent or adjoining structures.

C. Abandon in place shoring, sheet piling. and underpinning below top of pipe, or, if approved in advance by Engineer/Architect and Owner's Representative.

3.04 DEWATERING

A. Provide, operate and maintain pumps and other equipment necessary to drain and keep all excavation pits, trenches and entire subgrade area free from water under all circumstances.

B. Obtain general permit from authorities having jurisdiction for discharge of construction dewatering effluent. Obtain well permit from authorities having jurisdiction for dewatering wells discharging more than 70 GPM. Comply with permit requirements.

3.05 CONCRETE WORK

A. Cast-in-place concrete within building will be performed by Division 03 - Concrete Contractor unless otherwise noted.

B. Provide layout drawings, anchor bolts, metal shapes, and templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties, and equipment.

C. Coordinate locations of equipment, pipe penetrations in wet areas with Division 03 Contractor.

D. Plumbing related cast-in-place concrete on exterior of building to be provided by this Contractor in conformance with requirements of Division 03, including piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, and yard hydrant pads.

3.06 CUTTING AND PATCHING

A. Division 01 - General Requirements: Cutting and Patching.

3.07 BUILDING ACCESS

A. Arrange for necessary openings in building to allow for admittance or removal of all apparatus.

B. When building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after apparatus has been brought into building.

3.08 EQUIPMENT ACCESS

A. Install piping, conduit, and accessories to permit access to equipment for maintenance. Coordinate exact location of wall and ceiling access panels and doors with General Contractor, making sure that access is available for all equipment and specialties.

B. Where access is required in plaster walls or ceilings, furnish access doors to General Contractor.

3.09 COORDINATION

A. Coordinate work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at installing contractor's expense.

B. Verify that devices are compatible for type of construction and surfaces on which they will be used.

3.10 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

B. Where stenciling is not appropriate for equipment identification, engraved name plates shall be used.

C. Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of partition where accessible piping passes through walls or floors.

D. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background.

E. Identify exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts.

F. Place tape 12 inches below finished grade along entire length of pipe.

G. Extend tape to surface at building entrances, meters, hydrants, and valves.

H. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

I. Identify valves with brass tags bearing system identification and valve sequence number.

J. Identify medical gas and vacuum valves with brass tags and wall or cabinet mounted color coded engraved nameplate with the following "(Type of Gas) Shutoff Valve for (Location or Zone)".

K. Valve tags are not required at a terminal device unless valves are greater than ten feet from device, located in another room, or not visible from device.

L. Provide a typewritten valve schedule and pipe identification schedule indicating valve number and equipment or areas supplied by each valve and symbols used for pipe identification.

M. Locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

3.11 LUBRICATION

A. Lubricate bearings with lubricant as recommended by manufacturer before equipment is operated for any reason.

B. Once equipment has been operated, maintain lubrication in accordance with manufacturer's instructions until Owner accepts work.

C. Maintain a log of lubricants used and frequency of lubrication; include this information in Operation and Maintenance Manuals at completion of project.

3.12 SLEEVES

A. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping.

B. Patch wall around sleeve to match adjacent wall construction and finish.

C. Grout area around sleeve in masonry construction.

D. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall.

E. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required.

F. Pipe sleeves are not required in interior non-rated drywall, plaster, or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

G. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe, sized to allow insulated pipe to run through sleeve, cast in place.

H. In piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend one-inch above adjacent finished floor.

I. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout.

J. If pipe penetrating sleeve is supported by a pipe clamp resting on sleeve, weld a collar or struts to sleeve that will transfer weight to existing floor structure.

K. For floor penetrations through existing floors in mechanical and wet locations listed below, core drill opening and provide a "Link Seal" as manufactured by the Thunderline Corporation. "Link Seal" shall consist of ASTM D2000 EPDM rubber compound interlocking links, Devlin pressure plates, and corrosion resistant fastener to prevent water from entering the penetration or core drill sleeve openings large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout and cement.

L. Wet locations include:
   1. Toilet building mechanical rooms.

M. For pipe penetrations through existing floors in food service areas, core drill sleeve opening large enough to insert Schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout/cement.

N. Size sleeve to allow insulated pipe to pass through sleeve and paint sleeve.

O. Pipe sleeves are not required in cored floor pipe penetrations through existing floors that are not located in mechanical rooms, food service areas, or wet locations listed above.

3.13 SEALING AND FIRESTOPPING

A. FIRE AND SMOKE RATED PENETRATIONS:
   1. Install approved product in accordance with manufacturer's instructions where a pipe penetrates a fire/smoke rated surface.
   2. When pipe is insulated, use a product which maintains integrity of insulation and vapor barrier.
   3. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming.
   4. Firestop mortar alone is not adequate to support substantial weight.

B. NON-RATED PARTITIONS:
   1. In exterior wall openings below grade, assemble rubber links of mechanical seal to proper size for pipe and tighten in place, in accordance with manufacturer's instructions.
   2. At interior partitions and exterior walls, pipe penetrations are required to be sealed.
   3. Apply sealant to both sides of penetration in such a manner that annular space between pipe sleeve or cored opening and pipe or insulation is completely blocked.

END OF SECTION 22 05 00

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SECTION 22 05 03

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Pipe and pipe fittings for the following systems:
   a. Domestic water piping, within 5 feet of building.
   b. Sanitary sewer piping, within 5 feet of building.
   c. Equipment drains and over flows.
   d. Unions and flanges.
   e. Underground pipe markers.
   f. Bedding and cover materials.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
3. Division 07 – Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
4. Division 08 – Openings: Product requirements for access doors for placement by this section.
5. Division 09 – Finishes: Product and execution requirements for painting specified by this section.
6. Section 22 05 23 - Valves for Plumbing Piping: Product requirements for valves for placement by this section.
7. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
8. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.
9. Division 31 – Earthwork: Soils for backfill in trenches.
10. Division 31 – Earthwork: Aggregate for backfill in trenches.
11. Division 31 – Earthwork: Product and execution requirements for excavation, backfilling and compaction required by this section.
12. Division 33 – Utilities: Product and execution requirements for site natural gas distribution systems.
13. Division 33 – Utilities: Product and execution requirements for factory insulated piping for use with oil distribution systems in underground applications.
14. Division 33 – Utilities: Factory insulated piping for use with hydronic distribution systems in below ground applications.
15. Division 33 – Utilities: Factory insulated piping for use with steam distribution systems in below ground applications.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.4 - Gray Iron Threaded Fittings.
4. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
6. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
9. ASME B31.9 - Building Services Piping.
10. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
11. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International (ASTM):
1. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
4. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
5. ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. ASTM A536 - Standard Specification for Ductile Iron Castings.
7. ASTM B32 - Standard Specification for Solder Metal.
8. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
9. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
10. ASTM B75 - Standard Specification for Seamless Copper Tube.
11. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
12. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
13. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
14. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
15. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
16. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
17. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
18. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
19. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
20. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
21. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

22. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
23. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
24. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
25. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
26. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
27. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
28. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
29. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
30. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
31. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
32. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
33. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
34. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
35. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
36. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
37. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
38. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
39. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
40. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
41. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
42. ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
43. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
44. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
45. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
46. ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

47. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
48. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
49. ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.
50. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
51. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
52. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
53. ASTM F441 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
54. ASTM F442 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
55. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
56. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
57. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
58. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
59. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
60. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
61. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society: (AWS)
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association: (AWWA)
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
8. AWWA C950 - Fiberglass Pressure Pipe.

E. Cast Iron Soil Pipe Institute: (CISPI)
   1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.03 SUBMITTALS

A. Division 01 - General Requirements: Submittal procedures.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used.

E. Welders' Certificate: Include welders' certification of compliance with ASME Section IX or AWS D1.1.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years experience.

B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.06 PRE-INSTALLATION MEETINGS

A. Division 01 - General Requirements: Pre-installation meeting.

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - General Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - General Requirements: Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet or frozen.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Division 01 - General Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151 or C104.
   1. Fittings: AWWA C110, gray iron, standard thickness.
   2. Joints: AWWA C111, rubber gasket with rods.
   3. Jackets: AWWA C105 polyethylene jacket.

B. Copper Tubing: ASTM B88, Type L, annealed.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

C. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC and ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. PVC Pipe: AWWA C900 Class 150, polyvinyl chloride (PVC) material.
   1. Fittings: AWWA C110, ductile iron, standard thickness.
   2. Joints: ASTM D3139 compression gasket ring.

E. Copper Tubing: ASTM B42, Temper H80 hard drawn or Temper O61 annealed.
   1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony.

F. Copper Tubing: ASTM B42, Temper O61 annealed.
1. Fittings: ASME B16.26 cast bronze.
2. Joints: Flared.

G. Polyethylene Pipe: ASTM D2239, SIDR 19, or ASTM D2447 Schedule 40.
1. Fittings: ASTM D2609, Polyethylene.
2. Joints: Mechanical with stainless steel clamps.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

B. Copper Tubing: ASTM B88, Type L, drawn, rolled grooved ends.
1. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze, or ASTM B584 bronze sand castings,
2. grooved ends.
3. Joints: Grooved mechanical couplings meeting ASTM F1476.
   a. Housing Clamps: ASTM A395 and ASTM A536 ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.
   b. Gasket: Elastomer composition for operating temperature range from 86 degrees F to 180 degrees F.
   c. Accessories: Stainless steel bolts, nuts, and washers.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.
1. Fittings: Cast iron, ASTM A74.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less.
1. Fittings: Cast iron, CISPI 301.
2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.
1. Fittings: PVC, ASTM D2729.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. PVC Pipe: ASTM D3034 SDR 35, polyvinyl chloride (PVC) material.
1. Fittings: ASTM D3034, PVC.
2. Joints: ASTM F477, elastomeric gaskets.

E. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.
   1. Fittings: ASTM D2466, Schedule 40, PVC and ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

F. Copper Tube: ASTM B306, DWV, Type M.
   1. Fittings: ASME B16.23, cast bronze, or ASME B16.29 wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

G. Plastic Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
   1. Fittings: PVC, ASTM D2665.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV, Type M.
   1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

D. Copper Pipe: ASTM B42, Temper O61 annealed or Temper H80 hard drawn.
   1. Fittings: ASME B16.23, cast bronze, or ASME B16.29 wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

E. PVC Pipe: ASTM D2729, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2729, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

F. PVC Pipe: ASTM D2665, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2665, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

G. PVC Pipe: ASTM D1785, Schedule 40 or ASTM D2241 SDR-26 for not less than 150 psi pressure rating, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC and ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

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

B. Steel Pipe: ASTM A53, Schedule 40, galvanized, cut or rolled grooved ends.
   1. Fittings: ASTM A395 and ASTM A536 ductile iron, or ASTM A234 carbon steel, grooved ends.
   2. Joints: Grooved mechanical couplings meeting ASTM F1476.
      a. Housing Clamps: ASTM A395 and ASTM A536 ductile iron, hot dipped galvanized, compatible with steel piping sizes, rigid or flexible type.
      b. Gasket: Elastomer composition for operating temperature range from 86 degrees F to 180 degrees F.
      c. Accessories: Stainless steel bolts, nuts, and washers.

C. Copper Tubing: ASTM B88, Type L, drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder.

D. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC and ASTM D2464 PVC, threaded.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

E. ABS Pipe: ASTM D2680 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material.
   1. Fittings: ABS, ASTM D2751.
   2. Joints: ASTM D2235, solvent weld.

2.06 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. PVC Piping: PVC.
   5. CPVC Piping: CPVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.
   4. CPVC Piping: CPVC flanges.
   5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

2.07 UNDERGROUND PIPE MARKERS

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

B. Trace Wire: Magnetic detectable conductor, clear or brightly colored plastic covering, imprinted with "Domestic Water Service or Sewer Service" in large letters.

2.08 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type A1 as specified in Section 31 05 16 – Aggregates for Earthwork.

B. Cover: Fill Type A1, as specified in Section 31 05 16 – Aggregates for Earthwork.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type S1, as specified in Section 31 05 13 – Soils for Earthwork. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Division 01 – General Requirements: Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 4 ft of cover.

C. Establish minimum separation of 4 feet from other services piping in accordance with Wisconsin Plumbing Code.

D. Excavate pipe trench in accordance with Division 31 – Earthwork.

E. Install pipe to elevation as indicated on Drawings.

F. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth.

G. Install pipe on prepared bedding.

H. Route pipe in straight line.

I. Install pipe to allow for expansion and contraction without stressing pipe or joints.

J. Install shutoff and drain valves at locations indicated on Drawings in accordance with Section 22 05 23 – Valves for Plumbing Piping.

K. Install plastic ribbon tape continuous over top of pipe, above pipe line; coordinate with Division 31 - Earthwork.

3.04 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Reference Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.

E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Reference Section 22 07 00 – Plumbing Insulation.

F. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08 – Openings.

G. Install non-conducting dielectric connections wherever jointing dissimilar metals.

H. Establish invert elevations, slopes for drainage to 1/8 inch per foot, one percent minimum. Maintain gradients.

I. Slope piping and arrange systems to drain at low points.

J. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.

L. Install valves in accordance with Section 22 05 23 – Valves for Plumbing Piping.

M. Install piping specialties in accordance with Section 22 05 15 – Piping Specialties.

N. Insulate piping. Refer to Section 22 07 00 – Plumbing Insulation.

O. Install pipe identification in accordance with Section 22 05 53 – Identification for Plumbing Piping and Equipment.

3.05 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with Section 22 11 00 – Facility Water Distribution.

3.06 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with Section 22 13 00 – Facility Sanitary Sewerage.

B. Install bell and spigot pipe with bell end upstream.

C. Support cast iron drainage piping at every joint.

3.07 FIELD QUALITY CONTROL

A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.

B. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.

C. Test domestic water piping system in accordance with local authority having jurisdiction.

D. Test sanitary waste and vent piping system in accordance with local authority having jurisdiction .

3.08 CLEANING

A. Division 01 – General Requirements: Requirements for cleaning.

B. Clean and disinfect domestic water distribution system in accordance with Section 22 11 00 – Facility Water Distribution.

END OF SECTION 22 05 03

SECTION 22 05 14

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Floor drains.
2. Cleanouts.
3. Backflow preventers
4. Water hammer arrestors.
5. Miscellaneous plumbing specialties.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
3. Section 22 05 23 - Valves for Plumbing Piping.
4. Section 22 11 00 - Facility Water Distribution.
5. Section 22 13 00 - Facility Sanitary Sewerage.

1.02 REFERENCES

A. American Society of Mechanical Engineers: (ASME)
1. ASME A112.14.1 - Backwater Valves
2. ASME A112.21.1M - Floor Drains.
3. ASME A112.21.2M - Roof Drains.

B. American Society of Safety Engineers: (ASSE)
1. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
2. ASSE 1010 - Water Hammer Arrestors.
3. ASSE 1011 - Hose Connection Vacuum Breakers.
4. ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
5. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
6. ASSE 1018 - Trap Seal Primer Valves.
7. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

C. ASTM International: (ASTM)
1. ASTM A48 – Specification for Gray Iron Castings.
2. ASTM A443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
3. ASTM A478 - Specification for Precast Reinforced Concrete Manhole Sections.
4. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

5. ASTM C990 - Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

D. Plumbing and Drainage Institute: (PDI)
1. PDI-WH-201 - Water Hammer Arrestors.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Shop Drawings: Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, and manufacturer's performance limitations.

C. Submit manufacturer's installation requirements.

1.04 QUALITY ASSURANCE

A. Plumbing products requiring approval by State and local authorities must be approved at time of shop drawing submission.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

A. Manufacturers:
1. Josam Company.
2. Jay R. Smith Manufacturing Company.
3. Tyler Pipe/Wade Division.
4. Watts Water Technologies.
5. Zurn Plumbing Products.
6. Or approved equal.

B. Reference Plumbing Drain and Cleanout Schedule on Drawings.

2.02 FLOOR SINKS

A. Manufacturers:
1. Josam Company.
2. Jay R. Smith Manufacturing Company.
3. Tyler Pipe/Wade Division.
4. Watts Water Technologies.
5. Zurn Plumbing Products.
6. Or approved equal.

B. Reference Plumbing Drain and Cleanout Schedule on Drawings.

2.03 HUB DRAINS

A. Manufacturers:
1. Josam Company.
2. Jay R. Smith Manufacturing Company.
3. Tyler Pipe/Wade Division.
4. Watts Water Technologies.
5. Zurn Plumbing Products.
6. Or approved equal.

B. Reference Plumbing Drain and Cleanout Schedule on Drawings.

2.04 CLEANOUTS

A. Manufacturers:
1. Josam Company.
2. Jay R. Smith Manufacturing Company.
3. Tyler Pipe/Wade Division.
4. Watts Water Technologies.
5. Zurn Plumbing Products.
6. Or approved equal.

B. Reference Plumbing Drain and Cleanout Schedule on Drawings.

2.05 WATER HAMMER ARRESTORS

A. Manufacturers:
1. PPP Industries.
2. Sioux Chief Manufacturing Company.
3. Tyler Pipe/Wade Division.
4. Watts Water Technologies.
5. Or approved equal.

B. Water Hammer Arrestors: ASSE 1010, sized in accordance with PDI WH-201, precharged piston type constructed of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig working pressure, 1500 psig surge pressure. Watts Series 15 or approved equal.

2.06 BACKFLOW PREVENTERS

A. Manufacturers:
1. Conbraco Industries, Inc.
2. Chicago Faucet.
3. Febco Division - Watts Water Technologies.
4. Wilkins – A Zurn Company.
5. NIBCO, Inc.
6. Or approved equal.

B. Reference Plumbing Equipment Schedule on Drawings.

C. Reduced Pressure Zone Type (RPBP):
   1. Sizes: (3/4-inch through 3 inches): Bronze body, replaceable seats, ball valve type shutoffs, strainer, union connections, ball valve test ports, ASSE 1013, Watts 009 or approved equal.
   2. Sizes: (4 inches and Larger): Cast iron body, bronze check seats, stainless steel relief seat, ball valve test ports, ASSE 1013, Watts Series 909 or approved equal. Include butterfly shutoff valves, EPDM encapsulated disk, NIBCO FC-27 Series or approved equal.

2.07 HOSE BIBBS

A. Manufacturers:
   1. Josam Company.
   2. Jay R. Smith Manufacturing Company.
   3. Tyler Pipe/Wade Division.
   4. Watts Water Technologies.
   5. Woodford Manufacturing Company.
   6. Zurn Plumbing Products.
   7. Or approved equal.

2.08 TRAP PRIMER VALVES

A. Manufacturers:
   1. Ancon - Watts Water Technologies.
   2. PPP Industries.
   3. Jay R. Smith Manufacturing Company.
   4. Tyler Pipe/Wade Division.
   5. Or approved equal.

B. Bronze body, O-ring seals, integral threaded outlet vacuum breaker, adjustable, in conformance with ANSI/ASSE 1018. PPP Industries Model P-1/P-2.

2.09 SAFINGS

A. Manufacturers:
   1. Noble Company.
   2. Oatey.
   3. Or an approved equal.

B. Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent; or 3 lb./sq. ft. sheet lead.

2.10 VENT FLASHINGS

A. Manufacturers:
   1. SEMCO – A Gibraltar Company.

2. Oatey.
3. Or an approved equal.

B. Formed 3 lb./sq. ft. lead flashing with minimum base size of 15-inch x 17-inch.

C. Single Ply Membrane Roofs: Flashing boot of material compatible with roofing membrane with base flange for adhering to membrane and stainless steel drawband for securing to vent pipe.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

B. Set floor drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18-inch clearance around cleanouts for rodding.

C. Lubricate threaded cleanout plugs with graphite and oil, teflon tape, or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains.

D. Test and adjust valve for proper operation. Allow minimum 18-inch clearance for servicing.

E. Install water hammer arrestors where indicated and at quick closing valve installations.

F. Install backflow preventers in accordance with State and local code requirements maintaining minimum clearance distances for servicing and testing.

G. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

H. Where backflow preventers requiring governing agency registration are installed, provide initial registration, testing and report filing required by governing agency. List name and address of building that backflow preventer installations occur in.

I. Mount exterior hose bibbs recessed in exterior wall construction with valve plug extended beyond interior side of building insulation. Slope to drain to exterior.

J. Install bibbs so discharge is 18 inches minimum above finished grade. Set wall box in grout or caulk and fill exterior wall penetration with insulation.

K. Mount hose bibbs securely fastened to wall where indicated. Provide water hammer arrestor in line to hose bibb.

L. Install safing at floor drains above grade. Extend 12 inches beyond drains in all directions. Cover entire floor in showers and extend 6 inches up in walls above curbs and to a height of 6 inches (3 inches wide each direction) in corners.

M. Install safing on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test.

N. Install safing at all built-up shower installations. Spray-on and brush applied liquid safing is not acceptable.

O. Flash vent penetrations through roof. Turn down top of lead flashing into vent pipe. Tighten drawband of membrane boot to vent pipe.

P. Adhere base flashing to deck or membrane. Provide waterproof patch around penetration on existing roofs.

END OF SECTION 22 05 14

SECTION 22 05 15

PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Plumbing piping specialties for all piping systems.

B. Related Sections
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
   3. Section 22 05 23 - Valves for Plumbing Piping.
   4. Section 22 07 00 - Plumbing Insulation.
   5. Section 22 11 00 - Facility Water Distribution.
   6. Section 22 13 00 - Facility Sanitary Sewerage.
   7. Section 22 30 00 - Plumbing Equipment.

1.02 REFERENCE

A. ASTM International:
   1. ASTM A126 – Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. ASTM B30 – Specification for Copper Alloys in Ingot Form.
   3. ASTM B62 – Specification for Composition Bronze or Ounce Metal Castings.
   4. ASTM B650 - Specification for Electrodeposited Engineering Chromium Coatings on Ferrous Substrates.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, pressure drop data where appropriate, and identification as referenced in this section and on Drawings.

C. Submit manufacturer's installation requirements.

1.04 DESIGN CRITERIA

A. Piping specialties shall be rated for highest pressures and temperatures in respective system in accordance with ANSI B30, but not less than 125 psig, unless specifically indicated otherwise.

PART 2 - PRODUCTS

2.01 THERMOMETERS

A. Manufacturers:
- **1.** Ashcroft.
- **2.** Marsh.
- **3.** Taylor.
- **4.** H. O. Trerice.
- **5.** Ametek/U. S. Gauge.
- **6.** Weiss.
- **7.** Wika.
- **8.** Weksler.
- **9.** Or Approved Equal.

B. Thermometer: Stem type, cast aluminum case, 9-inch scale, clear acrylic window, adjustable angle brass stem with stem of sufficient length so end of stem is near middle of a pipe without reducing thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:
1. Service: Hot Water.
2. Scale Range: 30 – 180 degrees F.
3. Increment: 2 degrees F.

2.02 THERMOMETER SOCKETS

A. Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

2.03 TEST WELLS

A. Similar to thermometer sockets except with a brass cap that threads into inside of test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate pipeline insulation.

2.04 TEST PLUGS

A. Brass threaded pressure and temperature test plug with neoprene self-closing valve, valve retainer, brass threaded cap, rated for 150 psi and 0-200 degrees F.

2.05 PRESSURE GAUGES

A. Manufacturers:
- **1.** Ametek/U. S. Gauge.
- **2.** Ashcroft.
- **3.** Marsh.
- **4.** Taylor.

5. H. O. Trerice.
6. Weiss.
7. Wika.
8. Weksler.
9. Or Approved Equal.

B. Pressure Gauges: Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from front of dial, 99 percent accuracy over middle half of scale, 98.5 percent accuracy over remainder of scale, with scale range as follows:

Service	Hot Water	Cold Water	Compressed Air
Scale Range, psig	0-100	0-100	0-200
Increment, psig	1	1	2

C. Pressure Snubbers: Bronze construction, 300 psig working pressure, 1/4-inch size.

D. Gauge Valves: Use ball valves as specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

2.06 STRAINERS

A. Manufacturers:
1. Armstrong.
2. Illinois.
3. Keckley.
4. Metraflex.
5. Mueller Steam.
6. Sarco.
7. Watts.
8. Or Approved Equal.

B. Strainer: Y Type; cast bronze body, ASTM B62; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; sweat, threaded or flanged body rated at not less than 150 psi WOG.

C. Strainer: Y Type; cast iron body, ASTM A126; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded or flanged ends; rated at not less than 150 psi WOG.

PART 3 - EXECUTION

3.01 INSTALLATION - THERMOMETERS

A. Stem Type: Install in piping systems as indicated on Drawings or details using a separable socket in each location.

3.02 INSTALLATION - THERMOMETER SOCKETS

A. Install at each point where a thermometer or temperature control-sensing element is located in a pipeline.

3.03 INSTALLATION - TEST WELLS

A. Install in piping systems as indicated on Drawings or details wherever provisions are needed for inserting a thermometer at a later date.

3.04 INSTALLATION - TEST PLUGS

A. Install in piping systems as indicated on Drawings or details wherever provisions are needed for short-term measurement of pressure or temperature.

3.05 INSTALLATION - PRESSURE GAUGES

A. Install in locations where indicated on Drawings or details, with scale range appropriate to system operating pressures.

B. Pressure Snubbers: Install in gauge piping for all gauges used on water services.

C. Gauge Valves: Install at each gauge location as close to main as possible and at each location where a gauge tapping is indicated.

3.06 INSTALLATION - STRAINERS

A. Install all strainers where indicated allowing sufficient space for screens to be removed. Install a ball valve in tapped screen retainer.

END OF SECTION 22 05 15

SECTION 22 05 23

VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Specialty Valves and Valve Accessories.

B. Related Sections
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.

1.02 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. American Society of Safety Engineers (ASSE)
   1. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

C. American Water Works Association (AWWA)
   1. AWWA C504 – Rubber-Seated Butterfly Valves.
   2. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
   3. AWWA C550 – Protective Epoxy Interior Coatings for Valves and Hydrants.
   4. AWWA C800 - Underground Service Line Valves and Fittings.

D. ASTM International
   1. ASTM D4101 - Specification for Polypropylene Injection and Extrusion Materials

1.03 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Submit schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on project. Temperature ratings specified are for continuous operation.

1.04 DESIGN CRITERIA

A. Where valve types are specified for individual plumbing services, each valve type shall be of same approved manufacturer unless prior written approval is obtained from Owner's Representative.

B. Valves to be line size unless specifically noted otherwise.

PART 2 - PRODUCTS

2.01 WATER SYSTEM VALVES

A. Water system valves shall be rated at not less than 125 psig water working pressure at 240 degrees F unless noted otherwise.

B. Ball Valves: 3-Inch and smaller: Two or three piece bronze body; sweat ends, chrome plated bronze full port ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation.
   1. Manufacturers:
      a. Apollo 70-200.
      b. Hammond 8511.
      c. Milwaukee BA150.
      d. NIBCO S580-70.
      e. Watts B-6001.
      f. Or approved equal.

C. Butterfly Valves:
   1. 2-1/2-Inch and Larger: Cast or ductile iron body; stainless steel shaft; bronze, copper or teflon bushings; EPDM resilient seat; EPDM seals; bronze, aluminum-bronze, EPDM encapsulated ductile iron or stainless steel disc. 200 psig WOG through 12-inch, 150 psig WOG through 24-inch. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws, or grooved end connection valves, permitting removal of downstream piping while using valve for system shutoff.
   2. Manufacturers:
      a. Centerline LT Series.
      b. DeZurik 632.
      c. Hammond 6200 Series.
      d. Milwaukee M or C Series.
      e. NIBCO LD2000/LC2860.
      f. Victaulic 300/608/700/709.
      g. Watts BF-03.
      h. Or approved equal.
   3. Provide 10 position locking lever handle actuators for valves 6-inch and smaller. Provide worm gear operators with external position indication for valves 8-inch and larger.

D. Swing Check Valves: 3-Inch and Smaller: Bronze body, sweat ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward.
   1. Manufacturers:

a. Crane 1342.
b. Hammond IB941.
c. NIBCO S413B.
d. Watts CVYS.
e. Or approved equal.

E. Swing Check Valves: 4-Inch and Larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward.
1. Manufacturers:
a. Crane 373.
b. Hammond IR1124.
c. Milwaukee F2974.
d. NIBCO F918B.
e. Watts Series 411.
f. Or approved equal.

F. Spring Loaded Check Valves: 2-Inch and Smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available.
1. Manufacturers:
a. ConBraCo 61 Series.
b. Mueller 203BP.
c. NIBCO S480Y.
d. Val-Matic S1400 Series.
e. Or approved equal.

G. Spring Loaded Check Valves: 2-1/2-Inch and Larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125.
1. Manufacturers:
a. APCO 300 or 600 Series.
b. Centerline CLC with Full-Body Option.
c. Hammond IR9354.
d. Milwaukee 1800 Series.
e. Mueller Steam 101AP or 105AP.
f. NIBCO W910 or F910.
g. Val-Matic 1400 or 1800 or 8000 Series.
h. Or approved equal.

H. Stop and Waste Valves: 1-Inch and Smaller: Bronze body, sweat or threaded ends, 400 psi WOG, stainless steel ball and stem, full port ball valve, with threaded drain cap.
1. Manufacturers:
a. Watts B-6300/6301 SS Series.
b. Apollo.
c. Hammond.
d. Milwaukee.
e. NIBCO.
f. Or approved equal.

I. Balance Valves: 2-Inch and Smaller: Two or three piece bronze body ball valve, sweat or threaded ends, chrome plated brass full port ball, glass filled teflon seat, threaded packing nut, with adjustable memory stop position indicator and extended handle stem, suitable for 400 psig water working pressure at 240 degrees F.
   1. Manufacturers:
      a. Watts B-6000/B-6001 BS.
      b. Apollo.
      c. Grinnell.
      d. Hammond.
      e. Milwaukee.
      f. NIBCO.
      g. Or approved equal.

J. Drain Valves: 3/4-inch ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads.
   1. Manufacturers:
      a. Watts B-6000-CC/B-6001-CC Series.
      b. Or approved equal.

2.02 SPECIALTY VALVES AND VALVE ACCESSORIES

A. Gauge Valves: Use 1/4-inch ball valves. Needle valves and gauge cocks will not be accepted.

B. Water Pressure Reducing Valves: Bronze body, diaphragm operated, with an integral thermal expansion bypass valve, inlet union, stainless steel strainer, renewable monel or stainless steel seat, and adjustable reduced pressure range, 300 psig at 160 degrees F. Pre-set for scheduled pressure.
   1. Manufacturers:
      a. A. W. Cash.
      b. Conbraco.
      c. Watts.
      d. Wilkins.
      e. Or approved equal.

C. Safety Relief Valves: Bronze body, temperature and pressure actuated, stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH input, provide AGA, UL, or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment.
   1. Manufacturers:
      a. Bell & Gossett.
      b. A. W. Cash.
      c. Conbraco.
      d. Watts.
      e. Wilkins.
      f. Or approved equal.
   2. Size temperature and pressure relief valve in accordance with AGA rating for BTUH input.

PART 3 - EXECUTION

3.01 GENERAL

A. Properly align piping before installation of valves.

B. Install and test valves in strict accordance with valve manufacturer's installation recommendations.

C. Do not support weight of piping system on valve ends.

D. Mount valves in locations allowing access for operation, servicing, and replacement.

E. Provide valve handle extensions for all valves installed in insulated piping.

F. Install valves with stem in upright or horizontal position. Install butterfly valves with stem in horizontal position.

G. Valves installed with stems down will not be accepted.

H. Prior to flushing of piping systems, place valves in full-open position.

3.02 SHUT-OFF VALVES

A. Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair, as indicated on Drawings.

3.03 BALANCING VALVES

A. Install where indicated on Drawings and details for balancing of flow in pumped hot water recirculation piping systems.

B. Upon project completion, adjust each valve and set position stop.

C. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

3.04 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems.

B. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and as indicated on Drawings.

3.05 SPRING LOADED CHECK VALVES

A. Install spring loaded check valve in each circulating pump discharge line, each clear water sump pump discharge line, and as indicated on Drawings.

3.06 SWING CHECK VALVES

A. Install swing check valves in re-circulation branch lines and as indicated on Drawings.

B. Provide weighted swing check valves at sanitary sump pump discharges.

3.07 PRESSURE REDUCING VALVES

A. Provide ball valve and strainer at inlet and ball valve at outlet. Install pressure gauges to indicate inlet and outlet pressure at each pressure -educing valve.

3.08 SAFETY RELIEF VALVES

A. Install relief valves on pressure vessels and as indicated on Drawings.

B. Inlet and outlet piping connecting to valves must be same size as valve connections or larger.

C. Pipe discharge to drain where indicated or to floor.

END OF SECTION 22 05 23

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Supports of plumbing equipment and materials.
2. Piping system anchors.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
3. Section 22 07 00 - Plumbing Insulation: Insulation protection at support devices.
4. Division 03: Formwork and cast-in-place concrete for equipment pads.

1.02 REFERENCES

A. ASTM International: (ASTM)
1. ASTM A123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM B633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
3. ASTM B695 - Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

B. Manufacturers Standardization Society: (MSS)
1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.
2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

1.03 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01- General Requirements.

1.04 DESCRIPTION

A. Provide supporting devices as required for installation of mechanical equipment and materials.

B. Supports and installation procedures shall conform to latest requirements of ANSI Code for building piping.

C. Do not hang any mechanical item directly from a metal deck or run piping so it rests on bottom chord of any truss or joist.

D. Fasteners depending on soft lead for holding power or requiring powder actuation shall not be accepted.

E. Support apparatus and material under conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

F. Protect insulation at all hanger points.

1.05 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Submit manufacturer's installation instructions.

1.06 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from equipment, whichever is greater.

C. Standard pipe hangers and supports as specified in this section are required beyond 100 pipe diameter divided by 3 for support distance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Anvil.
2. B-Line.
3. Pate.
4. Piping Technology.
5. Roof Products & Systems.
6. Or approved equal.

2.02 STRUCTURAL SUPPORTS

A. Provide supporting steel required for installation of mechanical equipment and materials, including angles, channels, and beams, to suspended or floor supported tanks and equipment.

B. Supporting steel not be specifically indicated on Drawings, shall be used as required by governing code.

2.03 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2-Inch through 2-Inch:
   1. Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.
   2. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

B. Hangers for Pipe Sizes 2-Inch and Larger:
   1. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support:
   1. Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
   2. Perforated, epoxy painted finish, 16-12 gauge minimum, steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe and tubing clamps.
   3. B-Line type S channel with B-2000 series clamps or Anvil type PS 200 H with PS 1200 clamps.
   4. When copper piping is being supported, provide flexible elastomeric and thermoplastic isolation cushion material to completely encircle piping and avoid contact with channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil PS 1400 series.

E. Vertical Support: Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

F. Floor Support: Carbon steel pipe saddle, stand and bolted floor flange, B-Line B3088T/B3093.

G. Copper Pipe Supports: Supports, fasteners and clamps directly connected to copper piping shall be copper plated or polyvinyl chloride coated. Where steel channels are used, provide isolation collar between supports, clamps, fasteners and copper piping.

2.04 PIPE HANGER RODS

A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

B. Size rods for individual hangers and trapeze support as indicated in following schedule, total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed limits indicated in following schedule.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

2.05 BEAM CLAMPS

A. MSS SP-69 Types 19 or Type 23, malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

B. MSS SP-69 Type 28 or Type 29, forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

2.06 CONCRETE INSERTS

A. Poured In Place:
   1. MSS SP-69 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8-inch diameter. Wedge design to allow insert to be held by concrete in compression to maximize load carrying capacity. B-Line B2505, Anvil 281.
   2. MSS SP-69 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8-inch diameter. B-Line B3014N, Anvil 282.

B. Drilled Fasteners: Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, or Redhead.

2.07 CONTINUOUS CONCRETE INSERT CHANNELS

A. Steel inserts with an industry standard pre-galvanized finish, nominally 1-5/8-inch wide by 1-3/8 inch deep by length to suit application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices.

B. Installed channels to provide a load rating of 2000 pounds per foot in concrete.

C. Manufacturer's standard brackets, inserts, and accessories designed to be used with channel inserts may be used.

D. Select insert length to accommodate all pipe in area.

2.08 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to structure.

2.09 EQUIPMENT STANDS

A. Use structural steel members welded to and supported by pipe supports.

B. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic.

C. Where exposed to weather, treat with corrosive atmosphere coatings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Size, apply and install supports and anchors in compliance with manufacturer's recommendations.

B. Install supports to provide for free expansion of piping system.

C. Support piping from structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands.

D. Fasten ceiling plates and wall brackets securely to structure and test to demonstrate adequacy of fastening.

E. Coordinate hanger and support installation to properly group piping of all trades.

F. Where piping can be conveniently grouped to allow use of trapeze type supports, use standard structural shapes or continuous insert channels for supporting steel.

G. Where continuous insert channels are used, pipe supporting devices made specifically for use with channels may be substituted for specified supporting devices provided that similar types are used and all data is submitted for prior approval.

H. Size and install hangers and supports, except for riser clamps, for installation on exterior of piping insulation.

I. Where a vapor barrier is not required, hangers may be installed either on exterior of pipe insulation or directly on piping.

J. Perform welding in accordance with standards of American Welding Society.

3.02 HANGER AND SUPPORT SPACING

A. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

B. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

C. Use hangers with 1-1/2-inch minimum vertical adjustment.

D. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

E. Support riser piping independently of connected horizontal piping.

F. Adjust hangers to obtain slope specified in piping section of these specifications.

G. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Maximum Horizontal Spacing	Maximum Vertical Spacing
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Copper	4" and larger	12'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Glass	Per Pipe Mfr.	8'-0"	12'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Steel	14" and over	20'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"
Plastic	1" or less	32"	4'-0"
Plastic	1-1/4" and over	4'-0"	6'-0"
Plastic	Pure Water 1-1/2″ or less	Continuous	5′-0″

3.03 RISER CLAMPS

A. Support vertical piping with clamps secured to piping and resting on building structure or secured to building structure below at each floor.

3.04 CONCRETE INSERTS AND CONTINUOUS INSERT CHANNELS

A. Select size based on manufacturer's stated load capacity and weight of material that will be supported.

B. Locate continuous insert channels on 6'-0" maximum centers and 2'-0" from corners.

C. Furnish inserts to Contractor for placement in concrete formwork.

D. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

E. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size.

F. Where concrete slabs form finished ceiling, provide inserts that are flush with slab surface.

3.05 ANCHORS

A. Install where indicated on Drawings and details.

B. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops.

C. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION 22 05 29

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SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods: Material and method requirements.
3. Division 09 – Finishes: Execution requirements for painting specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit two tags, labels, and pipe markers, size used on project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Division 01 – General Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.06 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Division 01 – General Requirements: Pre-installation meeting.

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

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 EXTRA MATERIALS

A. Division 01 – General Requirements: Spare parts and maintenance products.

B. Furnish two containers of spray-on adhesive.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:
   1. Craftmark Identification Systems.
   2. Safety Sign Co.
   3. Seton Identification Products.
   4. Substitutions: Division 01 – General Requirements.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.02 TAGS

A. Plastic Tags:
   1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:
   1. Aluminum with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:
   1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location, plastic laminated.

2.03 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
   2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
   3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
   4. Ductwork and Equipment: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Division 09 – Finishes, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.04 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.
   1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

B. Plastic Tape Pipe Markers:
   1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Underground Pipe Markers:
   1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.05 LABELS

A. Description: Polyester, size 1.9 x 0.75 inches, adhesive backed with printed identification.

2.06 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:
   1. Plastic device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 – Finishes for stencil painting.

3.02 INSTALLATION

A. Apply stencil painting in accordance with manufacturer's written instructions.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with tags.

J. Identify piping, concealed or exposed, with plastic pipe markers.

K. Use tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure.

L. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

M. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 22 05 53

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SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Insulation for plumbing piping and equipment.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods.
3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
4. Section 22 11 00 - Facility Water Distribution.
5. Section 22 13 00 - Facility Sanitary Sewerage.
6. Section 22 30 00 - Plumbing Equipment.

1.02 REFERENCES

A. ASTM International: (ASTM)
1. ASTM A240 – Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM B209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
3. ASTM C195 - Specification for Mineral Fiber Thermal Insulation Cement.
4. ASTM C449 - Specification for Mineral Fiber Hydraulic Setting Thermal Insulation Cement.
5. ASTM C534 - Specification for Preformed Flexible Elastomeric Thermal Insulation.
6. ASTM C547 - Specification for Mineral Fiber Preformed Pipe Insulation.
7. ASTM C553 - Specification for Mineral Fiber Blanket and Felt Insulation.
8. ASTM C578 - Specification for Preformed, Block Type Cellular Polystyrene Thermal Insulation.
9. ASTM C591 - Specification for Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
10. ASTM C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
11. ASTM C1136 - Specification for Flexible Low Permeance Vapor Retarders for Thermal Insulation.
12. ASTM C1427 - Specification for Extruded Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form.
13. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

B. Midwest Insulation Contractors Association: (MICA)
1. National Commercial & Industrial Insulation Standards.

C. National Fire Protection Association: (NFPA)
1. NFPA 255 - Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories, Inc.: (UL)
   1. UL 723 - Surface Burning Characteristics of Building Materials.

1.03 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01 – General Requirements.

B. Label all insulating products delivered to construction site with manufacturer's name and description of materials.

1.04 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation.
   2. Equipment Insulation.

B. Install insulation in accordance with current edition of MICA Standards and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from Owner's Representative.

1.05 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.06 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Submit a schedule of insulating materials to be used on project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials or accessories containing asbestos shall not be allowed.

B. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

1. Insulation not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

2.02 INSULATION AND JACKETS

A. Manufacturers:
1. Armstrong.
2. Certainteed.
3. Manson.
4. Childers.
5. Dow.
6. Extol.
7. Halstead.
8. H.B. Fuller.
9. Imcoa.
10. Knauf.
11. Owens-Corning.
12. Pittsburgh Corning.
13. Rubatex.
14. Johns Manville.
15. Or approved equal.

B. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

C. Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10 percent deformation, rated for service to 450 degrees F.
2. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of 0.02 perms and minimum beach puncture resistance of 50 units.

D. Semi-Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10 percent deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.
2. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of 0.02 perms and minimum beach puncture resistance of 50 units.

E. Elastomeric Insulation:
1. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25 percent deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6 percent by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

F. Polyolefin Insulation (ASTM C1427):

1. Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25 percent deformation, maximum water vapor transmission of 0.0 perm inch, maximum water absorption of 0 percent by weight and volume, rated for service range of -165 degrees F to 210 degrees F.

G. PVC Fitting Covers and Jackets:
1. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be 0.02-inch .

2.03 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers:
1. B-Line.
2. Pipe Shields.
3. Value Engineered Products.
4. Or approved equal.

B. Construct inserts with calcium silicate, ASTM C533, minimum 140 psi compressive strength.

C. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping.

D. Contractor may propose shop and site fabricated inserts and shields. Contractor shall submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above.

E. For low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

F. Precompressed 20 lbs. density molded fiberglass blocks, Hamfab or approved equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1-inch x 6-inch block for piping through 2-1/2 inches and three 1-inch x 6-inch blocks for piping through 4 inches. Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

G. Wood blocks shall not be allowed.

2.04 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4-inch wide, constructed of aluminum or stainless steel. Minimum thickness to be 0.015 inch for aluminum and 0.010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Minimum untreated weight of fibrous glass or canvas fabric reinforcing shall be 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install insulation, jackets and accessories in accordance with manufacturer's instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

B. Do not insulate systems or equipment specified to be pressure tested or inspected, until testing, inspection, and any necessary repairs have been successfully completed.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed.

D. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

E. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

F. Use full-length material, as delivered from manufacturer, wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

G. Install insulation continuous through sleeves and openings. Maintain vapor barriers continuous through all penetrations.

H. Provide a complete vapor barrier for insulation on the following systems:
   1. Cold water (potable and non-potable).
   2. Equipment piping with a surface temperature below 65 degrees F.

3.02 PIPING, VALVE, AND FITTING INSULATION

A. General:
1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2-inch lap on jacket seams and 2-inch tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.
2. Water supply piping insulation shall be continuous throughout building and installed adjacent to and within building walls to a point directly behind fixture that is being supplied.
3. Install insulation continuous through pipe hangers and supports with hangers and supports on exterior of insulation. Where a vapor barrier is not required, attach hangers and supports directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration.
4. Where riser clamps are required to attach directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing or coating around riser clamp.

B. Insulation Inserts and Pipe Shields:
1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4-inch and smaller copper piping provided 12 inches long 22 gauge pipe shields are used.

C. Fittings and Valves:
1. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of same thickness as adjoining insulation.
2. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers.
3. Secure PVC fitting covers with tack fasteners and 1-1/2-inch band of mastic over ends, throat, seams or penetrations.
4. On systems requiring vapor barrier, use vapor barrier mastic.

D. Elastomeric and Polyolefin:
1. Where practical, slip insulation on piping during pipe installation when pipe ends are open.
2. Miter cut fittings allowing sufficient length to prevent stretching.
3. Completely seal seams and joints for vapor tight installation.
4. For elastomeric insulation, apply full bed of adhesive to both surfaces.
5. For polyolefin, seal factory pre-glued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

E. Protective Jackets:
1. Provide a protective PVC jacket for the following insulated piping: All piping.
2. Lap seams and joints a minimum of 2 inches and continuously seal with welding solvent recommended by jacket manufacturer.
3. Lap slip joint ends 4 inches without fasteners where required to absorb expansion and contraction.
4. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used.
5. Lap seams a minimum of 2 inches. Secure with metal bands for end-to-end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be constructed of same material as jacket. Locate seams on bottom for exterior applications.

F. Pipe Insulation Schedule:
   1. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	Insulation Types	Insulation Thickness by Pipe Size				
		1" and smaller	1-1/4" to 2"	2-1/2" to 4"	5" to 6"	8" and larger
Hot Water Supply	Rigid Fiberglass	1"	1"	1.5"	1.5"	1.5"
Hot Water Circulating	Rigid Fiberglass	1″	1″	1.5″		
Cold Water	Rigid Fiberglass	0.5″	0.5″	1″	1″	1″
Tempered Water	Rigid Fiberglass	0.5"	0.5"	1"		
Non-Potable Cold Water	Rigid Fiberglass *	0.5″	0.5″	1"		
Non-Potable Hot Water	Rigid Fiberglass *	1″	1″	1.5"		
All Horizontal Storm Piping and 4'-0" of vertical Piping thereafter, & Roof Drain bodies	Rigid Fiberglass	0.5"	0.5"	0.5"	0.5"	0.5"
Clearwater Waste	Rigid Fiberglass *	0.5"	0.5"	0.5"	0.5"	0.5"

* = Elastomeric & Phenolic types are acceptable.

G. Following piping and fittings shall not be insulated:
   1. Chrome plated exposed supplies and stops, except where specifically noted.
   2. Water hammer arrestors.
   3. Piping unions and flanges for systems not requiring a vapor barrier.

3.03 EQUIPMENT INSULATION

A. Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

B. Semi-Rigid Fiberglass:
   1. Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place.
   2. Fill joints, seams and depressions with insulating cement to a smooth, even surface.
   3. Cover with reinforcing fabric and 2 coats of mastic.
   4. Use vapor barrier mastic on systems requiring a vapor barrier.

C. Elastomeric/Polyolefin:

1. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints.
2. Place insulation with edge joints firmly butted pressing to surface for full adhesion.
3. Seal seams and joints vapor tight.

D. Equipment Insulation Schedule:
1. Provide equipment insulation as follows:

Equipment	Insulation Type	Thickness	Remarks
Storage Tanks	Semi-Rigid Fiberglass	2"	
Water Meter	Elastomeric	1/2″	Sheet type. Fabricate for ease of removal and replacement when service is required.
Water Softener	Elastomeric	1/2"	Sheet type. Fabricate for ease of removal and replacement when service is required.
Water Filters	Elastomeric	1/2″	Sheet type, pipe size type or combination of both. Fabricate for ease of removal and replacement when testing and servicing is required.
R.P.B.P.	Elastomeric	1/2″	Sheet type, pipe size type or combination of both. Fabricate for ease of removal and replacement when testing and servicing is required.

END OF SECTION 22 07 00

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Potable water pipe and pipe fittings.

B. Related Sections
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 22 05 00 – Basic Plumbing Materials and Methods.
   3. Section 22 05 14 - Plumbing Specialties.
   4. Section 22 05 29 - Hangers and Supports for Plumbing.

1.02 REFERENCES

A. American Society of Mechanical Engineers: (ASME)
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Cast Iron Threaded Fittings.
   3. ASME B16.5 - Pipe Flanges and Flanged Fittings.
   4. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
   5. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   6. ASME B16.22 - Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.
   7. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   8. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.

B. ASTM International: (ASTM)
   1. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
   2. ASTM A105 - Specification for Forgings, Carbon Steel, for Piping Components.
   3. ASTM A126 - Specification for Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
   4. ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
   5. ASTM B32 - Specification for Solder Metal.
   6. ASTM B88 - Specification for Seamless Copper Water Tube.
   7. ASTM B280 - Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   8. ASTM B813 - Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.
   9. ASTM D1785 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe.

10. ASTM D2241 - Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
11. ASTM D2464 - Specification for Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
12. ASTM D2466 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2513 - Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
14. ASTM D2564 - Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
15. ASTM D2657 –Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
16. ASTM D2774 - Practice for Underground Installation of Thermoplastic Pressure Piping.
17. ASTM D2855 – Practice for Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
18. ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
19. ASTM D3222 - Specification for Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials.
20. ASTM D4101 - Specification for Propylene Plastic Injection and Extrusion Materials.
21. ASTM F437 - Specification for Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80.
22. ASTM F438 - Specification for Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40.
23. ASTM F441 - Specification for Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80.
24. ASTM F493 - Specification for Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings.
25. ASTM F656 - Specification for Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.

C. American Welding Society: (AWS)
1. AWS A5.8 - Brazing Filler Metal

D. American Water Works Association: (AWWA)
1. AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water.
3. AWWA C110 - Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.
4. AWWA C111 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
5. AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
6. AWWA C153 - Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids.
7. AWWA C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.
8. AWWA C651 - Disinfecting Water Mains.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Schedule from Contractor indicating ASTM or AWWA specification number of pipe being proposed along with its type and grade if known at time of submittal, and sufficient information to indicate type and rating of fittings for each service.

C. Statement from manufacturer on his letterhead that pipe furnished meets ASTM OR AWWA specification contained in this section.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01 – General Requirements.

B. Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with name or trademark of manufacturer and type of pipe; with each shipping unit marked with purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting specification requirements must be replaced with material that meets these specifications without additional cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure that material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade.

C. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so caps remain in place.

D. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

E. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

F. Storage and protection methods must allow inspection to verify products.

1.06 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting latest revision of ASTM or AWWA specifications as listed in this specification.

B. Construct all piping for highest pressures and temperatures in respective system.

C. Non-metallic piping will be acceptable only for services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

D. Weld fittings or mechanical grooved fittings shall only use long radius elbows having a centerline radius of 1.5 pipe diameters.

E. Where ASTM A53 type F pipe is specified, grade A, type E or S, or grade B, type E or S may be substituted at Contractor's option. Where grade or type is not specified, Contractor may choose from those commercially available.

F. Where ASTM B88, Type L, H58 drawn temper copper tubing is specified, ASTM B88, Type K, H58 drawn temper copper tubing may be substituted at Contractor's option.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER

A. Above Ground:
   1. Type L, copper water tube, H58 drawn temper, ASTM B88; wrought copper pressure fittings, ASME B16.22; lead free, less than 0.2 percent solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.
   2. Wrought copper ANSI B16.22 or cast bronze. ANSI B16.18 fittings, copper tube dimensioned grooved ends, joined with mechanical couplings, synthetic rubber gasket seals, Victaulic style 606.
   3. Copper press fittings, ASTM B16.18 or ASTM B16.22, EPDM O-ring by Viega.

B. Below Ground 2-1/2-Inch and Smaller: Type K copper water tube, O50 (annealed) temper, ASTM B88; with cast copper pressure fittings, ASME B16.18; wrought copper pressure fittings, ASME B16.22; lead free, less than 0.2 percent solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ASME B16.26.

C. Below Ground 3-Inch and Larger: Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.
   1. Provide 8-mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

2.02 DIELECTRIC UNIONS AND FLANGES

A. Dielectric unions 2-inch and smaller; dielectric flanges larger than 2-inch; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

B. Manufacturers:
   1. Watts Regulator Company.
   2. Lochinvar.
   3. Wilkins.
   4. EPCO Sales, Inc.
   5. Or approved equal.

2.03 UNIONS AND FLANGES

A. Unions, flanges, and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.

B. 2-Inch and Smaller Steel:
   1. ASTM A197/ASME B16.3 malleable iron unions with brass seats.
   2. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

C. 2-Inch and Smaller Copper:
   1. ASME B16.18 cast bronze union coupling or ASME B15.24 Class 150 cast bronze flanges.

D. 2-1/2-Inch and Larger Steel:
   1. ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel.
   2. Use raised face flanges ASME B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets.
   3. Use ASME B16.1 flat face flanges with full face teflon gaskets for mating with other flat face flanges on equipment.
   4. Gaskets shall be teflon type.

E. 2-1/2-Inch and Larger Copper:
   1. ASME B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

2.04 MECHANICAL GROOVED PIPE CONNECTIONS

A. Mechanical grooved pipe couplings and fittings, ASTM F1476, may be used with roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.
   1. Manufacturers:
      a. Victaulic.
      b. Gruvlok.
      c. Gustin-Bacon.
      d. Or approved equal.

B. All mechanical grooved pipe material including gaskets, couplings, fittings, and flange adapters to be from same manufacturer.

C. Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536, with painted finish. Reducing couplings are not acceptable.

D. Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat-treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install piping parallel to building walls and ceilings and at heights not obstructing any portion of a window, doorway, stairway, or passageway.

B. Where interferences develop in field, offset or reroute piping as required to clear such interferences.

C. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances.

D. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

E. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

F. Maintain piping in clean condition internally during construction.

G. Provide clearance for installation of insulation, access to valves and piping specialties.

H. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

I. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including required service space for this equipment, unless piping is serving this equipment

J. Install all valves and piping specialties, including items furnished by others, as specified or detailed. Provide access to valves and specialties for maintenance.

K. Make connections to all equipment, fixtures and systems installed by others where same requires piping services indicated in this section.

3.04 PIPE JOINTS

A. Copper Pipe Joints: Comply with following installation requirements.
   1. Remove slivers and burrs remaining from cutting operation by reaming and filing both pipe surfaces.
   2. Clean fitting and tube with metal brush, emery cloth or sandpaper.

3. Remove residue from cleaning operation, apply flux and assemble joint to socket stop.
4. Apply flame to fitting until solder melts when placed at joint.
5. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears.
6. Wipe excess solder and flux from joint.

B. Threaded Pipe Joints: Comply with following installation requirements.
1. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

C. Mechanical Hubless Pipe Connections**:** Comply with following installation requirements.
1. Place gasket on end of one pipe or fitting and clamp assembly on end of other pipe or fitting.
2. Firmly seat pipe or fitting ends against integrally molded shoulder inside neoprene gasket.
3. Slide clamp assembly into position over gasket.
4. Tighten fasteners to manufacturers recommended torque.

D. Mechanical Joint Pipe Connections: Comply with following installation requirements.
1. Comply with AWWA C600 and C605 installation requirements.
2. Clean pipe end and socket.
3. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant.
4. Place gland and gasket, properly oriented, on pipe end.
5. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight.
6. Press gland evenly against gasket, insert bolts and hand tighten nuts.
7. Make joint deflection prior to tightening bolts.
8. Evenly tighten bolts in sequence to recommended torque.

E. Push-On Gasketed Pipe Connections: Comply with following installation requirements.
1. Clean pipe end, bell, gasket seat and gasket of dirt or debris.
2. Coat end of pipe and gasket with gasket lubricant.
3. Insure pipe is supported off-ground so lubricant does not pick up dirt.
4. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer.
5. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end.
6. Insert to fully seated position or to reference mark on pipe.

F. Mechanical Grooved Pipe Connections: Comply with following installation requirements.
1. Use pipe factory grooved in accordance with coupling manufacturer's specifications or field grooved pipe in accordance with same specifications using specially designed tools specially designed for application.
2. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with coupling manufacturer's specifications.

3.05 DOMESTIC WATER

A. Maintain piping system in clean condition during installation.

B. Remove dirt and debris from assembly of piping as work progresses.

C. Cap open pipe ends where left unattended or subject to contamination.

D. Install exterior water piping below predicted frost level in accordance with authority having jurisdiction, but in no case less than 6-foot bury depth to top of pipe.

E. Maintain minimum of 8-foot horizontal distance between 2-1/2-inch and larger water piping and sanitary sewer piping.

F. Maintain minimum of 30-inch horizontal and 12-inch vertical distance, water on top, between 2-inch and smaller water piping and sanitary sewer piping.

G. Where water piping crosses a sanitary sewer, provide minimum 18-inch vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10 feet from sewer in both directions.

H. Provide thrust restraints for 3-inch and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more.

I. Field apply continuous anti-corrosion coating to rodded restraint components.

J. Protect mechanical joints, nuts and bolts from concrete cover.

K. Cover with 8-mil sheet or tube polyethylene material sleeve.

L. Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage.

M. Install shutoff valves where indicated and at base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

N. Prior to use, isolate and fill system with potable water. Allow to stand 24 hours.

O. Flush each outlet proceeding from service entrance to furthest outlet for minimum of one minute and until water appears clear.

P. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Alternately, a solution containing at least 200 parts per million of chlorine may be used and allowed to stand for 3 hours.

Q. Flush system with potable water until chlorine concentration is no higher than source water level.

R. Wait 24 hours after final flushing. Take samples of water for lab testing.

S. Number and location of samples shall be representative of system size and configuration and are subject to approval by Owner's Representative.

T. Test shall show absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

3.06 UNDERGROUND PIPE WRAP

A. Use for steel piping encased in concrete or underground which is not in a conduit.

B. Remove dirt and other foreign material from exterior of pipe.

C. Apply primer as recommended by manufacturer.

D. Use a spiral wrap process for applying tape to pipe.

E. Repair any breaks in tape coating caused by installation process.

3.07 DIELECTRIC UNIONS AND FLANGES

A. Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

3.08 UNIONS AND FLANGES

A. Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement.

B. Where a valve is located at a piece of equipment, locate flange or union connection on equipment side of valve. Concealed unions or flanges are not acceptable.

3.09 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure.

B. Test piping in sections or entire system as required by sequence of construction.

C. Do not insulate or conceal pipe until it has been successfully tested.

D. If required for additional pressure load under test, provide temporary restraints at fittings or expansion joints.

E. Backfill underground water mains prior to testing with exception of thrust restrained valves which may be exposed to isolate potential leaks.

F. For hydrostatic tests, use clean water and remove all air from piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at high point in system.

G. Inspect system for leaks. Where leaks occur, repair area with new materials and repeat test. Caulking will not be acceptable.

H. Testing with air will not be allowed.

System	Medium	Test Pressure	Test Duration
*Below Ground Domestic Water	Water	200 psig	2 hour
Above Ground Domestic Water	Water	150 psig	4 hour
Above Ground Non-potable Water	Water	150 psig	4 hour
Below Ground Non-potable Water	Water	200 psig	2 hour

* Leakage on exterior mains 3-inch and larger may not exceed leakage calculated as follows:
GPH Allowable Leakage = (Feet of Pipe) (Inches Dia. of Pipe) (Test Pressure)^2 = 133,200

I. Below Ground Domestic Water test pressure of 200 psig is required by NFPA 24 for private fire service mains. Small diameter piping not serving hydrants or buildings with fire protection systems may be tested at 150 psig.

END OF SECTION 22 11 00

SECTION 22 13 00

FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Sanitary sewer pipe and pipe fittings.

B. Related Sections
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 22 05 00 – Basic Plumbing Materials and Methods.
   3. Section 22 05 14 - Plumbing Specialties.
   4. Section 22 05 29 - Hangers and Supports for Plumbing.

1.02 REFERENCES

A. American Society of Mechanical Engineers: (ASME)
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Cast Iron Threaded Fittings.
   3. ASME B16.5 - Pipe Flanges and Flanged Fittings.
   4. ASME B16.22 - Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.

B. ASTM International: (ASTM)
   1. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
   2. ASTM A74 - Specification for Cast Iron Soil Pipe and Fittings.
   3. ASTM A105 - Specification for Forgings, Carbon Steel, for Piping Components.
   4. ASTM A126 - Specification for Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings.
   5. ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
   6. ASTM A861 - Specification for High Silicon Iron Pipe and Fittings.
   7. ASTM A888 - Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   8. ASTM B32 - Specification for Solder Metal.
   9. ASTM B306 - Specification for Copper Drainage Tube (DWV).
   10. ASTM B813 - Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.
   11. ASTM C76 - Specification for Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe.

12. ASTM C564 - Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
13. ASTM C1540 - Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
14. ASTM D1785 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe.
15. ASTM D2241 - Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
16. ASTM D2466 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
17. ASTM D2564 - Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
18. ASTM D2665 - Specification for Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.
19. ASTM D2729 - Specification for Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
20. ASTM D2774 - Practice for Underground Installation of Thermoplastic Pressure Piping.
21. ASTM D2855 – Practice for Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
22. ASTM D3034 - Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
23. ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
24. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
25. ASTM D3222 - Specification for Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials.
26. ASTM D3311 - Specification for Drain, Waste and Vent (DWV) Plastic Fitting Patterns.

C. American Welding Society: (AWS)
1. AWS A5.8 - Brazing Filler Metal.

D. Cast Iron Soil Pipe Institute:(CISPI)
1. CISPI 301 - Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.
2. CISPI 310 - Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Schedule from Contractor indicating ASTM or CISPI specification number of pipe being proposed along with its type and grade if known at time of submittal, and sufficient information to indicate type and rating of fittings for each service.

C. Statement from manufacturer on his letterhead that pipe furnished meets ASTM or CISPI specification contained in this section.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01 – General Requirements.

B. Order copper, cast iron, steel, PVC and polyethylene pipe with each length marked with name or trademark of manufacturer and type of pipe; with each shipping unit marked with purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting specification requirements must be replaced with material that meets these specifications without additional cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure that material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation.

C. Do not store materials directly on grade.

D. Protect pipe, tube, and fitting ends so they are not damaged.

E. Where end caps are provided or specified, take precautions so caps remain in place.

F. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

G. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

H. Storage and protection methods must allow inspection to verify products.

1.06 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting latest revision of ASTM or CISPI specifications as listed in this specification.

B. Construct all piping for highest pressures and temperatures in respective system.

C. Non-metallic piping will be acceptable only for services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

D. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

E. Where ASTM A53, Type F pipe is specified, Grade A, Type E or S, or Grade B, Type E or S may be substituted at Contractor's option. Where grade or type is not specified, Contractor may choose from those commercially available.

F. Where ASTM B88, Type L, H58 drawn temper copper tubing is specified, ASTM B88, Type K, H58 drawn temper copper tubing may be substituted at Contractor's option.

PART 2 - PRODUCTS

2.01 SANITARY WASTE AND VENT

A. Interior Above Ground:
   1. Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 310, CISPI 310, ASTM A74.
   2. Pipe and fittings shall be marked with collective trademark of Cast Iron Pipe Institute or receive prior approval of Engineer.
   3. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ASME16.23; wrought copper drainage fittings (DWV), ASME16.29; lead free, less than 0.2 percent solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.
   4. PVC Plastic Pipe: Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

B. Pressurized Interior Above Ground:
   1. Type L, Copper water tube, H58 drawn temper, ASTM B88; with cast copper drainage fittings (DWV), ASME B16.23; wrought copper drainage fittings (DWV), ASME 16.29; lead free, less than 0.2 percent solder, ASTM B32; flux, ASTM B813.
   2. Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

C. Interior Below Ground:
   1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564, CISPI 301, and CISPI HSN 85.
   2. Pipe and fittings shall be marked with collective trademark of Cast Iron Pipe Institute.
   3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

D. Exterior Below Ground 15-Inch and Smaller:
   1. Cast iron soil pipe and fittings, CISPI 301, ASTM A74 or ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with collective trademark of Cast Iron Pipe Institute.
   2. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.
   3. Type PSM PVC sewer pipe and socket fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.
   4. Corrugated PVC pipe and fittings with smooth interior, ASTM F949; gasketed joint, ASTM D3212; elastomeric gasket, ASTM F477.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturers' recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 ERECTION

A. Install piping parallel to building walls and ceilings and at heights not obstructing any portion of a window, doorway, stairway, or passageway.

B. Where interferences develop in field, offset or reroute piping as required to clear such interferences.

C. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances.

D. In all cases, consult Drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

E. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve of elastomeric pipe insulation.

F. Install underground warning tape 6-12 inches below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

G. Maintain piping in clean condition internally during construction.

H. Provide clearance for installation of insulation, access to valves, and piping specialties.

I. Provide anchors, expansion joints, swing joints, or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

J. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including required service space for this equipment, unless piping is serving this equipment.

K. Install all valves and piping specialties, including items furnished by others, as specified and detailed.

L. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires piping services indicated in this section.

3.04 PIPE JOINTS

A. Copper Pipe Joints:
1. Remove slivers and burrs remaining from cutting operation by reaming and filing both pipe surfaces.
2. Clean fitting and tube with metal brush, emery cloth, or sandpaper.
3. Remove residue from cleaning operation, apply flux, and assemble joint to socket stop.
4. Apply flame to fitting until solder melts when placed at joint.
5. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

B. Welded Pipe Joints:
1. Make welded joints by fusion welding in accordance with ASME Codes, ASMR B31, and state Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) diameter of main.

C. Threaded Pipe Joints:
1. Use a thread lubricant or teflon tape when making joints. No hard setting pipe thread cement or caulking will be allowed.

D. Solvent Welded Pipe Joints:
1. Install in accordance with ASTM D2855.
2. Saw cut piping square and smooth.
3. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior.
4. Support and restrain pipe during cutting to prevent nicks and scratches.
5. Bevel ends 10-15 degrees and deburr interior.
6. Remove dust, drips, moisture, grease, and other superfluous materials from pipe interior and exterior.
7. Check dry fit of pipe and fittings.
8. Reject materials which are out of round or do not fit within close tolerance.
9. Use heavy body solvent cement for large diameter fittings.
10. Maintain pipe, fittings, primer, and cement between 40 and 100 degrees F during application and curing.
11. Apply primer and solvent using separate daubers (3-inch and smaller piping only) or clean natural bristle brushes about 1/2 size of pipe diameter.
12. Apply primer to fitting socket and pipe surface with a scrubbing motion.
13. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths.
14. Apply solvent cement to fitting socket and pipe in an amount greater than needed to fill any gap.
15. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to bottom of socket.
16. Solvent cement application and insertion must be completed in less than one minute.
17. Minimum of 2 installers is required on piping 4-inch and larger.
18. Hold joint for 30 seconds or until set.

19. Reference manufacturers' recommendations for initial set time before handling and for full curing time before pressure testing.
20. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by Owner's Representative.

3.05 PIPE CONNECTIONS

A. Mechanical Hubless Pipe Connections:
1. Place gasket on end of one pipe or fitting and clamp assembly on end of other pipe or fitting.
2. Firmly seat pipe or fitting ends against integrally molded shoulder inside neoprene gasket.
3. Slide clamp assembly into position over gasket.
4. Tighten fasteners to manufacturers recommended torque.

B. Mechanical Joint Pipe Connections:
1. Comply with AWWA C600/C605 installation requirements.
2. Clean pipe end and socket.
3. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant.
4. Place gland and gasket, properly oriented, on pipe end.
5. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight.
6. Press gland evenly against gasket, insert bolts and hand tighten nuts.
7. Make joint deflection prior to tightening bolts.
8. Evenly tighten bolts in sequence to recommended torque.

C. Push-On Gasketed Pipe Connections:
1. Clean pipe end, bell, gasket seat and gasket of dirt or debris.
2. Coat end of pipe and gasket with gasket lubricant.
3. Insure pipe is supported off ground so lubricant does not pick up dirt.
4. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer.
5. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end.
6. Insert to fully seated position or to reference mark on pipe.

D. Mechanical Grooved Pipe Connections:
1. Use pipe factory grooved in accordance with coupling manufacturer's specifications or field grooved pipe in accordance with same specifications using specially designed tools specially designed for application.
2. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with coupling manufacturer's specifications.

3.06 MECHANICALLY FORMED TEE FITTINGS

A. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out tube surface to form a collar having a height of not less than three times thickness of tube wall.

B. Use an adjustable collaring device. Notch and dimple branch tube.

C. Braze joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.07 SANITARY WASTE AND VENT

A. Verify invert elevations and building elevations prior to installation.

B. Install exterior piping pitched to drain at indicated elevations and slope.

C. Install interior piping pitched to drain at minimum slope of 1/4-inch per foot where possible and in no case less than 1/8-inch per foot for piping 3-inch and larger.

D. Install exterior piping below predicted frost level and shall maintain not less than 5-foot of bury depth to top of pipe wherever possible.

E. Where piping is located above predicted frost level, provide frost protection as required.

F. Flush piping inlets including floor drains, hub drains, mop basins, and fixtures, with high flow of water at completion of project to demonstrate full flow capacity.

G. Remove blockages and make necessary repairs wherever flow is impeded.

3.08 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components not rated for test pressure from system.

B. Perform final testing for medical and lab gas with all system components in place.

C. Test piping in sections or entire system as required by sequence of construction.

D. Do not insulate or conceal pipe until it has been successfully tested.

E. If required for additional pressure load under test, provide temporary restraints at fittings or expansion joints.

F. Backfill underground water mains prior to testing with exception of thrust restrained valves which may be exposed to isolate potential leaks.

G. For hydrostatic tests, use clean water and remove all air from piping being tested by means of air vents or loosening of flanges and unions.

H. Measure and record test pressure at high point in system.

I. For air or nitrogen tests, gradually increase pressure to not more than one half of test pressure; then increase pressure in steps of approximately one-tenth of test pressure until required test pressure is reached.

J. Examine joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during test period.

K. Inspect system for leaks. Where leaks occur, repair area with new materials and repeat test; caulking will not be acceptable.

System	Medium	Test Pressure	Test Duration
Sanitary Waste and Vent	Water	10-foot water	2 hour

END OF SECTION 22 13 00

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SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Water heaters.
2. Water softeners
3. Pumps.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods.
3. Section 22 05 14 - Piping Specialties.
4. Section 22 05 23 - Valves for Plumbing Piping.
5. Section 22 07 00 - Plumbing Insulation.
6. Division 26 – Electrical.

1.02 REFERENCES

A. American Society of Heating, Refrigerating, and Air Conditioning Engineers: (ASHRAE)
1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. American Society of Mechanical Engineers: (ASME)
1. BPVC Section IV - Rules for Construction of Heating Boilers.
2. BPVC Section VIII - Rules for Construction of Pressure Vessels.

C. ASTM International: (ASTM)
1. ASTM A53 – Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM B88 – Specification for Seamless Copper Water Tube.
3. ASTM C443 – Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
4. ASTM C478 – Specification for Precast Reinforced Concrete Manhole Sections.
5. ASTM C923 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
6. ASTM C990 - Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.
7. ASTM D4101 - Specification for Polypropylene Injection and Extrusion Materials.

D. National Association of Corrosion Engineers: (NACE)
1. NACE No. 1 - White Metal Blast Cleaning.

E. Society for Protective Coatings: (SSPC)

1. SSPC SP 5 - White Metal Blast Cleaning.

1.03 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01 – General Requirements.

B. Plumbing products requiring approval by State of Wisconsin Department of Safety and Professional Services must be approved or have pending approval at time of Shop Drawing submission.

1.04 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

PART 2 - PRODUCTS

2.01 POINT OF USE WATER HEATERS

A. POU-1 – Basis of Design – Eemax Inc. Tankless Water Heaters – Model No. EX144TC, 15 KW, 240VAC, 64A, 68 degree temperature rise @ 1.5 gallons per minute output. 15-year warranty. Unit shall have a power mode control to increase or decrease the water output temperature.

B. POU-2 – Basis of Design – Eemax Inc. Tankless Water Heaters – Model No. EX65, 6.5 KW, 240V, 27A, 44 degree temperature rise @ 1.0 gallons per minute output. 15 year warranty. Unit shall have a power mode control to increase or decrease the water output temperature.

2.02 WATER SOFTENERS

A. Manufacturers:
   1. Amtrol Water Treatment Technologies.
   2. Capital Water Softener, Inc.
   3. CustomCare Water Technologies, Inc.
   4. Hellenbrand, Inc.
   5. Water-Right., Inc.
   6. Substitutions: In accordance with Division 01 – General Requirements.

B. Tanks:
   1. Fiberglass reinforced mineral tank constructed of molded high-density polyethylene inner shell reinforced by exterior fiberglass winding and epoxy resin.
   2. NSF approved and rated for 150 psig.
   3. Mount slotted or lateral hub PVC distributor in tank with underbedding gravel.

C. Mineral:
   1. High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech, or Puralite.
   2. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt.
   3. Design for minimum 50 percent resin bed freeboard.

D. Valve:
   1. Top mount brass valve with motor drive, hydraulically balanced piston, seal and spacers, adjustable brine flow control, backwash flow control, adjustable capacity, and regeneration settings.
   2. Provide bypass ball valve arrangement.

E. Controls: Factory wired and tested controls with transformer and labeled terminal block for twin alternating consisting of the following:
   1. 7-Day Time Clock.
   2. Mechanical Demand Meter Delayed Regeneration.
   3. Mechanical Demand Meter Immediate Regeneration.
   4. Electronic Meter and 480 Microprocessor with LED Display for Delayed Regeneration.
   5. Electronic Meter and 480 Microprocessor with LED Display for Immediate Regeneration.
   6. Systemax Microprocessor Controller with LED Display.

F. Brine Tank: High density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Contractor to provide initial salt fill.

G. Ratings: Maximum 10 MG/L hardness leakage, 110 degrees F maximum operating temperature, 30-100 psig operating pressure, 120/60/1 electrical.

H. Accessories:
   1. Flexible braided stainless steel pipe connectors for tanks over 24-inch diameter.
   2. Inlet and outlet sampling valves, inlet and outlet pressure gauges with shutoff valve.
   3. Resin defoulant system with chemical metering pump, tubing and 4 month supply of chemical cleaner for iron and bacteria fouling.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit, and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

B. Connect equipment to water and drain piping using unions or flanges and isolation valves.

C. Connect pneumatic controls to compressed air source.

D. Startup and test equipment adjusting operating and safety controls for proper operation.

E. Cycle softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.

F. Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

G. Adjust compression tank pre-charge to scheduled minimum operating pressure prior to connecting to system.

END OF SECTION 22 30 00

SECTION 22 42 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Plumbing fixtures.
2. Faucets.
3. Trim.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 22 05 00 – Basic Plumbing Materials and Methods.
3. Section 22 05 14 - Plumbing Specialties.
4. Section 22 05 29 – Hangers and Supports for Plumbing.
5. Section 22 11 00 - Facility Water Distribution.
6. Section 22 13 00 - Facility Sanitary Sewerage.

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute: (ARI)
1. ARI-1010-94 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.

B. American National Standards Institute: (ANSI)
1. ANSI Z124.1 - Plastic Bathtub Units.
2. ANSI Z124.2 - Plastic Shower Receptors and Shower Stalls.

C. American Society of Mechanical Engineers: (ASME)
1. ASME A112.6.1M - Supports for Off Floor Plumbing Fixtures for Public Use.
2. ASME A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
3. ASME A112.19.1 - Enameled Cast Iron Plumbing Fixtures.
4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
5. ASME A112.19.5 - Trim for Water Closet Bowls, Tanks and Urinals.

D. American Society of Safety Engineers: (ASSE)
1. ASSE 1011-93 - Hose Connection Vacuum Breakers.
2. ASSE 1014-90 - Handheld Showers.
3. ASSE 1035-93 - Laboratory Faucet Backflow Preventers.

1.03 QUALITY ASSURANCE

A. Substitution of Materials: In accordance with Division 01 – General Requirements.

B. Plumbing products requiring approval by code authority having jurisdiction, must be approved or have pending approval at time of Shop Drawing submission.

1.04 SUBMITTALS

A. Division 01 – General Requirements: Requirements for submittals.

B. Submit data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.05 ENERGY EFFICIENCY REQUIREMENTS

A. Plumbing fixtures must meet the following maximum water usage requirements based upon Federal Energy Management Program (FEMP) performance requirements.
   1. Lavatory Faucets, flow of 2 gpm or less and .25 gallon per cycle or less (based on inlet pressure of 60 psi).
   2. Urinal Flush Valves, 1.0 gallon per flush or less.
   3. Water Closet Flush Valves, 1.6 gallon per flush or less.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

A. Water Closet - Handicap, (WC-1)
   1. Bowl:
      a. Wall mounted, 18 inch high, vitreous china siphon jet closet bowl, with elongated rim, back spud, with chrome bolt covers, white.
      b. Manufacturer:
         1) American Standard: Equal product to Kohler
         2) Crane: 3462 Rapidway
         3) Kohler: K-5329 Kingston
   2. Seat:
      a. Solid white plastic, open front, extended back, brass bolts, bolt caps, without cover, anti-microbial, extra heavy duty, white.
      b. Manufacturer:
         1) Kohler: #K-4670-C.
         2) Equal products by Church or Beneke are accepted.
   3. Flush Valve:
      a. Zurn Z6143AV with standard handle. Concealed in plumbing chase, chrome plated exposed parts, signage for handle.
      b. Equal products by Sloan are accepted.
   4. Carrier:
      a. J.R. Smith concealed floor mounted carrier with 3 point anchorage and adjustable for ADA water closet height.
      b. Equal products by Zurn or Wade accepted.

B. Water Closet – Standard (WC-2)
   1. Bowl:
      a. Wall mounted, vitreous china siphon jet closet bowl, elongated rim, back spud, with chrome bolt covers, white.
      b. Manufacturer:
         1) American Standard: Equal product to Kohler
         2) Crane: 3462 Rapidway
         3) Kohler: K-4329 Kingston
   2. Seat:
      a. Solid white plastic, open front, extended back, brass bolts, bolt caps, without cover, anti-microbial, extra heavy duty, white.
      b. Manufacturer:
         1) Kohler: #K-4670-C.
         2) Equal products by Church or Beneke are accepted.
   3. Flush Valve:
      a. Zurn Z6143AV with standard handle. Concealed in plumbing chase, chrome plated exposed pants, signage for handle.
      b. Equal products by Sloan are accepted.
   4. Carrier:
      a. J.R.Smith concealed floor mounted carrier with 3 point anchorage and adjustable for standard mounting height.

C. Urinal - Wall Hung Handicap (U-1)
   1. Urinal:
      a. Vitreous china washout urinal with 3/4 inch top spud and carrier, white.
      b. Manufacturer:
         1) American Standard: Equal product to Kohler.
         2) Crane: 7398 Cromwell.
         3) Kohler: K4960-ER Bardon.
   2. Fittings:
      a. Manufacturer:
         1) Zurn: ZEMS-6195AV-OB-HW6-PC6 concealed – Sensor activated flush valve, hardwired, with over-ride button.
         2) Equal product by Sloan is accepted.
   3. Mount at handicapped height.
   4. Carrier: J.R. Smith carrier with bottom plate for urinals with back spuds.
   5. This contractor to wire flush valve to electrical contractor provided junction box.

D. Lavatory - Single Lever Handicap (L-1)
   1. Bowl:
      a. 19 x 17 inch cast iron lavatory, white, 4” centers.
      b. Manufacturer:
         1) American Standard: Equal to Kohler product.
         2) Crane: 1412V Harwich – 20 x 18.
         3) Kohler: K2805 Hudson – 19 x 17.
   2. Fittings:
      a. Manufacturer:
         1) Zurn Z6913-XL-CWB Aqua Sense – CP4-F – Automatic on demand sensor activated faucet. Provide all solenoid valves, power converters, and thermostatic mixing valve TMV-1, Hardwired Powered Faucet.
         2) McGuire: #8872, 1-1/4 inch semi-cast brass P-trap, with insulated covering.

3) McGuire: #2165 supplies to wall, chrome nipple with stop, with insulated covering.
4) McGuire: #155-WC offset tailpiece, with insulated covering.

3. Mounting height of 34 inches from basin rim to finished floor.
4. Offset p-trap with protective wrap.
5. Concealed support arms in wall: Smith, Wade or Zurn.

E. Floor Drain - Regular (FD-1)
1. Floor Drain:
a. Cast iron floor drain with polished nickel-bronze top, adjustable 6″ x 6″ square strainer with flashing clamp device.
b. Size of drain as shown on drawings.
c. Manufacturer:
1) Josam: #3000-S.
2) J.R. Smith: #2005-A.
3) Zurn: #Z-415-S.

F. Hose Bibbs - Non-Freeze (HB-1)
1. Wall Hydrants
a. Anti-siphon non-freeze recessed wall hydrant, cast polished brass face, with vacuum breaker, loose key. Provide exterior box and door, polished brass finish.
b. Manufacturer:
1) Woodford Model 67 with B67 box.
2. Mounting height as shown on drawings.

G. Hose Bibb – Non-Freeze (HB-2)
1. Wall hydrants:
a. Anti-siphon, nonfreeze, cast polished brass, with vacuum breaker, oval metal handle, mounting sleeve.
b. Manufacturer:
1) Woodford Model 30 CC, ¾″, wall hydrant.
2) Woodford Model WF-20MS mounting sleeve.

H. Floor Clean-Out (FCO-1)
1. Floor Clean-out:
a. Cast iron body and frame, clean-out plug and adjustable round top.
b. Manufacturer:
1) Wade: 6000-Z.
c. Provide frost sleeves and covers for cleanouts in sewer lateral line.

I. Mop Sink Basin (MSB-1)
1. Basin: 24″ x 24″ x 10″ molded fiberglass mop sink with dome strainer, lint basket, hose, hose bracket, and mop bracket.
a. Fiat Model MSB2424
b. Mustee accepted.
2. Faucet:
a. Chicago Faucet No. 897 – RNP with Watts 8A vacuum breaker.

J. Jug Filler (JF-1)
1. Jug Filler:

a. Most dependable Fountains WMSSJF, wall mounted jug filler. Color to be selected by A/E.

K. Drinking Fountains, Dual Height, DF-1
1. Wall mounted barrier free stainless steel dual height drinking fountain with self-closing front mounted push button valve, wall hanger, 3/8 inch supply and 1-1/4 inch tailpiece. Mount at 36 inches spout height. Provide wall access panel for access to trap and stop.
a. Fixture: Elkay EDFPBM-117C
b. Trap: 1-1/4 inch x 1-1/4 inch, 17 gauge cast brass trap.
c. Stop: 3/8 inch concealed ball valve.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumbing fixtures in accordance with manufacturer's instructions.

B. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting.

C. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

D. Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

E. Install barrier free fixtures in compliance with IBC 1108 and 3408, code authority having jurisdiction and Federal ADA Accessibility Guidelines.

F. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to 27 inches above floor to avoid contact by wheelchair users.

G. Provide unions at water connections to drinking fountains and electric water coolers.

H. Each fixture shall have a stop valve installation to control fixture. Stop valves shall be heavy-duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

I. Cover pipe penetrations with escutcheons. Exposed traps, stops, piping, and escutcheons to be chrome-plated brass. Same items in concealed locations may be of rough brass finish.

J. Set floor mounted water closets, floor mounted service sinks, counter mounted lavs and sinks; lav and sink faucets and drains with full setting bed of flexible non-staining plumber's putty. Cover exposed water closet bolts with bolt covers.

K. Set mop basins to floor and wall with grout or silicone sealant.

L. Seal openings between walls, floors, and fixtures with mildew-resistant silicone sealant same color as fixture.

M. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise, or overflow. Adjust self-closing lavatory faucets to 15 second cycle. Adjust shower valve temperature limit stops to 110 degrees F maximum outlet temperature.

N. Protect fixtures during construction. At completion, clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

END OF SECTION 22 42 00

SECTION 23 05 00

BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Reference Standards.
2. References.
3. Regulatory Requirements.
4. Quality Assurance.
5. Drawings.
6. Protection of Products and Finished Surfaces.
7. Sleeves and Openings.
8. Sealing and Firestopping.
9. Product Substitution Procedures.
10. Submittals.
11. Off Site Storage.
12. Request and Certification for Payment.
13. Certificates and Inspections.
14. Operating and Maintenance Instructions.
15. Training of Owner Personnel.
16. Record Drawings.
17. Manufacturer's Field Services and Reports.
18. Identification.
19. Cutting and Patching.
20. Building Access.
21. Equipment Access.
22. Coordination.
23. Lubrication.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 23 33 00 - Air Duct Accessories.

1.02 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:
1. AABC Associated Air Balance Council.
2. ABMA American Boiler Manufacturers Association.
3. ADC Air Diffusion Council.
4. AGA American Gas Association.
5. AMCA Air Movement and Control Association.
6. ANSI American National Standards Institute.

7. ARI Air-Conditioning and Refrigeration Institute.
8. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers.
9. ASME American Society of Mechanical Engineers.
10. ASTM American Society for Testing and Materials.
11. AWWA American Water Works Association.
12. AWS American Welding Society.
13. EPA Environmental Protection Agency.
14. GAMA Gas Appliance Manufacturers Association.
15. IEEE Institute of Electrical and Electronics Engineers.
16. ISA Instrument Society of America.
17. MCA Mechanical Contractors Association.
18. MICA Midwest Insulation Contractors Association.
19. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
20. NBS National Bureau of Standards.
21. NEBB National Environmental Balancing Bureau.
22. NEC National Electric Code.
23. NEMA National Electrical Manufacturers Association.
24. NFPA National Fire Protection Association.
25. SMACNA Sheet Metal and Air Conditioning Contractors' National Association, Inc.
26. UL Underwriters Laboratories Inc.

1.03 REFERENCES

A. ASTM International
   1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E814 - Test Method for Fire Tests of Through-Penetration Fire Stops.

B. Underwriters Laboratories, Inc. (UL)
   1. UL 1479 - Fire Tests of Through-Penetration Firestops.
   2. UL 723 - Surface Burning Characteristics of Building Materials.

1.04 REGULATORY REQUIREMENTS

A. Specified systems shall be installed in compliance with federal, state and local codes and regulations.

B. Contractor shall secure and pay for permits, licenses and certificates of inspection applicable to this work.

C. Contractor shall pay taxes applicable to this work.

1.05 QUALITY ASSURANCE

A. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated in the Contract Documents, Contractor is responsible for all costs involved in integrating equipment or accessories into system and for obtaining performance from system into which these items are placed.

B. This may include changes found necessary during testing, adjusting, and balancing phase of project.

1.06 DRAWINGS

A. Drawings show general arrangement of piping, equipment and appurtenances and shall be followed as close as possible actual building construction and work of other Contractors.

B. Work shall conform to requirements indicated on Drawings. Architectural and structural Drawings shall take precedence.

C. Due to the scale of the Drawings, it is not possible to indicate all offsets, fittings and accessories that may be required.

D. Investigate architectural and structural conditions affecting work and arrange work accordingly, providing offsets, fittings and accessories as may be required to meet constructed design.

E. HVAC equipment and systems, including piping and ductwork shall also be installed to maintain required operation and maintenance clearances.

F. Work shall conform to requirements indicated on the Drawings

1.07 PROTECTION OF PRODUCTS AND FINISHED SURFACES

A. Furnish one can of touch-up paint for each different color factory finish which is to be final finished surface of product.

B. Deliver touch-up paint with other "loose and detachable parts" to Owner as specified.

C. Transport and handle products in accordance with manufacturer’s instruction.

D. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

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

F. Store and protect products in accordance with manufacturer’s instructions.

G. Store with seals and labels intact and legible.

H. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

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

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

L. Structural mechanical iron, iron pipe supports, platforms, and any equipment which is not furnished with an enamel prime coat finish and furnished under this section of work, shall be wire brushed free of rust and scale and given two (2) coats of brown colored rust-proof paint applied by this Division of Work.

M. Any surfaces of existing or new equipment, in areas of work where finish has been used or destroyed, shall be refinished to match original finish.

1.08 SLEEVES AND OPENINGS

A. Base Requirements:
   1. Contractor shall provide concrete bases, for equipment as required or as indicated on Drawings or identified in specification sections.
   2. Contractor shall be responsible for location, size and any changes required by substitution of equipment.
   3. Provide alignment, foundation template drawings, anchor bolts and Embeco non-shrink grouting for bases in accordance with manufacturer's instructions.

1.09 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between ductwork, piping, and sleeves, structural or partition opening shall be responsibility of Contractor whose work penetrates an opening.

B. The responsible Contractor shall hire individuals skilled in such work, such as sealing and fireproofing. These individuals hired shall normally and routinely be employed in sealing and fireproofing occupation.

1.10 PRODUCT SUBSTITUTION PROCEDURES

A. Engineer will consider requests for Substitutions only within 15 days after date of Owner-Contractor Agreement.

B. Substitutions will not be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work that may be required for Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
   3. Engineer will notify Contractor in writing of decision to accept or reject request.

G. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

1.11 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Submit for equipment and systems as indicated in respective specification sections, marking each submittal with that specification section number.

C. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in Contract Documents.

D. Before submitting electrically powered equipment, verify that electrical power and control requirements for equipment are in agreement with motor starter schedule on electrical Drawings.

E. Contractor shall include a statement on Shop Drawing transmittal to Engineer/Architect that equipment submitted and motor starter schedule are in agreement or indicate any discrepancies.

F. Include wiring diagrams of electrically powered equipment.

G. Submit sufficient quantities of Shop Drawings to allow the following distribution:
   1. Operating and Maintenance Manuals: Three (3) copies.
   2. Testing, Adjusting and Balancing Contractor: One (1) copy.
   3. Engineer/Architect: One (1) copy each.

4. Contractor and Manufacturer: As required.

H. Shop Drawings Submittal Procedures:
1. Shop drawings shall include detailed dimensions, capacities, gauges, arrangement and operating clearances.
2. Incomplete submittals shall not be reviewed and Contractor will be held responsible for correction of work not having final approval.
3. Engineer will review or take other appropriate action on Contractor submittals, such as certified shop drawings, product data, samples and other data, which Contractor is required to submit, but only for limited purpose of checking for conformance with design concept and Contract Documents.
4. This review shall not include review of accuracy or completeness of details, such as quantities, dimensions, capacities, weights or gauges, fabrication processes, construction means or methods, coordination of work with other trades or construction safety precautions, all of which are sole responsibility of Contractor.
5. Engineer's review will be conducted with reasonable promptness while allowing sufficient time in Engineer's judgment to permit adequate review.
6. Review of specific items shall not indicate that Engineer has reviewed entire assembly of which said item is a component.
7. Engineer will not be responsible for any deviations from Contract Documents not submitted to Engineer in writing by Contractor.
8. Engineer will not be required to review partial submissions or those for which submissions of correlated items have not been received.
9. Review of certified drawings does not relieve Contractor of responsibility of furnishing and installing all system components, as per drawings and specifications for proper system operation with particular respect to BTU outputs, water and air flow capacities, minimum noise requirements and space limitations, nor from responsibility for errors or omissions of any sort in submittal drawings.
10. Engineer assumes no responsibility for Contractor calculated dimensions or exact quantities of materials on shop drawings.
11. Review by Engineer is subject to limitations of general conditions of the contract for construction.
12. Contractor shall thoroughly check all shop drawings prepared by subcontractors for materials or equipment suppliers with regard to measurements, size of members, materials and details to satisfy specifications and drawings.
13. Each drawing shall have a date of approval and signature of Contractor's reviewer.
14. If Contractor's shop drawings have been submitted and reviewed by Engineer for a particular product and Engineer has stamped "rejected", "revised and resubmit" or "submit specified items" after two reviews, any further review by Engineer for that particular product will require contractor to compensate Engineer for time spent for further review of that product at a rate of one hundred fifty dollars ($150.00) per hour.
15. Furnish approved and corrected shop drawings to all other Contractors whose work is affected.

1.12 OFF SITE STORAGE

A. Prior approval by Engineer/Architect is required.

B. Ductwork and metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for off site storage.

C. For pipe material that can be stored off site, no material will be accepted for off-site storage unless Shop Drawings for that material have been approved.

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

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

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

1.13 CERTIFICATES AND INSPECTIONS

A. Obtain and pay for Authorities Having Jurisdiction required inspections except those provided by Engineer/Architect in accordance with governing building code.

B. Deliver originals of these certificates to Engineer/Architect.

C. Include copies of certificates in Operating and Maintenance Manuals.

1.14 OPERATING AND MAINTENANCE MANUALS

A. Contractor shall submit to Engineer for review three bound copies of typewritten instructions covering complete maintenance and operation of the system.

B. Assemble material in three-ring or post binders, using an index at front of each volume and tabs for each system or type of equipment. In addition to data indicated in General Requirements, include following information:
   1. Copies of all approved Shop Drawings.
   2. Manufacturer's wiring diagrams for electrically powered equipment.
   3. Records of tests performed to certify compliance with system requirements.
   4. Certificates of inspection by regulatory agencies.
   5. Temperature control Record Drawings and control sequences.
   6. Parts list for manufactured equipment.
   7. Lubrication instructions, including list/frequency of lubrication done during construction.
   8. Warranties.
   9. Testing, Adjusting and Balancing Data.
   10. Additional information as indicated in technical specification sections.

C. Maintenance instructions shall include manufacturer’s literature on system major equipment components.

D. Maintenance instructions shall be explicit concerning time intervals for servicing and preventative maintenance, type and grades of oil and grease, packing materials, normal and

abnormal clearances, cleaning, methods of equipment adjustments and complete description and list of replacement parts and materials for wearing items.

E. Operation instructions shall include detailed step-by-step startup and shutdown procedures, normal operating ranges such as temperatures and pressures and yearly system changeover procedure.

1.15 TRAINING OF OWNER PERSONNEL

A. Instruct Owner's personnel in proper operation and maintenance of systems and equipment provided as part of this project. Videotape all training sessions.

B. Include not less than 1 hour of instruction, over total of 1 training session, using Operating and Maintenance manuals during this instruction.

C. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

D. Coordinate with Owner at least two weeks prior to scheduling training sessions.

1.16 RECORD DRAWINGS

A. In addition to data required by General Conditions, maintain temperature control Record Drawings on originals prepared by installing contractor and subcontractor. Include copies of these Record Drawings with Operating and Maintenance manuals.

B. Record Drawings shall be maintained by the Contractor on a daily basis.

1.17 MANUFACTURERS' FIELD SERVICES AND REPORTS

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 as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Owner 30 days in advance of required observations. Observer is subject to approval of Engineer/Architect and Owner.

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

D. Submit report in duplicate within (15) fifteen days of observation to Engineer for review.

PART 2 - PRODUCTS

2.01 IDENTIFICATION

A. Stencils: Not less than one-inch high letters/numbers for marking pipe and equipment.

B. Snap-On Pipe Markers: Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without use of adhesive, tape or straps. Not less than one-inch high letters/numbers and flow direction arrows for piping marking.
   1. W. H. Brady.
   2. Seton.
   3. Marking Services.
   4. Champion America.
   5. Or an approved equal.

C. Engraved Name Plates: White letters on a black background, 1/16-inch thick plastic laminate, beveled edges, screw mounting.
   1. Setonply Style 2060 by Seton Name Plate Company
   2. Emedolite- Style EIP by EMED Co.
   3. Marking Services.
   4. W. H. Brady.
   5. Or an approved equal.

2.02 NON-RATED PENETRATIONS

A. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors, and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

B. Duct Penetrations:
   1. Annular space between duct, with or without insulation, and non-rated partition or floor opening shall not be larger than two inches. Where existing openings have an annular space larger than two inches, patch space to match existing construction to within two inches around duct.
   2. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide four-inch sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 - EXECUTION

3.01 CONCRETE WORK

A. Division 03 – Concrete: Contractor shall provide cast-in-place concrete, unless otherwise noted.

B. Provide layout drawings, anchor bolts, metal shapes, and templates to be cast into concrete or used to form concrete for support of mechanical equipment.

3.02 CUTTING AND PATCHING

A. Cutting and patching of existing general construction (except pipe openings), as required to accommodate new system, will be provided by General Contractor.

B. If Contractor should neglect to inform other Sections of work of his opening requirements before that portion of building construction has been complete, this Contractor shall cut their own openings and provide framing and lintels as required.

C. Before cutting or drilling, he must obtain permission from Engineer/Architect and he shall repair any damage to Engineer/Architect satisfaction.

D. In the event holes must be cut through reinforced concrete, drill carefully so as to avoid spalling and unnecessary damage or weakening of structural members.

E. No chopping or breaking will be permitted.

F. Repair surfaces damaged during installation of new system to complete satisfaction of Owner and Engineer/Architect.

G. Do not cut through any building structural members without prior approval from Engineer/Architect.

H. Openings in general construction shall be neatly cut with smooth edges and opening shall be made only large enough to accommodate new system.

I. Other openings shall be machine sawed.

J. Breaking or chopping out will not be permitted.

3.03 BUILDING ACCESS

A. Arrange for necessary openings in building to allow for admittance of all apparatus.

B. When building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after apparatus has been brought into building.

3.04 EQUIPMENT ACCESS

A. Install piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service.

B. Coordinate exact location of wall and ceiling access panels and doors with General Contractor, making sure that access is available for all equipment and specialties.

C. Where access is required in plaster walls or ceilings, furnish access doors to General Contractor.

D. Provide color-coded thumb tacks or screws, depending on surface, for use in accessible ceilings which do not require access panels.

3.05 COORDINATION

A. Verify that devices are compatible for surfaces on which they will be used including, but not limited to, diffuser and grille units installed in or on architectural surfaces.

B. Coordinate work with other contractors prior to installation.

C. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at installing contractor's expense.

D. Cooperate with test and balance agency in ensuring compliance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

E. Verify system completion to test and balance agency including;
1. Flushing.
2. Pressure testing.
3. Provide clean filters.
4. Provide clean strainers.
5. Duct and pipe system cleaning.
6. Controls adjusted and calibrated.
7. Controls cycled through their sequences are ready for testing, adjusting and balancing work.

F. Install dampers, shutoff valves, gauges, and temperature controls required for functional and balanced systems.

G. Demonstrate starting, interlocking and control features of each system so test and balance agency can perform its work.

3.06 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background.

B. Use a primer where necessary for proper paint adhesion.

C. Do not label equipment such as ceiling fans in occupied spaces.

D. Where stenciling is not appropriate for equipment identification, engraved nameplates may be used.

E. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of partition where exposed piping passes through walls, floors, or roofs.

F. Place flow directional arrows at each pipe identification location.

G. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified.

H. Schedules in mechanical rooms to be framed under clear plastic.

I. Use engraved nameplates to identify control equipment.

3.07 LUBRICATION

A. Lubricate bearings with lubricant as instructed by manufacturer before equipment is operated for any reason.

B. Once equipment has been run, maintain lubrication in accordance with manufacturer's instructions until the work is accepted by Engineer/Architect.

C. Maintain a log of lubricants used and frequency of lubrication and include this information in Operating and Maintenance Manuals at completion of project.

3.08 SEALING AND FIRESTOPPING

A. Non-Rated Partitions:
   1. In exterior wall openings below grade, assemble rubber links of mechanical seal to proper size for pipe and tighten in place, in accordance with manufacturer's instructions.
   2. At interior partitions and exterior walls, pipe penetrations are required to be sealed.
   3. Apply sealant to both sides of penetration in such a manner that annular space between pipe sleeve or cored opening and pipe or insulation is completely blocked.
   4. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include toilet rooms and mechanical rooms.

3.09 PROJECT CLOSEOUT

A. Contractor shall provide the following submittal data prior to final site walk-through review.

B. Closeout Data Submittals:
   1. Record Drawing submission.
   2. Air balance test reports.
   3. Operating and maintenance manuals.
   4. Instructional walk-through and training.
   5. Inspector’s test reports as follows:
      a. HVAC inspector.
   6. Pipe Pressure test reports as follows:
      a. Special systems.
      b. Gas piping leak test.
   7. System startup reports:
      a. Heating equipment.
      b. Temperature control equipment.
   8. Closeout statements:
      a. Work completion.
      b. Warranty statements.

c. Punch list completion.

END OF SECTION 23 05 00

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SECTION 23 05 10

HVAC ELECTRICAL CONNECTIONS AND MOTOR STARTERS

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all starting equipment including push button and pilot light stations, selector switches, motor starters, and relays.

B. Furnish components to Electrical Contractor with complete installation instructions and wiring diagrams required for complete installation.

C. Provide all low voltage wiring (less than 110 volts) required by HVAC system.

D. Provide complete installation instructions and wiring diagrams for all HVAC equipment requiring electrical wiring.

E. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section
2. Section 23 05 13 – Common Motor Requirements for HVAC Equipment.
3. Division 26 – Electrical.

1.02 ABBREVIATIONS

Man. Str.	Manual Starter
Mag. Str.	Magnetic Starter
Stat.	Thermostat
T.C.	Temperature Control subcontractor
HVAC	Heating, Ventilating & Air Conditioning Contractor
E.C.	Electrical Contractor
Disc. Sw.	Disconnect Switch

1.03 REFERENCES

A. The Institute of Electrical and Electronics Engineers, Inc (IEEE)
1. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.

B. Association of Electrical and Medical Imaging Equipment Manufacturers (NEMA)
1. ANSI/NEMA MG-1 – Motors and Generators.
2. ANSI/NEMA MG1-Part 31 - Application of Induction Motors with Variable Frequency Drives .

C. National Fire Protection Association (NFPA):

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories, Inc. (UL)

1.04 ELECTRICAL REQUIREMENTS

A. Line voltage wiring is required to relay on energy recovery ventilator to close fresh air damper and exhaust damper whenever unit fan motor is shut down.

1.05 SUBMITTALS

A. Division 01: Requirements for submittals.

B. Submit shop drawings for motor starters. Include information with motor starter submittals on identification of motor starters as specified.

C. Motor starter submittals shall indicate starter features and options, auxiliary contactors and installation instructions.

D. For stand alone motors and equipment furnished with motors, include with equipment which motor drives, the following motor information:
1. Motor manufacturer.
2. Horsepower.
3. Voltage,
4. Phase,
5. Hertz,
6. RPM.
7. Full load efficiency.
8. Related power factor.
9. Installation and Maintenance Instructions.

E. Submit wiring diagrams for motor starters and HVAC equipment requiring wiring by Electrical Contractor for this project.

F. Include manufacturer's instructions in the manuals with specific equipment to which they apply. Also include following information, if not previously documented on shop drawings:
1. Full load power factor.
2. Service factor.
3. NEMA design designation.
4. Insulation class.
5. Frame type.

1.06 ELECTRICAL COORDINATION AND GENERAL REQUIREMENTS

A. Starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, and other devices required for control of motors or electrical equipment shall be furnished by HVAC Contractor and turned over for installation by Electrical Contractor, unless stated otherwise.

B. Drawings and specifications show number and horsepower rating of motors furnished by Contractor, together with their actuating devices, if devices are furnished by HVAC Contractor.

C. Discrepancies in size, horsepower rating, electrical characteristics, or means of control be found for motors or other electrical equipment after contracts are awarded, Contractor shall immediately notify Engineer/Architect of discrepancy.

D. Costs involved in changes required due to equipment substitutions initiated by Contractor shall be responsibility of Contractor.

E. Electrical Contractor shall provide line voltage power wiring.

F. HVAC Contractor shall be responsible for providing control wiring (line and low voltage) for project, including installation of interlock wiring of line and low voltage motorized automatic dampers.

G. Furnish project specific wiring diagrams to Electrical Contractor for equipment, starters and devices furnished by Contractor and indicated to be wired by Electrical Contractor.

H. Provide on front enclosure face of starting equipment, selector switches and push-button stations, a securely mounted, laminated plastic engraved name plate which shall identify motorized equipment served by respective starter.

I. Name tags shall be constructed of black and white plastic (black face and white lettering) with 1/4-inch high lettering. Lettering shall identify unit served by plan identification mark (example: "Exhaust Fan EF-1").

1.07 PRODUCT REQUIREMENTS

A. Motor starters to conform to applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by UL for service specified.

B. Magnetic starters shall be equipped with adequate interlocks and relays for equipment control interlocking. Provide minimum of one normally open and one normally closed auxiliary contacts.

PART 2 - PRODUCTS

2.01 MOTOR STARTERS

A. Manufacturers:
   1. Models specified are based on Allen-Bradley starters and accessories.
   2. Equivalent units as manufactured by:
      a. Square D.
      b. General Electric
      c. Cutler Hammer/Westinghouse.
      d. Cerus Industrial.
      e. Substitutions: In accordance with Division 01 – General Requirements.

2.02 MANUAL STARTERS

A. Manual starters shall be two-pole type, compatible for use with single-phase motors and include overload protection, general purpose (NEMA 1) enclosure and toggle operation.

B. Units shall have neon or L.E.D. type pilot lights and "On-Off" or "Hand-Off-Auto" selector switched as specified on plan schedule.

C. Manual starter types:
   1. Manual starters: Bulletin 600-TAX5 or Cerus Model BAS-1P.
   2. Manual starters with pilot light: Bulletin 600-TAX109.
   3. Manual starters with "Hand-Off-Auto" selector switch: Bulletin 600-TAX9.
   4. Manual starters with "Hand-Off-Auto" selector switch and pilot light: Bulletin 600-TAX142.

2.03 MAGNETIC STARTERS

A. Magnetic starters shall be three pole type, compatible for use with three-phase motors and include general purpose (NEMA 1) enclosure, manual reset button in front cover and overload and under-voltage protection.

B. Provide necessary control circuit transformers with fused protection and auxiliary contactors.

C. Units shall be non-combination or combination type and have pilot light and "On-Off" or "Hand-Off-Auto" selector switches as specified on Drawing schedule.

D. Magnetic starter types:
   1. Magnetic Starters (Non-Combination): Bulletin 509.
   2. Magnetic Combination Starters: Bulletin 513 with circuit breaker disconnect switch.

PART 3 - EXECUTION

3.01 SCHEDULE

A. Reference Drawings for electrical connection schedule.

3.02 MOTOR STARTER INSTALLATION

A. Motor starting equipment shall be delivered to selected location on job site by Contractor furnishing starters and turned over to installing Contractor.

B. Provide coordination, supervision and instructions to installing Contractor.

C. Motor starting equipment shall be clearly tagged and identified with respect to motor which it serves. Hand marking or "magic-marker" type method is not acceptable.

D. Motor starters shall be installed in strict accordance with manufacturer's instructions and recommendations.

END OF SECTION 23 05 10

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SECTION 23 05 13

MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Single Phase, Single Speed Motors.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern Work under this Section.
   2. Section 23 05 00 - Basic HVAC Requirements.
   3. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
   4. Division 26 - Electrical.

1.02 REFERENCES

A. American National Standards Institute:
   1. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
   2. ANSI/NEMA MG-1 - Motors and Generators.
   3. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Include with equipment which motor drives, the following motor information:
   1. Motor manufacturer.
   2. Horsepower.
   3. Voltage.
   4. Phase.
   5. Hertz.
   6. RPM.
   7. Full load efficiency.
   8. Include project wiring diagrams prepared by Contractor specifically for this work.

1.04 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Include manufacturer's instructions in manuals with specific equipment to which they apply. Also include the following information if not previously documented on shop drawings:
   1. Full Load Power Factor.
   2. Service Factor.
   3. NEMA Design Designation.

4. Insulation Class.
5. Frame Type.

1.05 ELECTRICAL COORDINATION

A. All starters, overload relay heater coils, control relays, pushbuttons, pilot lights, and other devices required for control of motors or HVAC equipment are furnished by HVAC Contractor and installed by Electrical Contractor, except as specifically noted.

B. Mechanical drawings show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by Electrical Contractor.

C. Should discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify Engineer/Architect of such discrepancy.

D. Costs involved in any changes required due to equipment substitutions initiated by this Contractor will be responsibility of this Contractor.

E. Electrical Contractor will provide power wiring, except temperature control wiring.

F. Furnish project specific wiring diagrams to Electrical Contractor for equipment and devices furnished by this Contractor and indicated to be wired by Electrical Contractor.

1.06 PRODUCT CRITERIA

A. Motors to conform to applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for service specified.

B. Select motors for conditions in which they will be required to perform such as general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 - PRODUCTS

2.01 SINGLE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated 115 volt, single phase, 60 hertz motors for motors 1/3 HP and smaller.

B. Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

B. When motor will be flexible coupled to driven device, mount coupling to shafts in accordance with coupling manufacturer's recommendations.

C. Using a dial indicator, check angular misalignment of two shafts; adjust motor position as necessary so that angular misalignment of shafts does not exceed 0.002 inches per inch diameter of coupling hub.

D. Using dial indicator, check shaft for run-out to assure concentricity of shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

E. When motor will be connected to driven device by means of a belt drive, mount sheaves on appropriate shafts in accordance with manufacturer's instructions.

F. Use a straight edge to check alignment of sheaves; reposition sheaves as necessary so that straight edge contacts both sheave faces squarely.

G. After sheaves are aligned, loosen adjustable motor base so that belt(s) can be added and tighten base so that belt tension is in accordance with drive manufacturer's recommendations.

H. Frequently re-check belt tension and adjust if necessary during first day of operation and again after 80 hours of operation.

I. Lubricate motors requiring lubrication. Record lubrication material used and frequency of use. Include this information in maintenance manuals.

END OF SECTION 23 05 13

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Air systems testing, adjusting and balancing.

B. Related Sections
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 23 05 00 - Basic HVAC Requirements.
   3. Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC) for HVAC Shop Drawings to be given to test and balance agency and for coordination between Contractor and firm performing the work in this section.
   4. Division 23 - Heating, Ventilating, and Air-Conditioning: Drawings and specifications which define scope of systems to be balanced. Reference to construction bulletins for proposed changes and to change orders for changes that have been accepted.
   5. Division 26 – Electrical: Electrical drawings and specifications which define scope of electrical systems that serve mechanical equipment.

1.02 REFERENCES

A. Associated Air Balance Council (AABC)
   1. AABC - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems, Current Edition.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
   1. ASHRAE - ASHRAE Handbook, HVAC Applications - Testing Adjusting and Balancing, Current Edition.

C. National Environmental Balancing Bureau (NEBB)
   1. NEBB - Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Current Edition.

1.03 QUALITY ASSURANCE

A. Qualifications: An independent firm specializing in the testing and balancing of HVAC systems for a minimum of three (3) years. A firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installed testing and balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

B. A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of project. If certification of firm or any staff performing work is terminated or expires during the duration of project, contact Architect/Engineer immediately.

C. Technicians on this project must have satisfactorily completed work on a minimum of three (3) projects of at least 50 percent in size, and of similar complexity.

D. Submit Qualifications of firm and project staff to Architect/Engineer upon request.

1.04 PRE-INSTALLATION MEETING AND SCHEDULING

A. Test and balance agency shall be required to attend a pre-installation meeting with other project Contractors before construction process is started.

B. Test and balance agency shall provide input on time requirements for work required in this section.

1.05 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Submit testing, adjusting and balancing reports bearing seal and signature of NEBB or AABC Certified Test and Balance Supervisor.

C. Reports to be certified proof that systems have been tested, adjusted and balanced in accordance with referenced standards; are an accurate representation of how systems have been installed and are operating; and are an accurate record of final quantities measured to establish normal operating values of systems.

D. Submit six (6) complete sets of reports. If information is incomplete or further testing, adjusting and balancing is deemed necessary, resubmit complete sets.

E. Format: Bind report forms in three-ring binders or portfolio binders.

F. Label edge or front with label identifying project name, project number and descriptive title of contents.

G. Divide contents of report into below listed divisions, separated by divider tabs:
   1. General information.
   2. Summary.
   3. Air systems.

H. Contents: Provide the following minimum information, forms and data:
   1. General Information:
      a. Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Construction Manager, Project Name, and Project Number.
      b. Include addresses, contact names and telephone numbers.

c. Also include a certification sheet containing seal and signature of Test and Balance Supervisor.

2. Summary:
   a. Provide summary sheet describing mechanical system deficiencies.
   b. Describe objectionable noise or drafts found during testing, adjusting, and balancing.
   c. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within scope of the contract, are design related or installation related.
   d. List instrumentation used during testing, adjusting and balancing procedures.
3. Remainder of report to contain appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

1.06 TESTING, ADJUSTING AND BALANCING REQUIREMENTS

A. Provide total mechanical systems testing, adjusting and balancing. Requirements include balance of air distribution, adjustment of new systems to provide design quantities indicated on Drawings, electrical measurement and verification of performance of all equipment, all in accordance with standards published by AABC or NEBB.

B. Balancing work shall be performed by AABC or NEBB certified air balance agency. Certification number and seal of registration shall be included with each balancing report.

C. Test, adjust and balance all air systems so that each room, piece of equipment or terminal device is using quantities indicated on Drawings and in specifications.

D. Test and balance agency is encouraged to make periodic site visits to make sure that provisions are being made to accomplish specified testing, adjusting and balancing work.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. Provide required instrumentation to obtain proper measurements.

B. Application of instruments and accuracy of instruments and measurements to be in accordance with requirements of NEBB or AABC Standards and instrument manufacturer's specifications.

C. Instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by Owner upon request.

D. Calibration and maintenance of all instruments to be in accordance with requirements of NEBB or AABC Standards

PART 3 - EXECUTION

3.01 PRELIMINARY PROCEDURES

A. Obtain preconstruction meeting report, applicable construction bulletins, applicable change orders, and approved Shop Drawings of equipment, outlets/inlets, and temperature controls.

B. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

C. Notify Engineer/Architect on daily basis during balancing.

D. Identify deficiencies preventing completion of testing, adjusting, and balancing procedures. Do not proceed until systems are fully operational with components necessary for complete testing, adjusting, and balancing.

E. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing, and assist Balancing Agency in providing specified system performance.

3.02 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing, adjusting, and balancing procedures on each system identified, in accordance with detailed procedures outlined in referenced standards except as may be modified below.

B. Unless specifically instructed in writing, all work in this specification section is to be performed during normal workday.

C. If ceiling construction is such that access panels are required for the work of this section and panels have not been provided, inform Engineer/Architect.

D. Cut ductwork for installation of test probes to minimum extent necessary for adequate performance of procedures.

E. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

F. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

G. Measure and record system measurements at fan to determine total flow.

H. Adjust equipment as required to yield specified total flow at terminals.

I. Proceed taking measurements in mains and branches as required for final terminal balancing.

J. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors, and valves prior to adjustment of terminals.

K. Measure and record static air pressure conditions across fans, coils and filters.

L. Spot check static air pressure conditions directly ahead of terminal units.

M. Determine air handling system total supply and return airflow and return and exhaust fan total airflow at each piece of equipment utilizing a pitot tube duct traverse. Summation of air terminal inlet/outlet CFM's is not acceptable, unless a pitot tube traverse is impractical. If summation of the air inlets/outlets is used in lieu of traverse method, a valid explanation shall be submitted along with balancing reports. Insufficient back-up information to support use of summation method is cause for rejection of balancing reports without review.

N. Balance modulating dampers at extreme conditions and record both sets of data.

O. Adjust register, grille, and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within capabilities of installed system.

P. Provide fan and motor drive sheave adjustments necessary to obtain design performance.

Q. If work of this section indicates that any drive or motor is inadequate for application, advise Engineer/Architect by giving properly sized motor and drive information.

R. Verify that any change will keep duct system within its design limitations with respect speed of device and pressure classification of distribution system.

S. Time and material for motor/drive changes will be considered a reimbursable expense and will require an itemized cost breakdown of all time and drive changes submitted to Engineer/Architect; prior authorization is needed before this work is started.

T. Areas or rooms designed to maintain positive, negative, or balanced air pressures with respect to adjacent spaces, as indicated by design air quantities, require special attention.

U. Adjust fan drives, distribution dampers, terminals, and controls to maintain indicated pressure relationship.

V. Final air system measurements to be within the following range of specified cfm:
   1. Fans: -5 percent to +10 percent.
   2. Supply grilles, registers, diffusers: -5 percent to +10 percent.
   3. Return/exhaust grilles, registers: +5 percent to -10 percent

W. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

X. Permanently mark equipment settings, including damper positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

Y. Leave systems in proper working order, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

3.03 DEFICIENCIES

A. Mechanical Contractor to correct any installation deficiencies found by test and balance agency that were specified and shown on Contract Documents to be performed as part of that division of work.

B. Test and balance agency shall notify Engineer/Architect of these items and instructions will be issued to Mechanical Contractor for correction of deficient work.

C. Corrective work to be done at no cost to Owner.

D. Retest mechanical systems, equipment, and devices after corrective work is completed as specified.

END OF SECTION 23 05 93

SECTION 23 09 13

INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Control Dampers.
2. Thermostats.
3. Temperature Sensors.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 23 05 00 - Basic HVAC Requirements.
3. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: Coordination.
4. Section 23 33 00 – Air Duct Accessories: Control damper installation.

1.02 QUALITY ASSURANCE

A. Installing Contractor must be a manufacturer's branch office or an authorized representative of control equipment manufacturer that provides engineering and commissioning of manufacturers control equipment.

B. Submit written confirmation of such authorization from manufacturer.

C. Indicate in letter of authorization that installing Contractor has successfully completed necessary training required for engineering, installation, and commissioning of equipment and systems to be provided for project, and that such authorization has been in effect for a period of not less than three years.

1.03 REFERENCES

A. Air Movement and Control Association (AMCA)
1. AMCA 500-D-Laboratory Method of Testing Dampers for Rating.

B. ASTM International
1. ASTM D635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
2. ASTM D1693 - Environmental Stress-Cracking of Ethylene Plastics.

C. Underwriters Laboratories, Inc. (UL)
1. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.04 SUBMITTALS

A. Division 01 – General Requirements: - Submittal Procedures: Shop drawings, product data and samples.

B. Submit the following information:
1. Manufacturer's data sheets indicating model number, pressure and temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance.
2. General catalog sheets showing a series of same device is not acceptable unless specific model is clearly marked.
3. Include temperature sensor color information offered by the manufacturer for Engineer approval.
4. Schematic flow diagrams of systems showing fans, pumps, coils, filters, dampers, valves, and other control devices.
5. Label each device with setting or adjustable range of control.
6. Indicate wiring, clearly, differentiating between factory and field installed wiring.
7. Wiring should be shown in schematics that detail contact states and relay references; Diagrammatic representations of devices alone are not acceptable.
8. Details of construction, layout, and location of each temperature control panel within building, including instruments location in panel and labeling.
9. Include on Shop Drawings location of mechanical equipment controlled by room number, horsepower and flow of motorized equipment when this data is available on Drawings, locations of remote sensors and control devices by room number or column lines.
10. Schedule of control dampers indicating sizes, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.
11. A complete description of each control sequence for equipment that is controlled.
12. Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.

C. Operating and Maintenance Manuals: Furnish three (3) bound operating and maintenance manuals for review and approval prior to substantial completion, performance testing, and training. Manuals to include the following:
1. Operation and maintenance instructions for equipment and systems provided.
2. Recommendations for frequency of service and preventative maintenance.
3. List indicating types and grades of oil and grease, packing materials, normal and abnormal tolerances for devices, and method of equipment adjustment.
4. Description of recommended replacement parts and materials which Owner should stock.
5. A summary of equipment vendors, or location where replacement parts can be purchased.
6. Manufacturer's literature indicating features, materials of construction, and operating limits of installed equipment. Brochures giving brief descriptions of multiple pieces of control apparatus are not acceptable.
7. A complete set of control Record Drawings.
8. Name, address, and telephone number of person or office to contact for service during warranty period.

9. Name, address, and telephone number of person or service organization to be contacted for service after warranty period.

1.05 DESIGN CRITERIA

A. Size control apparatus to properly supply and operate and control apparatus served.

B. Provide control devices subject to corrosive environments with corrosion protection or construct control devices so they are suitable for use in such an environment.

C. Provide devices exposed to outside ambient conditions with weather protection or construct devices so they are suitable for outdoor installation.

D. Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet requirements of electrical sections in Division 26 – Electrical.

1.06 TRAINING

A. Provide a minimum of 1 hour of training to Owner's personnel, concerning proper operation and maintenance of all control systems and all sensing, monitoring, and control equipment. Conduct training sessions during normal business hours after system start-up and acceptance by Owner.

B. Submit operating and maintenance manuals to Engineer/Architect minimum of five (5) working days prior to training session. Use these manuals as basis for instruction at all training sessions.

1.07 MATERIAL DELIVERY AND STORAGE

A. Provide factory shipping cartons for each piece of equipment and control device. Contractor is responsible for storage of equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION AND CONTROL DEVICES

A. Manufacturers:
1. Honeywell.
2. Johnson Controls, Inc.
3. Siemens.
4. TAC.
5. Invensys, Siebe.
6. Kreuter, KMC.
7. Substitutions: In accordance with Division 01.

2.02 CONTROL DAMPERS

A. Provide control dampers shown on Drawings and as required to perform specified functions.

B. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal or greater than ductwork pressure class as specified in Section 23 31 00 – HVAC Ducts and Casings, of ductwork where damper is installed.

C. Use only factory-fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for maximum temperature and air velocities encountered in system.

D. Dampers, unless otherwise specified, to be rated at a minimum of 180 degrees F working temperature.

E. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1-inch w.g.	≤3 CFM/ft^2
Class I	4-inch w.g.	≤8 CFM/ft^2
Class I	8-inch w.g.	≤11 CFM/ft^2
Class I	12-inch w.g.	≤14 CFM/ft^2

F. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

G. Steel Framed Dampers:
1. Manufacturers:
   a. Nailor Models 2010 and 2020.
   b. Greenheck Models VCD-33 and VCD-42.
   c. Johnson Controls Model V-1330.
   d. Ruskin Models CD60 and CD40.
   e. Substitutions: In accordance with Division 01.

H. Aluminum Frame and Blade Dampers:
1. Manufacturers:
   a. Nailor Models 2010EAF and 202EAF.
   b. Greenheck Model VCD-43.
   c. Ruskin Model CD50.
   d. Arrow Model AFD-20.
   e. Substitutions: In accordance with Division 01.

I. Dampers to have frames of not less than 16-gauge galvanized steel or 12-gauge extruded aluminum.
1. Blades shall be two-ply steel airfoil of not less than 2 x 20-gauge galvanized steel (14-gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings.
2. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

J. Extend jackshafts outside of ductwork for external actuator mounting.

K. Provide bearings on point of exit for support of damper shafts to prevent wear on shaft and ductwork.

L. If locating actuators out of air stream is impossible, obtain mounting location approval from Engineer unless Contract Documents indicate in air stream mounting is acceptable.

M. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered.

N. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking.

O. Electric actuators shall be provided with overload protection to prevent motor from damage when stall condition is encountered.

P. Provide operators with linkages and brackets for mounting on device served.

2.03 ELECTRIC/ELECTRONIC THERMOSTATS

A. Electric Thermostats:
1. For single setpoint applications, provide line or low voltage electric type suitable for heating as required.
2. For line voltage ventilation applications utilizing fans and where otherwise specified in sequence of operations, provide an integral manual On/Off/Auto selector switch.
3. Minimum contact rating shall be equal to electrical load of device being controlled.

2.04 TEMPERATURE SENSORS

A. Manufacturers (Thermistor Temperature Sensor):
1. PreCon.
2. BAPI.
3. ACI.
4. Substitutions: In accordance with Division 01.

B. Use thermistor or RTD type temperature sensing elements constructed so accuracy and life expectancy is not affected by moisture, physical vibration, or other conditions that exist in each application.

C. RTD's shall be of nickel or platinum construction and have a base resistance of 1000 ohms at 70 degrees F and 77 degrees F respectively.

D. 100-ohm platinum RTD's are acceptable if used with temperature transmitters.

E. RTD:
1. Accuracy (Room Sensor Only): Minimum $\pm$ 1.0 degrees F.
2. Accuracy (Averaging): Minimum $\pm$ 1.2 degrees F.

3. Accuracy (Other than Room Sensor or Averaging): Minimum ± 0.65 degrees F.
4. Range: minimum -40 to 220 degrees F.

F. Thermistor:
1. Accuracy (All): Minimum ± 0.36 degrees F.
2. Range: Minimum -30 to 230 degrees F.
3. Heat Dissipation Constant: Minimum 2.7 mW/degree C.

G. Temperature Transmitter:
1. Accuracy: Minimum ± 0.1 degree F or ±0.2 percent of span.
2. Output: 4-20 mA.

H. Provide limited range or extended range sensors if required to sense range expected for a respective point.

I. Use RTD type sensors for extended ranges beyond -30 to 230 degrees F.

J. Use wire size appropriate to limit temperature offset due to wire resistance to 1.0 degree F.

K. If offset is greater than 1.0 degree F due to wire resistance, use temperature transmitter.

L. Provide sensors in occupied spaces with brushed aluminum or brushed nickel covers unless otherwise noted or features specified will not allow for this.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install system with trained mechanics and electricians employed by control equipment manufacturer or an authorized representative of manufacturer.

B. Where installing Contractor is an authorized representative of control manufacturer, such authorization shall have been in effect for a period of no less than three years.

C. Install control equipment, accessories, wiring, and piping in a neat and workmanlike manner.

D. Control devices must be installed in accessible locations.

E. Contractor shall verify that all control devices furnished under this Section are functional and operating mechanical equipment.

F. Control Contractor to ensure that each device is operating per control sequences as shown on drawings.

G. Label control devices with exception of dampers, with permanent printed labels that correspond to control drawings.

H. Identify temperature control junction and pullboxes by using spray painted green covers.

I. Other electrical system identification shall follow Division 26 – Electrical.

J. Provide mounting stand-offs where necessary for adequate support.

K. This Contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates building if equipment is installed prior to building being enclosed.

L. Provide electrical relays and wiring, line and low voltage, for control systems, devices, and components.

M. Install high voltage and low voltage wiring, including low voltage cable, in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit.

N. Reference Wire Conduit Installation Schedule below for specific conduit to be used.

O. Conduit shall be installed in accordance with Division 26 of this specification and National Electrical Code.

P. Conduit shall be a minimum of 1/2-inch for low voltage control provided pipe fill does not exceed 40 percent.

Q. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. Low voltage wiring to be stranded.

R. Low voltage wiring can be run without conduit above accessible lay-in tile ceilings.

S. Wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in other locations shall be in conduit.

T. Wire for wall sensors must be run in conduit.

U. Run wiring for radiation valves in conduit where routed through walls.

V. Where wiring is installed free-air, installation shall be as follows:
   1. Wiring shall utilize cable tray wherever possible.
   2. Wiring shall run at right angles and be kept clear of other trades work.
   3. Support wiring using "J" or "Bridal-type" steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams.
   4. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through ring.
   5. For mounting rings that do not completely surround wire, attach wire to mounting ring with a strap.
   6. Space supports at a maximum 4-foot interval unless limited by building construction. If wiring "sag" at mid-span exceeds 6 inches; provide an additional support.
   7. Sleeve wall penetrations.
   8. Do not attach wring to existing cabling, existing tubing, plumbing or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

W. When switch is in "hand" position, allow manual operation of selected device without operating interlocked motors but allowing all unit safety devices to stay in circuit.

X. Electrical wiring is to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with Record Drawings.

Y. After completion of installation, test and adjust control equipment.

Z. Submit data showing set points and final adjustments of controls.

3.02 WIRE CONDUIT INSTALLATION SCHEDULE

A. Following conduit schedule shall apply to wire in conduit where conduit is specified for wiring.

B. Conduit referenced below shall meet specifications in Division 26 - Electrical and as defined below.

C. Conduit other than that specified below for specific applications shall not be used. Comply with following schedule:
   1. Concealed in Concrete and Block Walls: Rigid steel conduit.

3.03 CONTROL DAMPERS

A. Control dampers furnished by control manufacturer are to be installed by Mechanical Contractor under coordinating control and supervision of Control Contractor in locations shown on Drawings or where required to provide specified sequence of control.

B. Coordinate installation with sheet metal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted.

C. Each operator shall serve a maximum damper area of 36 square feet.

3.04 ROOM THERMOSTATS AND TEMPERATURE SENSORS

A. Check and verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation.

B. Locate room thermostats and sensors distance as shown on drawings.

C. Mount any room sensors mounted on an exterior wall on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

D. Provide guards on thermostats in entrance public areas, or in locations where thermostat is subject to physical damage.

END OF SECTION 23 09 13

SECTION 23 11 00

FACILITY FUEL PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Propane Piping.
2. Vent and Relief Valve Piping.
3. Unions and Flanges.
4. Propane Gas Service.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 23 05 00 - Basic HVAC Requirements.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. ASME 16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.3 - Malleable Iron Threaded Fittings.
3. ASME B16.5 – Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
4. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.
5. ASME B31.9 – Building Services Piping.
6. ASME BPVC Section IX - Welding and Brazing Qualifications.

B. ASTM International (American Society for Testing and Materials):
1. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
2. ASTM A105 – Specification for Carbon Steel Forgings for Piping Applications.
3. ASTM A181 – Specification for Carbon Steel Forgings, for General-Purpose Piping.
4. ASTM A197 – Specification for Cupola Malleable Iron.
5. ASTM A234 - Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
6. ASTM D2513 – Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.

C. Code of Federal Regulations (CFR)
1. 48 CFR 192.285 - Plastic pipe: Qualifying persons to make joints.

D. National Fire Protection Association (NFPA)
1. NFPA 54 – National Fuel Gas Code, latest edition.

1.03 SUBMITTALS

A. Division 01 – General Requirements: Submittal Procedures: Shop Drawings, product data, and samples.

B. Contractor shall submit schedule indicating ASTM designation of pipe being proposed along with its type and grade and sufficient information to indicate type and rating of fittings for each service.

C. Type "E" or "S" Steel Pipe:
   1. Mill certification papers, also known as material test reports, for pipe furnished for this project, in English.
   2. Heat numbers on these papers to match heat numbers stenciled on pipe.
   3. Chemical analysis indicated on mill certification papers to meet or exceed requirements of referenced ASTM specification.

D. Welder Qualifications:
   1. Before any metallic welding is performed, Contractor shall submit his Standard Welding Procedure Specification together with Procedure Qualification Record as required by Section IX of ASME BPVC and National Certified Pipe Welding Bureau.
   2. Before any polyethylene fusion welding is performed, Contractor shall submit certification that welders to be used on this project have successfully demonstrated proper welding procedures in accordance with Code of Federal Regulations, Title 49, Part 192, Section 192.285.
   3. Engineer reserves right to test Work of any welder employed on Project, at Contractor's expense. If Work of welder is unsatisfactory, prevent welder from doing further welding on Project.

1.04 QUALITY ASSURANCE

A. Order Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on size of pipe, and in accordance with appropriate ASTM specification.

B. Contractor must replace any installed material not meeting Specification requirements with material that meets those requirements without additional cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure that material is undamaged and complies with specifications.

B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation.

C. Do not store materials directly on grade.

D. Protect pipe, tube, and fitting ends from damage. Take precautions to keep provided or specified end caps in place.

E. Off-site storage agreements will not relieve Contractor from using proper storage techniques.

F. Storage and protection methods must allow inspection to verify products.

1.06 DESIGN CRITERIA

A. Use only new material, free of defects, rust, and scale, and meeting latest revision of ASTM specifications as listed in this Section.

B. Construct piping for highest pressures and temperatures in respective system in accordance with ASME B31.9, but not less than 125 psig unless specifically indicated otherwise.

C. Non-metallic piping will be acceptable only for services indicated. It shall not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.

D. Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

E. Where ASTM A53, Grade A pipe is specified, ASTM A53 Grade B pipe may be substituted at Contractor's option. Where no grade or type is specified, Contractor may choose from those commercially available.

F. Piping systems shall comply with NFPA 54, current edition.

1.07 L.P. GAS SERVICE

A. Contractor shall pay charges for propane tank service and installation, including all required valving, piping, and tank sitting requirements.

PART 2 - PRODUCTS

2.01 PROPANE PIPING

A. 2-Inch and Smaller: ASTM A53, Type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ASME B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ASME B16.9 standard weight, seamless, carbon steel weld fittings.

B. Underground Propane Gas: ASTM D2513 thermoplastic polyethylene gas pressure pipe with butt-weld or socket-type polyethylene fusion joints and fittings.

2.02 VENT AND RELIEF VALVES

A. Use pipe and fittings specified for system to which relief valve or vent is connected.

2.03 UNIONS AND FLANGES

A. 2-Inch and Smaller:
   1. ASTM A197/ASME B16.3 malleable iron unions with brass seats.
   2. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.
   3. Use unions of pressure class equal to or higher than that specified for fittings of respective piping service but not less than 250 psi.

PART 3 - EXECUTION

3.01 PREPARATION

A. Remove foreign material from interior and exterior of pipe and fittings.

3.02 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights not obstructing any portion of a window, doorway, stairway, or passageway.

B. Where interferences develop in field, offset or reroute piping as required to clear such interferences. In all cases, consult Drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

C. Provide anchors, expansion joints, swing joints, and expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

D. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

E. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) diameter of main.

F. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including required service space for this equipment, unless piping is serving this equipment.

G. Install valves, and piping specialties, including items furnished by others, as specified and detailed.

H. Make connections to equipment installed by others where that equipment requires piping services indicated in this section.

3.03 WELDED PIPE JOINTS

A. Make welded joints by fusion welding in accordance with ASME B31, and State and local codes where applicable.

B. Electrodes shall be Lincoln, with coating and diameter as recommended by manufacturer for type and thickness of work performed.

3.04 THREADED PIPE JOINTS

A. Use Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.05 PROPANE PIPING

A. Pitch horizontal piping down 1-inch in 60 feet in direction of flow. Install a 4-inch minimum depth dirt leg at bottom of each vertical run and at each appliance.

B. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended.

C. Branch connections to main shall be from top or side of main.

D. Install a shut off valve at each appliance. Provide valved connection at main for equipment and appliances furnished by others.

E. Run each gas pressure reducing valve vent and relief valve vent separately to a point outside of building. Terminate with a screened vent cap, and locate according to gas utility regulations.

F. Do not install gas pipe below building or its foundation.

3.06 VENTS AND RELIEF VALVES

A. Install vent and relief valve discharge lines as indicated on Drawings, as detailed, and as specified for each specific valve or piping specialty item.

B. In no event is termination to occur less than six feet above roof line.

3.07 UNIONS AND FLANGES

A. Install union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement.

B. Where valve is located at piece of equipment, locate flange or union connection on equipment side of valve. Concealed unions or flanges are not acceptable.

3.08 PIPING SYSTEM LEAK TESTS

A. Verify that piping system being tested is fully connected to components and that equipment is properly installed, wired, and ready for operation.

B. If required, for additional pressure load under test, provide temporary restraints at expansion joints or isolate them during test.

C. Verify that hangers can withstand any additional weight load imposed by test.

D. Provide all piping, fittings, blind flanges, and equipment to perform testing.

E. Conduct pressure test with test medium of air or water unless specifically indicated.

F. Minimum test time is indicated in table below; additional time may be necessary to conduct an examination for leakage.

G. If leaks are found, repair area with new materials and repeat test. Caulking will not be acceptable.

H. Do not insulate pipe until it has been successfully tested.

I. For air tests, gradually increase pressure to not more than one-half of test pressure; then increase pressure in steps of approximately one-tenth of test pressure until reaching required test pressure.

J. Examine all joints and connections with a soap bubble solution or equivalent method.

K. Piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking.

L. After testing is complete, slowly release pressure in a safe manner. Testing to conform to requirements of NFPA Chapter 54, latest edition.

M. Measure propane system test pressure with a water manometer or equivalent device calibrated in increments not greater than 0.1 inch water column.

N. System will not be approved until demonstrating that there is no measurable loss of test pressure during test period.

O. Instead of pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury maintained for at least one hour.

System	Pressure	Medium	Duration
Propane	100 psig	Air	24 hours

P. Document all pressure tests on form included in this specification.

Q. After completion of test, remove temporary flanges and make final connections to piping.

END OF SECTION 23 11 00

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name:_____

Location:_____ **Project No:**_____

Contractor:_____

□ **HVAC** □ **Refrigeration** □ **Controls**
□ **Power Plant** □ **Plumbing** □ **Sprinkler**

Test Medium: □ **Air** □ **Water** □ **Other**_____

Test performed per Specification Section _____

Specified Test Duration _____ **Hours** **Specified Test Pressure** _____**PSIG**

System Identification:_____

Describe Location:_____

_____

Test Date:_____

Start Test Time:_____ **Initial Pressure:**_____**PSIG**

Stop Test Time:_____ **Final Pressure:**_____**PSIG**

Tested By:_____ **Witnessed By:**_____

Title:_____ **Title:**_____

Signed:_____ **Signed:**_____

Date:_____ **Date:**_____

Comments:_____

_____

_____

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SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Low pressure ductwork.
2. Duct sealant.
3. Gaskets.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 23 05 00 - Basic HVAC Requirements.
3. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
4. Section 23 33 00 – Air Duct Accessories.

1.02 REFERENCES

A. American National Standards Institute (ANSI)
1. ANSI SS-EN 485-2 - Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties.

B. ASTM International
1. ASTM A90 - Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
2. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. National Fire Protection Association (NFPA)
1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
2. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

E. Underwriters Laboratories, Inc. (UL)
1. UL 181 - Standard for Safety for Factory Made Air Ducts and Air Connectors.

1.03 SUBMITTALS

A. Division 01: Shop drawings, product data and samples.

B. Submit manufacturer's data and Contractor data for the following:
   1. Fabrication and installation drawings.
   2. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, with details as appropriate.
   3. Duct sealant and gasket material.

1.04 DESIGN CRITERIA

A. Construct ductwork to be free from vibration, chatter, objectionable pulsations, and leakage under specified operating conditions.

B. Use material, weight, thickness, gauge, and construction and installation methods as outlined in the following Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) publications, unless noted otherwise:
   1. HVAC Duct Construction Standards, Metal and Flexible, Latest Edition.
   2. HVAC Air Duct Leakage Test Manual, Latest Edition.
   3. HVAC Systems - Duct Design, Latest Edition.

C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.05 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that ductwork is undamaged and complies with specification.

B. Protect ductwork against damage.

C. Protect ductwork by storing inside or by durable, waterproof, above ground packaging.

D. Do not store material on grade. Protect ductwork from dirt, dust, construction debris, and foreign material.

E. Where end caps or packaging are provided, take precautions so caps or packaging remain in place and free from damage.

F. Offsite storage agreements do not relieve Contractor from using proper storage techniques.

G. Storage and protection methods must allow inspection to verify products.

PART 2 - PRODUCTS

2.01 GENERAL

A. Sheet metal used for construction of duct shall be 24-gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12-inch and below may be 26-gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, latest edition.

B. Duct sizes indicated on Drawings are net inside dimensions.

2.02 DUCTWORK PRESSURE CLASS

A. Minimum acceptable duct pressure class, for ductwork except transfer ductwork, is 2-inch W.G. positive or negative, depending on application.

B. Transfer ductwork minimum acceptable duct pressure class is 1-inch W.G. positive or negative, depending on application.

C. Duct system pressure classes not indicated on Drawings to be as follows:

Duct System	Pressure Class
Supply duct	1 inch pressure class
Exhaust ducts	1 inch pressure class
Return ducts	1 inch pressure class

2.03 MATERIALS

A. Galvanized Steel Sheet:
   1. ASTM A653, galvanized steel sheet of lock forming quality.
   2. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90.

2.04 LOW PRESSURE DUCTWORK (MAXIMUM 3-INCH PRESSURE CLASS)

A. Fabricate and install ductwork in sizes indicated on Drawings and in accordance with SMACNA recommendations, except as modified below.

B. Construct so that interior surfaces are smooth.

C. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork..

D. Use spiral lock seam construction when fabricating round spiral ductwork.

E. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if screw does not extend more than 1/2-inch into duct.

F. Use elbows and tees with centerline radius to width or diameter ratio of 1.5 wherever space permits.

G. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA, Type RE 3.

H. Where space will not allow and C value of radius elbow, as given by SMACNA, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00 – Air Duct Accessories.

I. Square throat-radius heel elbows shall not be acceptable. Straight taps or bullhead tees are also not permitted.

J. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00 – Air Duct Accessories.

K. Provide expanded take-offs or 45-degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps are unacceptable.

L. Button punch snaplock construction will not be accepted on aluminum ductwork.

M. Contractor may substitute round ducts for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of Engineer/Architect.

N. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.05 DUCT SEALANT

A. Manufacturers:
1. 3M 800.
2. 3M 900.
3. H.B. Fuller/Foster.
4. Hardcast.
5. Hardcast Peal & Seal.
6. Lockformer Cold Sealant.
7. Mon-Eco Industries.
8. United Sheet Metal.
9. Or approved equal.

B. Silicone sealants will not be allowed in any type of ductwork installation.

C. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations.

D. Allow sealant to fully cure before pressure testing of ductwork or startup of air handling systems.

2.06 GASKETS

A. Two-Inch Pressure Class and Lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Verify dimensions at site, making field measurements and drawings necessary for fabrication and erection.

B. Check Drawings showing work of other trades and consult with Engineer/Architect in event of any interference.

C. Make allowances for beams, pipes, or other obstructions in building construction and for work of other contractors.

D. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 2-7, except do not reduce duct to less than 6 inches in any dimension and do not exceed an 8:1 aspect ratio.

E. In all cases, seal to prevent air leakage.

F. Test openings for test and balance work will be provided under Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

G. Provide frames constructed of angles or channels for coils, filters, dampers, or other devices installed in duct systems, and make connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts, and washers.

H. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

I. Where two different metal ducts meet, install joint in such a manner that metal ducts do not contact each other by using proper seal or compound.

J. Install motor operated dampers and connect to or install equipment furnished by others. Blank off unused portions of louvers, as indicated on Drawings, with 1-1/2-inch board insulation with galvanized sheet metal backing on both sides.

K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

L. Provide adequate access to ductwork for cleaning purposes.

M. Provide temporary capping of ductwork openings to prevent entry of dirt, dust, and foreign material.

N. Protect diffusers, registers, and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust, and foreign material into ductwork.

O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.02 DUCTWORK SUPPORT

A. Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-4, except supporting ductwork with secure wire method is not allowed.

B. Support with 3/32-inch, 7-inch x 7-inch, stainless steel air-craft cable, with matching fastener rated for 150 percent of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

3.03 LOW PRESSURE DUCT (MAXIMUM 3-INCH PRESSURE CLASS)

A. Seal ducts, with exception of transfer ducts, in accordance with SMACNA seal class "A"; sealing transverse and longitudinal seams, joints, and penetrations.

B. Install a manual-balancing damper in each branch duct and for each diffuser or grille. Use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheet metal screws or pop rivets. Trapeze hangers may be used at Contractor's option.

3.04 CLEANING

A. Remove dirt and foreign matter from entire duct system and clean grilles and inside of furnace before operating fans.

B. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

END OF SECTION 23 31 00

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes.
1. Manual volume dampers.
2. Turning vanes.
3. Gravity backdraft dampers.
4. Duct flexible connections.
5. Louvers.

B. Related Sections
1. Applicable provisions of Division 01 shall govern work under this Section.
2. Section 23 05 00 – Basic HVAC Requirements.

1.02 REFERENCES

A. Air Movement & Control Association International, Inc. (AMCA)
1. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

B. ASTM International
1. ASTM C411 – Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
2. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.
3. ASTM C1071 – Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material.
4. ASTM C1338 – Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
5. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
6. ASTM G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

C. National Fire Protection Association (NFPA)
1. NFPA 90A - Standard for Installation of Air Conditioning and Ventilating Systems.

D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
1. SMACNA - HVAC Duct Construction Standards - Metal and Flexible, Latest Edition.

E. Underwriters Laboratories, Inc. (UL)
1. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors
2. UL 214 - Test for Flame-Propagation of Fabrics and Films.
3. UL 555 - Standard for Fire Dampers and Ceiling Dampers.

4. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

1.03 SUBMITTALS

A. Division 01: Shop Drawings, product data and samples.

B. Submittals for accessories shall include dimensions, capacities, ratings, installation instructions, and appropriate identification.

C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

D. Submit manufacturer's color charts where finish color is be selected by Engineer/Architect.

PART 2 - PRODUCTS

2.01 MANUAL VOLUME DAMPERS

A. Manufacturers:
1. Ruskin
2. Vent Products
3. Air Balance
4. Or approved equal.

B. Construct dampers in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

C. Reinforce blades to prevent vibration, flutter, or other noise.

D. Construct dampers in multiple sections with mullions where width is over 48 inches.

E. Use rivets or tack welds to secure individual components; sheet metal screws are unacceptable.

F. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts.

G. Provide end bearings or bushings for volume damper rods penetrating ductwork constructed to a 3-inch water column pressure class or above.

2.02 TURNING VANES

A. Manufacturers:
1. Aero Dyne
2. Anemostat
3. Barber-Colman
4. Hart & Cooley
5. Or approved equal.

B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4, except use only airfoil type vanes.

C. Construct turning vanes for short radius elbows and elbows where one dimension changes in turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

2.03 GRAVITY BACKDRAFT DAMPERS

A. Manufacturers:
1. Ruskin Model CBD4 or equivalent.
2. Air Balance.
3. Advanced Air
4. Cesco
5. American Warming and Ventilating.
6. Vent Products Company, Inc.
7. Greenheck.
8. Arrow.
9. Or approved equal.

B. Dampers shall be adjustable type, counterbalanced, self-acting, multiple bladed backdraft air dampers of sizes indicated or required.

C. Dampers shall begin to open in the desired direction of airflow when the upstream to downstream differential static pressure reaches approximately 0.05 to 0.10 inches of water column.

D. Blades shall be constructed of 0.070 inch thickness aluminum with a 6 inch maximum blade width, interlocking neoprene or extruded vinyl blade edge seals, dust proof ball bearing shaft supports, interconnecting linkage and adjustable counterbalancing weights.

E. Frame shall be constructed of 0.081 thickness extruded aluminum

2.04 CONTROL DAMPERS

A. Control dampers are specified in Section 23 09 13 - Instrumentation and Control Devices for HVAC.

2.05 ACCESS DOORS

A. Manufacturers:
1. Ruskin.
2. Air.
3. Balance.
4. Advanced Air.
5. Arrow.
6. Vent Products Co., Inc.
7. Greenheck.

8. Or approved equal.

B. Design and construct access door for pressure class of duct receiving door installation.

C. Doors in exposed areas shall be hinged type with cam sash lock.

D. Hinges shall be steel full- length continuous piano type.

E. Secure doors in concealed spaces with cam sash latches.

F. For both hinged and non-hinged doors provide sufficient number of cam sash latches to provide airtight seal when door is closed.

G. Do not use hinged doors in concealed spaces if this will restrict access.

H. Use minimum 1-inch deep 24-gauge galvanized steel double wall access doors with minimum 24-gauge galvanized steel frames.

I. For non-galvanized ductwork, use minimum 1-inch deep double wall access door with frame using materials of construction identical to adjacent ductwork.

J. Provide double neoprene gasket that seals from frame to door and frame to duct.

K. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment.

2.06 DUCT FLEXIBLE CONNECTIONS

A. Material to be fire retardant, UL 214 listed, and meet requirements of NFPA 90A.

B. Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight.

C. Connections to have adequate flexibility and width to allow for thermal expansion and contraction, vibration of connected equipment, and other movement.

D. Use coated glass fiber fabric. Material for inside applications to be double coated with neoprene, air and water tight, suitable for temperatures between –10 degrees F and 200 degrees F, with a nominal weight of 30 ounces per square yard.

2.07 LOUVERS

A. Manufacturers:
1. Airolite K6776.
2. Industrial Louvers 658.
3. American Warming and Ventilating LE-31.
4. Carnes FPCB.
5. Vent Products co., Inc. 4650
6. Ruskin ELF6375 DX.
7. Or approved equal.

B. Extruded aluminum alloy not less than 12-gauge, drainable blades, all-welded assembly, 35-degree or 45-degree blades with water baffle, 6 inches thick.

C. Provide with bird screen of 1/2 x 1/2-inch mesh aluminum in 12-gauge aluminum frame and an aluminum sill.

D. Locate bird screen inside of louver unless noted otherwise.

E. Louver to bear AMCA certified ratings seal for both air performance and water penetration, having free area not less than 50 percent based on a 48 x 48-inch section, water penetration less than 0.1 oz/square foot under AMCA 500-L test at 1000 feet per minute, and intake pressure drop less than 0.20 inches of water at 1000 feet per minute.

F. Color to be selected by Architect.

PART 3 - EXECUTION

3.01 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and each grille, register, or diffuser as far away from outlet as possible while still maintaining accessibility to damper.

B. Install so there is no flutter or vibration of damper blades.

C. Splitter dampers shall not be used in place out volume dampers.

3.02 TURNING VANES

A. Install turning vanes in rectangular, mitered elbows in accordance with SMACNA standards and manufacturer's recommendations.

B. Install double wall, airfoil, 2-inch radius vanes in ducts with vane runner length 18 inches or greater and air velocity less than 2000 fpm.

C. Install double wall, airfoil, 4-1/2-inch radius vanes in ducts with vane runner length greater than 18 inches and air velocity 2000 fpm or greater.

D. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension.

E. If duct size changes in a radius elbow or if short radius elbows must be used, install sheet metal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.03 GRAVITY BACKDRAFT DAMPERS

A. Install at locations indicated on drawings.

B. Install access door for service and access to damper.

C. Adjust counterbalance weight for proper operation.

3.04 CONTROL DAMPERS

A. Install dampers in locations indicated on Drawings, as detailed, and according to manufacturer's instructions.

B. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums.

C. Provide adequate operating clearance and access to operator. Install an access door adjacent to each control damper for inspection and maintenance.

3.05 ACCESS DOORS

A. Install access doors where specified, indicated on Drawings, and in locations where maintenance, service, cleaning, or inspection is required.

B. Examples include, but are not limited to, motorized dampers, smoke detectors, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

C. Size and numbers of duct access doors to be sufficient to perform intended service.

D. Minimum access door size shall be 8 x 8-inch size for hand access, 18 x 18-inch size for shoulder access, or other size as indicated.

3.06 DUCT FLEXIBLE CONNECTIONS

A. Install at duct connections to rotating or vibrating equipment, or other motorized equipment in accordance with SMACNA Figure 2-19.

B. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets.

3.07 LOUVERS

A. Furnish louvers to General Contractor for mounting in exterior walls. Connect outside air intake duct to louver, sealing connections airtight and watertight.

B. Provide bird screen on inside of active louver area where none is provided with louver. Where louvers are equipped with inside bird screen, remove screen at locations where duct connections are not made.

C. Install insulated metal panel on unused portion of louver. Seal panels weather tight to louver assembly with flashing as required for proper drainage to outside of building.

D. Paint outside surface of panel to match louver prior to installation.

E. Where ductwork is visible through louver when viewed from outside building, paint inside of duct to match louver color.

END OF SECTION 23 33 00

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SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Side-wall registers and grilles.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern Work under this Section.
   2. Section 23 05 00 – Basic HVAC Requirements.
   3. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
   4. Section 23 31 00 - HVAC Ducts and Casings.
   5. Section 23 33 00 - Air Duct Accessories.

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute (ARI)
   1. ARI-ADC Standard 880.

B. ASTM International
   1. ASTM D6386 - Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

C. National Fire Protection Association (NFPA)
   1. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

D. Underwriters Laboratories, Inc. (UL)
   1. UL 181 - Factory-Made Air Ducts and Connectors.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Shop drawings, product data and samples.

B. Furnish submittal information including, but not limited to, the following:
   1. Manufacturer's name and model number.
   2. Identification as referenced in documents.
   3. Capacities/ratings.
   4. Materials of construction.
   5. Sound ratings.
   6. Dimensions.
   7. Finish.
   8. Color selection charts where applicable.

9. Manufacturer's installation instructions.
10. Frame and border for each application.

1.04 DESIGN CRITERIA

A. Basel performance data on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.01 SIDE-WALL REGISTERS AND GRILLES

A. Manufacturers:
1. Titus: Series 300 (Supply) and Series 350 (Return/Exhaust).
2. Carnes: Model R Series.
3. Price Industries: Model 520 (Supply) and 530 (Return Exhaust).
4. MetalAire: Series V4000 or H4000.
5. Krueger: Series 880.
6. Or approved equal.

B. Side-Wall Registers And Grille Assembly:
1. Steel unless otherwise indicated, with frame type appropriate to installation.
2. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all directions.
3. Fixed blade 45-degree core return and exhaust registers and grilles.
4. Opposed blade volume control damper return registers, operable from face.
5. Register and grille sizes as shown on Drawings and as scheduled. Unless noted otherwise, baked enamel finish with color selected by Architect.
6. Screw holes on surface counter sunk to accept recessed type screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install grilles, registers, and diffusers as shown on Drawings and according to manufacturer's instructions.

B. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

C. Seal connections between ductwork drops and diffusers/grilles airtight. The use of duct tape or insulating tape is not acceptable.

D. Where grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

E. Grilles and registers shall be securely and neatly attached to the building construction or sheet metal flanges.

END OF SECTION 23 37 13

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SECTION 23 54 00

GAS FIRED FURNACES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Gas fired furnaces.

B. Related Sections
   1. Applicable provisions of Division 01 shall govern Work under this Section.
   2. Section 23 05 00 – Basic HVAC Requirements.
   3. Section 23 05 13 - Motor Requirements for HVAC Equipment.
   4. Section 23 09 13 – Instrumentation and Control Devices for HVAC.
   5. Section 23 11 00 - Facility Fuel Piping.

1.02 REFERENCES

A. American Gas Association (AGA):

B. American National Standards Institute (ANSI) :
   1. ANSI Z21.47 – Gas-Fired Central Furnaces

C. ASTM International:
   1. ASTM D1785 – Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

D. Gas Appliance Manufacturers Association (GAMA):

E. National Fire Prevention Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

1.03 ENERGY EFFICIENCY

A. Provide gas furnaces that bear ENERGY STAR label and meet ENERGY STAR specifications for energy efficiency.

1.04 SUBMITTALS

A. Division 01 - Submittal Procedures: Shop Drawings, product data and samples.

B. Submit specific manufacturer and model numbers, equipment identification corresponding to Drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements, and wiring diagrams, filter information, and information for accessories.

1.05 WARRANTY

A. Warrant furnace primary and secondary heat exchangers for 20 years under normal use and maintenance. Warrant remainder of furnace components for 1 year from date of start up.

PART 2 - PRODUCTS

2.01 FURNACES

A. Manufacturers:
   1. American Standard - Trane.
   2. Carrier Corporation.
   3. Lennox International, Inc.
   4. Bryant Heating & Cooling Systems, Inc.
   5. York Division - Johnson Controls.
   6. Substitutions: In accordance with Division 01 – Product Requirements.

B. Direct vent, sealed combustion, condensing type AGA certified for use with propane gas. Minimum annual fuel utilization efficiency (A.F.U.E.) of 91. Ratings shall be GAMA Certified. Wiring shall comply with National Electrical Code.

C. Furnace shall have 22 gauge steel casing with baked enamel finish or prepainted galvanized steel. Insulate casing back and side panels with foil faced fiberglass insulation.

D. Construct primary heat exchanger of aluminized steel. Construct secondary heat exchanger of stainless steel with aluminum fins or of polypropylene laminated steel.

E. Aluminized steel multi-port in-shot burner with hot surface or electronic spark ignition, approved for vertical or sidewall venting.

F. AGA listed gas controls including manual main shut-off valve, double automatic gas valves for redundancy and gas pressure regulator.

G. Centrifugal type blower fan statically and dynamically balanced with multiple speed, direct drive or belt drive fan motor. Provide low energy induced draft blower for heat exchanger prepurge and combustion gas venting.

H. Provide unit with 2-inch thick 30 percent efficient disposable type panel air filter and filter holding rack with a maximum filter face velocity of 500 fpm.

I. Provide solid state integral control unit with necessary controls and relays including but not limited to:
   1. Pressure switch for airflow of flue products through furnace and out vent system.

2. Rollout switch with manual reset to prevent over-temperature in burner area.
3. Electronic flame sensor.
4. Blower access safety interlock.
5. Timed blower start after main burners ignite.
6. Factory installed 24-Volt transformer for controls and thermostat.
7. LED's to indicate status and to aid in troubleshooting.

J. HVAC Contractor shall provide temperature control and interlocking necessary to perform specified control sequence.

K. Wiring is to be in conduit in accordance with Division 26 - Electrical. Relays, transformers and controls are to be in enclosures.

L. Provide manual control thermostat.

M. Provide lockable thermostat guards in public spaces.

N. When occupancy sensor detects occupant, run furnace supply fan continuously and energy recovery ventilator, open outside and exhaust air damper, and cycle heating as required to maintain space temperature cooling or heating set point.

O. During unoccupied mode energy recovery ventilator shuts off, close outside and exhaust air damper and cycle supply fan and heating as required to maintain heating space temperature set point.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units as shown on Drawings, as detailed, and according to manufacturer's installation instructions.

B. Pipe vents from gas regulator to outside.

C. Coordinate power wiring with electrical work.

3.02 FURNACES

A. Install neoprene pads as indicated on Drawings. Pipe condensate to floor drain.

B. Provide ASTM D1785, Schedule 40 PVC, combustion air and vent piping and fittings with solvent welded joints as indicated on Drawings. Terminate as recommended by furnace manufacturer.

C. Provide separate condensate drain lines from heat exchanger condensate drain pan.

D. Provide flexible duct connections to furnaces.

END OF SECTION 23 54 00

SECTION 23 72 23

PACKAGED AIR-TO-AIR ENERGY-RECOVERY UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Packaged indoor air-to-air heat energy recovery units.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 23 05 00 – Basic HVAC Requirements.
   3. Section 23 05 13 – Motor Requirements for HVAC.
   4. Section 23 09 13 – Instrumentation and Control Devices for HVAC
   5. Section 23 33 00 - Air Duct Accessories.
   6. Section 23 34 00 - HVAC Fans.

1.02 REFERENCES

A. Air Conditioning and Refrigeration Institute (ARI):
   1. ARI Standard 1060 – Rating Air to Air Energy Ventilation Heat Exchangers.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
   1. ASHRAE Standard 84 –Method of Test for Air to Air Heat/Energy Exchangers.

C. ASTM International (American Society for Testing and Materials)
   1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Division 01 – Submittal Procedures: Shop Drawings, product data, and samples

B. Include unit dimensions, weights, wiring diagrams, roof curbs, materials of construction, thermal characteristics, ratings, capacities, fabrication methods, manufacturer's installation requirements, accessories, and appropriate identification.

C. Submittals are to comply with submission and content requirements specified in Division 01 - Commissioning.

1.04 OPERATION AND MAINTENANCE DATA

A. Operations and maintenance data shall comply with submission and content requirements specified in Division 01.

1.05 DESIGN CRITERIA

A. Capacity, efficiency, and operating characteristics as indicated on Drawings or as scheduled.

B. Energy recovery wheel shall be designed for sensible and latent energy recovery.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers:
   1. Renew Aire Model EV450.
   2. Other approved Manufacturers:
      a. Governair.
      b. Thermotech.
      c. Des Champs.
      d. Xetex.
      e. Venmar.
   3. Substitutions in accordance with Division 01 – General Requirements.

2.02 GENERAL

A. Units shall be packaged outdoor factory assembled and wired with static plate, supply air fan, exhaust air fan, and air filters.

B. Unit shall be capable of operating within a temperature range from as low as -25 degrees F to a maximum of 125 degrees F and withstanding entrained moisture from outside air steam or exhaust air stream without damaging unit or causing any deterioration in unit performance.

C. Energy recovery unit performance shall be as listed on drawings. Pressure drops shall not exceed those listed.

D. All control and power wiring shall be numbered. Wiring shall be connected to numbered wiring terminals. Electrical components shall bear U.L. approval.

2.03 CASING

A. Frame shall be constructed of galvanized steel or extruded aluminum tubes and cast aluminum corners.

B. Case walls and doors shall be insulated with 1 inch, 4 pound density, foil/scrim faced, high density fiberglass board insulation.

C. Provide units with hinged and gasketed access doors to allow manual cleaning of heat exchanger interior surfaces.

2.04 ENERGY RECOVERY STATIC PLATE

A. Unit shall be capable of transferring sensible and latent energy airstreams.

B. Exhaust and fresh airstreams shall not mix.

C. Energy recovery component shall be of fixed plate cross flow construction with no moving parts.

2.05 FANS AND MOTORS

A. Supply air and exhaust air fans shall be direct drive forward curved centrifugal type. Refer to Section 23 05 13 for motor requirements.

2.06 UNIT FILTER SECTIONS

A. Standard filter sections shall consist of 2 inch thick MERV-8 disposable media type filters.

B. Provide one extra set of air filters.

2.07 UNIT ELECTRICAL

A. Units shall have electrical characteristics as specified on equipment schedule, and shall allow either aluminum or copper main conductors to be connected to terminal block power connections.

2.08 CONTROLS

A. See plans for sequence of operations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units in accordance with unit manufacturer's installation requirements in locations indicated on drawings and as detailed.

B. Units shall be started by a factory authorized service agency following manufacturer's written instructions.

C. Provide hinged and gasketed access doors at fan sections, filter sections, and at all components on entering and leaving side of both airstreams of energy wheel for inspection and cleaning.

END OF SECTION 23 72 23

SECTION 26 00 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. General Electrical Requirements.
2. Work Included in Contract.
3. Definitions.
4. Dimensions and Equipment Location.
5. Owner Supplied Products.
6. Work by Owner.
7. Pre-Installation Meetings.
8. Demonstration and Training Meetings.
9. Product Data.
10. Shop Drawings.
11. Test Reports.
12. Manufacturer's Certificates.
13. Manufacturer's Instructions.
14. Manufacturer's Field Reports.
15. Quality Assurance and Control of Installation.
16. Temporary Facilities and Controls.
17. Delivery, Storage, and Handling Requirements.
18. Product Options.
19. Product Substitution Procedures.
20. Final Cleaning and Painting.
21. Starting of Systems.
22. Demonstration and Instructions.
23. Project Record Documents.
24. Extra Material and Spare Parts.
25. Operation and Maintenance Manuals.
26. Warranties.
27. Identification.
28. Pre-bid Survey.

1.02 GENERAL ELECTRICAL REQUIREMENTS

A. Mention of any article, operation or method requires that Contractor shall provide same and perform each operation in complete accordance with conditions stated.

B. Contractor shall provide all material, labor, equipment and transportation as necessary to complete project in compliance with Contract Documents.

C. In general, this work includes everything essential for a complete electrical system in operating order as shown on drawings and indicated in specifications.

D. Work shall be installed in accordance with National, State, and Local codes, ordinances, laws, and regulations. Comply with all applicable OSHA regulations.

E. Materials shall have a UL or ETL label where a UL or ETL standard or testing requirement exists.

F. All work shall be installed in accordance with all State and Local Inspection Authorities having jurisdiction together with recommendations of manufacturer whose equipment is to be supplied and installed under this Contract.

G. Before submitting a bid, each bidder shall examine all specifications and drawings relating to their work and shall become fully informed as to extent and character of work required and its relation to other work within project area.

H. Contractor, in conjunction with Engineer's representative, shall establish exact locations of all materials and equipment to be installed.

I. Consideration shall be given to construction features, equipment of other trades and requirements of equipment proper.

J. All materials shall be suitably stored and protected prior to installation and all work shall be protected after installation, during construction and prior to acceptance.

K. Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by Contractor.

L. All such equipment shall be removed by Contractor upon completion of project.

M. Refer to Division 01 for temporary electrical service.

1.03 WORK INCLUDED IN CONTRACT

A. Contractor shall provide auxiliary contacts, buttons, and switches on starters as required.

B. Contractor shall provide power wiring (120 V or greater) to control panels, motor starters, variable frequency drives, motors, electric actuators, electric devices and smoke detectors.

1.04 DEFINITIONS

A. Exposed: Exposed to view in any room, corridor or stairway.

B. Code: National, State and Local Electrical codes including OSHA requirements.

C. Signal Voltage: NEC class 1, 2, or 3 remote control, signaling, or power limited circuits.

D. Low Voltage: 50 to 600 volts.

E. Medium Voltage: 601 to 35,000 volts.

F. High Voltage: 35,001 volts and greater.

G. Electrical Ductbank: Assembly consisting of electrical conduits encased in concrete.

1.05 DIMENSIONS AND EQUIPMENT LOCATION

A. Drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices.

B. Exact locations of such equipment and devices shall be established in field in accordance with instructions from Engineer/Architect as established by manufacturer's installation drawings and details.
   1. Contractor shall refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection locations.
   2. Unless specifically stated, no measurement of an electric drawing derived by scaling shall be used as a dimension to work by.
   3. Dimensions noted on electric drawings are subject to measurements of adjacent and previously completed work.
   4. All measurements shall be performed prior to actual installation of equipment.

1.06 OWNER SUPPLIED PRODUCTS

A. Reference Division 01 for Owner supplied products.

1.07 WORK BY OWNER

A. Reference Division 01 for work by Owner.

1.08 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections, convene pre-installation meeting at Project site prior to commencing work of specific section.

B. Require attendance of parties directly affecting, or affected by, Work of specific section.

C. Notify Engineer/Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two (2) copies to Engineer/Architect, and those affected by decisions made.

1.09 DEMONSTRATION AND TRAINING MEETING

A. Contractor shall schedule and administer demonstration and training sessions for Owner for each portion of equipment and products that are required to have training in proper operation and maintenance.

B. Contractor shall schedule representatives of the equipment manufacturer to attend demonstration and training sessions to provide additional information as necessary.

1.10 PRODUCT DATA

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

B. Provide copies and distribute in accordance with Submittal Procedures article in Division 01 and for record documents purposes described in Division 01.

C. Submit number of copies Contractor requires, plus three copies Engineer/Architect will retain.

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

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

F. After review distribute in accordance with Submittal Procedures article in Division 01 and provide copies for record documents described in Division 01.

1.11 SHOP DRAWINGS

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

B. Produce copies and distribute in accordance with Submittal Procedures article in Division 01 and for record documents purposes described in Division 01.

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

D. Shop drawings shall be submitted in advance of construction and installation so as to not cause delay in other Contractor's work.

E. Data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with electrical drawings and shall bear:
   1. Name and location of project.
   2. Name of Contractor.
   3. Date of submittal.
   4. Date of drawings and date of each correction and revision.

5. If more than one type of lighting fixture (or other material) is on submitted sheet, proposed equipment shall be conspicuously checked with red pen by Electrical Contractor.

F. Shop drawings for different systems and equipment shall, be bound separately by specification section and not bound by manufacturer.

G. Submittals which contain different specification section systems bound together shall be returned not reviewed and returned to Contractor for re-submittal.

H. Lighting Fixture shop drawings shall consist of single submittal with all project light fixtures included. Submittals grouped by manufacturer shall not be accepted. Contractor shall be responsible for coordinating drawings from his various suppliers in order to comply with this requirement.

I. Contractor shall examine shop drawings and equipment brochures prior to submission.

J. Contractor shall verify that materials and equipment depicted will properly fit into construction.

K. Contractor shall also review all previously completed work related to installation of equipment depicted to insure that it has been properly installed.

L. No materials or equipment subject to prior review by Engineer shall be fabricated or installed by Contractor, without approval.

M. Engineer's review of shop drawings shall not relieve Contractor of responsibility for deviations from requirements of drawings and specifications, unless prior approval for such deviations has been granted.

N. Submit in form of one reproducible transparency and one opaque reproduction.

O. Submit number of opaque reproductions Contractor requires, plus three copies Engineer/Architect will retain.

P. After review, Contractor shall reproduce and distribute (3) three copies to Engineer/Architect, maintain copies required for Record Documents described in Division 01.

1.12 TEST REPORTS

A. Operation of equipment and electrical systems does not constitute an acceptance of work by Owner.

B. Final acceptance is to be made after Contractor has adjusted their equipment and demonstrated that it meets or exceeds requirements of drawings and specifications.

C. After work is completed and prior to acceptance, Contractor shall conduct following tests, tabulate data, date, sign and submit to Engineer:
   1. Standard megger insulation test on each feeder.
   2. Ground resistance test.

3. Clamp ammeter test on each feeder conductor with all utilization equipment energized.
   a. Load current in each phase conductor of feeder or portion thereof supplying panel shall not differ from average connected load currents in feeder conductors by more than 7-1/2 percent.
   b. If load current does differ by more than 7-1/2 percent, Contractor shall change phase loading to same or receive written approval from Engineer that this is not required due to nature of load.

D. Upon completion of installation, Contractor shall furnish certificates of approval from authorities having jurisdiction.

E. Contractor shall demonstrate that all work is complete and is in specified operating condition, with raceway and conduit system properly grounded, wiring free from grounds, shorts, and entire installation is free from any physical defects.

F. In presence of Engineer and Owner, Contractor shall demonstrate proper operation of all systems.

G. Perform other testing as specifically directed in other sections of specifications for specific equipment.

1.13 MANUFACTURER'S CERTIFICATES

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

1.14 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.

1.15 MANUFACTURER'S FIELD REPORTS

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

B. Submit report in duplicate within 30 days of observation to Engineer/Architect for information.

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

1.16 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.

B. Comply fully with manufacturer's instructions, including each step in sequence.

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer/Architect before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce workmanship of 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.

1.17 TEMPORARY FACILITIES AND CONTROLS

A. Reference Division 01 for temporary facilities and control requirements.

1.18 PRODUCT DELIVERY, STORAGE AND HANDLING REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

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

D. Store and protect products in accordance with manufacturer's instructions.

E. Store with seals and labels intact and legible.

F. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

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

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

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

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

1.19 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications; no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with following article.

D. Materials and equipment required shall be of new manufacture.

E. Items specified shall be of latest type or model produced by manufacturer specified. If model number is obsolete, substitute current manufacturer's product.

1.20 PRODUCT SUBSTITUTION PROCEDURES

A. Substitutions will not be considered when a product becomes unavailable through no fault of Contractor.

B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

C. A request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner and Engineer/Architect for review or redesign services associated with re-approval by authorities having jurisdiction.

D. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

E. Substitution Submittal Procedure:
   1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
   2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
   3. Lighting Fixtures: Request for substitutions shall include photometric test reports performed by an independent testing laboratory.
   4. Contractor shall provide samples of proposed equipment for Engineer's review, if requested by Engineer.
   5. Contractor shall furnish any other information or materials as requested by Engineer to establish equality.
   6. Engineer will notify Contractor in writing of decision to accept or reject request.

F. Contractor's submitting equipment for approval as an equal, shall include in their bid all incidental costs that may result from use of approved equipment.

G. Such costs shall include, but not be limited to, additional costs that may be incurred by other contractors whose scope of work is affected by use of "equal" products.

H. Electrical Contractor shall be responsible for those costs even if they do not become evident until after bidding.

I. Only one request for substitution will be considered for each product.

J. When substitution is not accepted, provide specified product.

1.21 FINAL CLEANING AND PAINTING

A. Rubbish resulting from work shall be removed and disposed of on a daily basis in such manner as to be acceptable to Architect.

B. Contractor shall clean all exposed iron work, interior and exterior of cabinets and pull boxes, etc., and remove rubbish and debris resulting from work.

C. Where painted surfaces of equipment have been damaged or rusted during construction, Contractor shall paint same to match final.

D. Clean other equipment as indicated in other sections of specification for specific equipment.

1.22 STARTING OF SYSTEMS

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

B. Notify Engineer/Architect seven 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 that 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 Contractor's personnel in accordance with manufacturer's 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.

1.23 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate Project equipment and instruct in classroom environment located and instructed by manufacturer's representative who is knowledgeable about the Project.
   1. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
   2. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
   3. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at designated location.
   4. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
   5. Required instruction time for each item of equipment and system is specified in individual sections.

1.24 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of following electrical record documents; record actual revisions to the Work:
   1. Locations of all buried conduit or similar items. Include buried depth.
   2. Field changes of dimension or detail.
   3. Changes made by field order or change order.
   4. Details not on original contract drawings.
   5. Changes to circuit numbers.
   6. Junction box locations and conduit runs, with trade sizes indicated, for all lighting, power, and electrical systems installed.
   7. Record documents include:
      a. Drawings.
      b. Specifications.
      c. Addenda.
      d. Change Orders and other modifications to the Contract.
      e. Reviewed Shop Drawings, Product Data, and Samples.

f. 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 following:
1. Manufacturer's name and product model and serial 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 depths of foundations in relation to finish main floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Submit documents to Engineer/Architect for review.

1.25 EXTRA MATERIAL AND SPARE PARTS

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.

1.26 OPERATION AND MAINTENANCE MANUALS

A. Electrical Contractor shall assemble and submit to Architect for subsequent submission to Owner, three complete sets of a Manual of Operation and Maintenance for each of electrical and communications systems.

B. Each manual shall consist of a 3-ring binder volume instructing Owner's personnel in operation and maintenance of system in question.

C. All information shall be bound and secured in manual.

D. Manual shall cover all phases of operation of equipment and shall be illustrated with photographs, drawings, and wiring diagrams.

E. Manuals shall accurately describe operation, construction and adjustable features of complete system and its component parts.

F. Manual shall be complete with an equipment parts listing to facilitate ordering of spare and replacement parts.

G. Each manual shall contain two sets of final shop drawings depicting equipment as installed.

1.27 WARRANTIES

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days 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 plastic cover.

F. 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.

1.28 IDENTIFICATION

A. Entrance door to primary electrical room shall have porcelain enameled sign lettered "DANGER HIGH VOLTAGE". This same sign shall also be placed on primary switch.

B. Each distribution and lighting panel shall be equipped with typewritten directory describing loads served. Directory shall be contained in steel frame mounted on inside face of panel's door and shall be covered with sheet of clear plastic.

C. Switchboards, transformers, switchgear, telephone backboards, transfer switches, panels and cabinets shall be provided with 1/8-inch minimum thickness 5 ply lamecoid plastic nameplates indicating usage, plan designation and voltage where applicable. In Equipment and Mechanical Rooms, this identification may be on exterior of unit, in other areas identification shall be inside door or cover. Nameplates shall be black with white engraved lettering. Lettering shall be 1/2-inch high minimum. Fasten nameplates with escutcheon pins.

D. Junction and pullboxes smaller than 12 inch x 12 inch shall be identified by using permanent marker on coverplate indicating originating panelboard and circuit(s) or system served.

E. Junction and pull boxes with dimensions 12 inch x 12 inch and larger shall be stenciled or provided with permanent labels as follows:
   1. Lighting and power feeders and branch circuits - 120, 208, 277, 480. Add "EM" for emergency circuits, ex. 120EM, etc.
   2. Signal voltage lighting controls - LVLC.

F. Branch wiring shall be color coded per industry standards.

G. If Owner does not have a pre-established color code, use following colors unless otherwise required by code:
   1. 120/240 volt systems.
      a. A-phase: solid black.
      b. B-phase: solid red.
      c. Different colors shall be used to identify switched legs.
      d. Neutral conductor: solid white.
      e. Provide additional markings for neutral conductors in the same raceway as required by code.

H. Where wires of different systems junction in common box, each cable shall be grouped with its own system and identified using tags or identification strips.

I. Cover plates for control stations controlling remote equipment shall be engraved to identify device being controlled.

J. Motor starters, remote control stations, etc., shall be identified with engraved lamecoid nameplates fastened to equipment with escutcheon pins. Nameplates shall be 1/8 -inch 5 ply lamecoid with 1/4-inch white letters on a black background. Adhesive cloth labels, similar to those manufactured by Brady Label Co., may be used on motor switches and controls only, indicating number, designation, size and usage of motor.

K. On inside of coverplates for light switches, occupancy sensors, receptacles, and special purpose outlets, provide a permanent label identifying panel and circuit number feeding device. Adhesive plastic tape will be permitted for this use.

L. On light fixtures at wiring entrance point, provide permanent label identifying panel and circuit number feeding fixture. Adhesive plastic tape will be permitted for this use.

M. Refer to individual specification sections for more specific or additional identification requirements.

1.29 PREBID SURVEY

A. Before submitting their bid, Contractor shall tour project site and review following items:
   1. Exact configuration of areas requiring demolition, temporary power, relocating, etc.
   2. Site conditions such as material storage, staging areas, parking, etc.
   3. Problems with work sequence.

B. Any conditions found that are not shown on drawings or stated within project manual that may affect scope of work shall be reported to Engineer.

PART 2 - PRODUCTS

2.01 FIRESTOPPING

A. Firestopping materials shall include, but not be limited to, mortars, sealants and caulks, putties, collars, intumescent wrap strips mastics, and firestop pillows. Materials and methods used shall be recognized by an independent testing agency and shall have flame and temperature ratings assigned by specific agency.

B. Materials using solvents or those requiring hazardous waste disposal shall not be used.

C. Firestop assemblies shall meet fire test and hose stream test requirements of independent testing agency;
   1. Acceptable Manufacturers:
      a. 3M Corporation.
      b. Rectorseal Corporation.

2.02 SLEEVES

A. Sleeves: ASTM A53, Schedule 40 galvanized steel pipe.

2.03 ACCESS PANELS

A. Access panels required by code or otherwise to electrical service equipment shall be supplied and installed by Electrical Contractor.

PART 3 - EXECUTION

3.01 FIRESTOPPING

A. Openings in fire rated construction and annular spaces around conduits, cable trays, and other penetrating items shall be protected in accordance with NEC article 300-21 and in accordance with Wisconsin Administrative Code, Department of Commerce Chapter 51.049. Fire rating of protective seal shall be at least that of floor or wall into which it is installed, so that original fire rating of construction is maintained.

B. Wall or floor penetration openings shall be as small as possible.

C. Openings and annular spaces required by code to be protected, shall be protected.

D. Installation of materials and assemblies shall be in strict accordance with manufacturer's instructions.

3.02 SLEEVES

A. Where conduits, cables trays, or other electrical raceways must pass through floors or walls that are to be constructed of poured in place concrete, contractor shall provide sleeves in formwork prior to concrete pour. It shall be Electrical Contractor's responsibility to provide all sleeves for his work unless specifically indicated otherwise on drawings. Prior to installing sleeves, contractor shall prepare drawings indicating locations, quantities, sizes, and spacings of all sleeves anticipated. Drawings shall be forwarded to structural engineer for approval.

B. Floor sleeves shall extend minimum of 2 inches above finished floor.

END OF SECTION 26 00 00

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SECTION 26 05 03

WIRING CONNECTIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Electrical Connections to Equipment.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 26 00 00 – Basic Electrical Requirements.
   3. Section 26 05 19 - Building Wire and Cable.
   4. Section 26 05 33 - Raceway and Boxes.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.03 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.01 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over-current protection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.02 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.03 ADJUSTING

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 26 05 03

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SECTION 26 05 19

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Building Wire.
2. Building Cable.
3. Wiring Connectors.
4. Connections.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.

1.02 REFERENCES

A. International Electrical Testing Association (NETA):
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code (NEC).

1.03 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years.

1.04 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.05 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. When wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 feet of length shown.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper only.

C. Insulation Voltage Rating: 600 volts, rated 75 degrees C unless otherwise noted.

D. In mechanical rooms, light fixtures, and others high temperature applications, insulation shall be rated 90 degrees C. or greater.

E. Provide following wiring types:
   1. Concealed or exposed dry interior locations: Use only building wire Type THHN/THWN or XHHW insulation in raceway.
   2. Above Accessible Ceilings: Use only building wire Type THHN/THWN or XHHW insulation in raceway.
   3. Wet or Damp Interior Locations: Use only building wire Type XHHW-2 insulation in raceway.
   4. Exterior Locations: Use only building wire Type XHHW-2 insulation in raceway.
   5. Underground Locations: Use only building wire Type XHHW-2 or USE insulation, in raceway.

F. Solid or Stranded conductor for 10 AWG and smaller. Conductor 8 AWG and larger shall be stranded.

G. Conductor not smaller than 12 AWG for power and lighting circuits.

H. Conductor not smaller than 14 AWG for control circuits.

I. All wires shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

2.02 WIRING CONNECTORS

A. Conductors No. 10 AWG and Smaller: Scotch 3M - Scotch-lok compression type solderless connectors with plastic cover.

B. Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless compression type connectors, tool and die applied, of a type that will not loosen under vibration or normal strains. Burndy "Hy-Dent" type or equivalent.

C. Rubber insulating electrical tape: Scotch 3M model 23, 30-mil tape.

D. Split bolt connectors are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Install in accordance with manufacturer's written instructions and in accordance with recognized industry practices.

B. Run wire and cable in conduit, unless otherwise indicated on drawings.

C. Do not draw conductors into conduits until building is enclosed and watertight and until work that may cause conductor damage has been completed.

D. Voltage drop for branch circuits and feeder circuit combined shall not exceed requirements of NEC Article 215.

E. Examine areas and conditions under which conductors are to be installed and notify Engineer in writing of conditions detrimental to proper and timely completion of work.

F. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 JOINTS, TAPS AND SPLICES

A. Each tap, joint, or splice in conductors No. 8 AWG and larger shall be taped with two half-lap layers of vinyl plastic electrical tape and a finish wrap of color coding tape, where required by code.

B. Cable splices shall be made only in distribution and junction boxes.

3.03 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.04 INSTALLATION

A. Route wire and cable to meet project conditions.

B. Conductors shall not be installed at temperatures below manufacturer’s minimum installation temperature.

C. Neatly train and lace wiring inside boxes, equipment, and panelboards.

D. Identify and color code wire and cable under provisions of Section 26 05 53 – Electrical Identification.

E. Identify each conductor with its panel and circuit number or other designation indicated.

F. Special Techniques - Building Wire in Raceway:
   1. Pull conductors into raceway at same time.
   2. Install building wire 4 AWG and larger with pulling equipment.

G. Special Techniques - Wiring Connections:
   1. Clean conductor surfaces before installing lugs and connectors.
   2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
   3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
   4. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
   5. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
   6. When 10 AWG and smaller stranded conductors are used install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

3.05 BRANCH CIRCUIT CONDUCTORS

A. Install branch circuits and switched circuits as required to comply with circuiting, switching, and control functions shown on drawings.

B. Conductors shall be size 12 AWG minimum, unless otherwise noted, for branch circuit wiring, including motor circuits.

C. Size 120V branch circuits for length of run on following basis:
   1. 0 to 75 ft. run from panelboard to first outlet: No. 12 AWG minimum.
   2. 75 to 125 ft. run: increase one wire size, No. 12 AWG becomes No. 10 AWG.
   3. 126 to 200 ft run: increase two wire sizes, No. 12 AWG becomes No. 8 AWG.
   4. 201 and above: wiring to be sized for 3 percent maximum voltage drop.

D. Provide individual neutral conductors for branch circuits serving isolated ground receptacles and computer equipment. No common neutrals for these circuits.

E. Route branch circuits and switch legs as dictated by construction, these specifications, or instruction from Engineer.

F. Size conduit, outlet boxes, and other raceway system components in accordance with NEC requirements as minimum.

G. Circuit numbers as shown on drawings are for Contractor to plan their wiring and for estimating purposes and are not necessarily exact circuit numbers to be used in specific panel for particular load.

H. Exact circuit numbers for each load are to be selected by Contractor at their option.

I. Balanced load on panelboard bus will be determining factor in arrangement of circuits. Panelboards average load shall not differ from phase to phase by plus or minus 7.5 percent.

J. Motor and equipment branch wiring.
   1. Furnish and install motor circuits in accordance with schedules on drawings and code requirements, from source of supply to associated motor starter, and from starter to motor terminal box, including necessary and required intermediate connections.
   2. Conductor and conduit size for motor branch circuits, if shown on drawings, are sized for motor requirement only.
   3. Control wiring is not included in conduit sizes shown on drawings.
   4. Motors shall have proper conductor sizes as per NEC requirements and nameplate ratings.
   5. Contractor shall be responsible for verification of ratings of motors and installing proper branch circuits.
   6. Obtain manufacturer's wiring diagrams and shop drawings for equipment requiring electrical connections.
   7. Check drawings and specifications of other divisions of work for equipment and work, which shall be included in order to provide a complete electrical installation.
   8. Motor connections shall be made by compression type connectors using proper tools and fittings to assure good electrical continuity and low resistance joint.

3.06 FEEDER INSTALLATION

A. Install in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.

B. Extend feeders at full capacity from origin to termination.

C. Feeder conduits shall contain only those conductors constituting a single feeder circuit.

D. Where feeder conductors are run in parallel, conductors shall be of same length, same material, circular-mil area, insulation type, and terminated in same manner.

E. Where parallel feeder conductors run in separate raceways, each raceway shall have same physical characteristics.

F. Feeders shall follow most accessible routes, concealed in construction in finished areas, exposed to minimum temperature gradient and to minimum temperature fluctuation.

G. Confine feeders to insulated portions of building, unless otherwise specified.

H. Trapped feeder runs without facilities for continuous drainage are not acceptable.

I. Feeder conduits shall not be routed in conduit floor slabs or below basement or grade level floor slabs.

J. Feeder conductors in switchboards, panelboards, pullboxes, gutters, and other open wiring spaces shall be bundled by feeder using plastic tie wraps at intervals not greater than 3 feet on center.

3.07 FIXTURE WIRES

A. Use conductor with insulation suitable for current, voltage, and temperature to which conductor will be subjected.

B. Provide minimum No. 12 wire size for conductors supplying power to a single fixture. 600V insulation minimum.

C. Insulation suitable for operation at 90 degrees C. minimum for lighting fixtures with integral ballast, mogul base sockets, quartz lamps, or otherwise where subject to excessive temperatures.

D. Fixture wiring shall be continuous wiring system to lampholder or to ballast and from ballast to lampholder.

3.08 WIRE COLOR

A. General
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Brown, orange, and yellow for circuits at 277/480 volts single or three phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.09 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 26 05 19

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SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.
6. Irreversible compression grounding connection.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.
3. Section 26 05 19 - Building Wire and Cable.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers (IEEE):
1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 837 – Standard for Qualifying Permanent Connections Used in Substation Grounding.
3. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association (NETA):
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.
2. NFPA 99 - Standard for Health Care Facilities.

1.03 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:
1. Metal underground water pipe.
2. Metal building frame.
3. Concrete-encased electrode.
4. Ground ring.
5. Rod electrode.

1.04 DESIGN REQUIREMENTS

A. Provide all material, labor and incidentals necessary for the completion of this section of the work.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.06 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Perform Work in accordance with National Electric Code and state and local code requirements.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Division 01 - Product Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.09 COORDINATION

A. Coordinate complete grounding and bonding of building reinforcing steel prior to concrete placement.

PART 2 - PRODUCTS

2.01 ROD ELECTRODES

A. Manufacturers:
   1. Galvan Industries/Erico Inc.
   2. LTV/Copperweld, Inc.

3. Eritech/Erico, Inc.
4. Lyncole XIT Grounding.
5. Harger Lightning and Grounding.
6. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description:
1. Material: Copper-clad steel.
2. Diameter: 3/4 inch.
3. Length: 10 feet.

C. Connector: Connector shall be exothermic welded connection unless otherwise noted. Provide U-bolt clamp in ground test wells and where indicated on drawings.

2.02 WIRE

A. Material: Stranded copper. Provide tin plated copper where exposed to corrosive environment.

B. Connection to Electrodes: 2/0 AWG, minimum size.

C. Grounding Electrode Conductor: Copper conductor, bare.

D. Bonding Conductor: Copper conductor, bare.

2.03 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS (DN200) by 24 inches long fiberglass pipe with belled end.

B. Well Cover: Fiberglass with legend "GROUND" embossed on cover.

2.04 MECHANICAL CONNECTORS

A. Manufacturers:
1. Erico, Inc.
2. ILSCO Corporation.
3. O-Z Gedney Co.
4. Thomas & Betts, Electrical.
5. Burndy Electric.
6. Substitutions: In accordance with Division 01 - Product Requirements.

B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.05 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Thermoweld.
2. Cadweld, Erico, Inc.
3. Harger Lightning Protection.

4. Exothermic Welding Co.
5. Thomas & Betts, Electrical.
6. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.06 IRREVERSIBLE COMPRESSION GROUNDING CONNECTION

A. Manufacturers:
1. Thomas & Betts, Electrical.

B. Product Description: Connector shall meet the requirements of IEEE 837, prefilled with oxide inhibiting compound and after installed, be clearly marked with the conductor size and die used for installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.02 PREPARATION

A. Remove paint, rust, mill oils, and other surface contaminants at connection points.

3.03 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install rod electrodes near location of electric service entrance unless otherwise shown on drawings. Install additional rod electrodes, if required, to achieve specified resistance to ground.

C. Install interconnecting wire 2 feet below finish grade.

D. Install grounding and bonding conductors concealed from view.

E. Install grounding well pipe with cover at rod locations as indicated on Drawings. Install well pipe top flush with finished grade.

F. Install continuous grounding using underground cold water system, driven ground rods, and building steel as grounding electrode.

G. Ground electrical systems and equipment as required by code, utility, local ordinances, and to requirements herein.

H. Install separate code rated grounding conductors to special equipment and activity areas as required by code.

I. Bond all metallic piping systems and service equipment as required by NEC.

J. Permanently attach grounding conductors prior to energizing equipment.

K. Drive ground rods to depth 4-inches below finished grade.

L. Grounding electrode conductor shall be continuous without splice from nearest building grounding electrode. Ground to service equipment. Install bonding jumper around water meter. Attach non-ferrous metal tag to warn against removal. Make connections to ground electrodes with approved molded exothermic weld process.

3.04 EQUIPMENT GROUND

A. Bond metallic conduits, supports, cabinets, and other equipment so ground will be electrically continuous from service to outlet boxes.

B. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

C. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits.

D. Size grounding conductors in accordance with NEC.

E. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment.

F. Install grounding conductor in nonmetallic and flexible conduit to complete equipment ground continuity.

G. Ground wire shall be bonded at equipment and at first junction box of conduit system on line side of flexible conduit to the system.

H. Install grounding conductors to permit shortest and most direct path from equipment to ground.

I. When grounding conductor runs through metallic conduit, bond to conduit at entrance and exit with a bolted clamp.

J. Ground neutral at service only.

K. Install separate equipment grounding conductor in each conduit containing feeder conductors.

L. Install a green equipment grounding conductor in all conduits serving branch circuits.

M. Green ground bar in panels, where required to be similar to neutral bar, except tinted green and bonded to panel tub.

N. Connections shall be accessible for inspection and checking.

O. No insulation shall be installed over ground connections.

P. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.

Q. Attach grounds permanently before permanent building service is energized.

3.05 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13. Make final grounding system measurements two days after latest rainfall.

D. Perform ground resistance testing in accordance with IEEE 142. Contractor shall make ground resistance measurements. Measure in normally dry conditions, not less than 48 hours after rainfall.

E. Perform leakage current tests in accordance with NFPA 99.

F. Perform continuity testing in accordance with IEEE 142.

G. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 26 05 26

SECTION 26 05 29

ELECTRICAL HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.
3. Division 03 Concrete: Product requirements for concrete for placement by this section.

1.02 REFERENCES

A. ASTM International (American Society for Testing and Materials):
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

B. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.

C. Underwriters Laboratories Inc. (UL):
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL - Fire Resistance Directory.

1.03 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.04 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Surface Burning: ASTM E84, UL 723 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.05 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code, UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State and Municipality standards.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Division 01 - Product Requirements.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Division 01- Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum three (3) days after installation of firestopping materials.

PART 2 - PRODUCTS

2.01 CONDUIT SUPPORTS

A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

E. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

2.02 FORMED STEEL CHANNEL

A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.03 SPRING STEEL CLIPS

A. Product Description: Mounting hole and screw closure.

2.04 MECHANICAL SLEEVE SEALS

A. Manufacturers:
   1. Link-Seal, Inc.
   2. NMP Corporation.
   3. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.05 FIRESTOPPING

A. Manufacturers:
   1. Dow Corning Corp.
   2. Fire Trak Corp.
   3. Hilti Corp.
   4. International Protective Coating Corp.
   5. 3M fire Protection Products.
   6. Specified Technology, Inc.
   7. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: Black.

2.06 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:
   1. Sheet metal.
   2. Plywood or particle board.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:
   1. Furnish UL listed products [or products tested by independent testing laboratory].
   2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify openings are ready to receive firestopping.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

F. Install hangers, supports, and anchors only after structural work, where work is to be installed, has been completed. Correct inadequacies such as proper placement of inserts, anchors, and other building structural attachments.

G. Examine areas and conditions under which equipment and associated components are to be installed and notify Architect, in writing, of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.03 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
   1. Concrete Surfaces: Provide self-drilling anchors and expansion anchors.
   2. Solid Masonry Walls: Provide expansion anchors and preset inserts.
   3. Sheet Metal: Provide sheet metal screws.
   4. Wood Elements: Provide wood screws.
   5. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent the transfer of loading and stresses to connected equipment.
   6. Installation methods shall be in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of hole be less than four bolt diameters. Minimum distance between the center of any expansion anchor and an edge

of exterior corner of concrete shall be not less than 4-1/2 times the diameter of the hole in which it is installed.

B. Inserts:
   1. Install inserts for placement in concrete forms.
   2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

C. Install conduit and raceway support and spacing in accordance with NEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:
   1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
   2. Install surface mounted cabinets and panelboards with minimum of four anchors.
   3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
   4. Support vertical conduit at every floor.

3.04 SUPPORT OF CONDUIT

A. Fasten conduit to structural parts of building in a manner acceptable to Engineer.

B. Do not use perforated hanger iron.

C. Install concrete insert channel as required, with spacings as recommended by manufacturer. Install with anchor and caps, insert joiner clips and closer seals as required.

D. Support conduit as follows:
   1. Single conduit runs vertical surfaces: galvanized, heavy duty, sheet steel straps; back straps to be provided for all exposed conduit and conduit on exterior walls.
   2. Single conduit runs horizontal surfaces: galvanized, heavy duty, one hole malleable iron or 2 hole steel pipe straps.
   3. Multiple conduit runs vertical surfaces: Horizontal or vertical rack channel with conduit straps as required.
   4. Multiple conduit runs horizontal surfaces: Single or double rack channel trapeze, complete with conduit straps as required; all supported with threaded hanger rods.
   5. Conduit runs through roof: conduit extending through roof shall pass through a ceiling box at roof lines. Provide 14 gauge minimum copper box complete with watertight

soldered seams and flanged to serve as pitch pocket for each conduit. Conduit and pitch pocket shall be installed in advance of roofing work.

3.05 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Place intumescent coating in sufficient coats to achieve rating required.

D. Dam material to remain.

E. Fire Rated Surface:
   1. Seal opening at floor, wall, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of one (1) inch on both sides of building element.
      b. Size sleeve allowing minimum of one (1) inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
   2. Where conduit, wireway penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

F. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, floor, ceiling, roof opening with material matching surface penetrated.

3.06 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Division 03 Concrete.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.07 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with adjustable interlocking rubber links.

B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

C. Set sleeves in position in forms. Provide reinforcing around sleeves.

D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

E. Extend sleeves through floors one (1) inch above finished floor level. Caulk sleeves.

F. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

G. Install plastic escutcheons at finished surfaces.

3.08 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.09 CLEANING

A. Provide under provisions of Division 01- Execution Requirements.

B. Clean adjacent surfaces of firestopping materials.

3.10 PROTECTION OF FINISHED WORK

A. Provide under provisions of Division 01- Execution Requirements.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAY AND BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Conduit.
2. Tubing.
3. Raceways.
4. Wireways.
5. Outlet Boxes.
6. Pull Boxes.
7. Junction Boxes.
8. Handholes.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.
3. Section 26 05 53 - Electrical Identification.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association (NEMA):
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Division 01 - Product Requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.04 COORDINATION

A. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.01 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 1/2 inch unless otherwise specified.

2.02 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: NEMA FB 1; Fittings for metal raceways shall be steel or malleable iron and shall be zinc galvanized, or cadmium plated. Do not use aluminum or die cast fittings.

2.03 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit, PVC gasketed for mating surfaces

2.04 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1. Threaded, grounding type, insulated throat, two screw clamp type with locknuts, externally secured.

C. Minimum size 1/2 inch with the exception that 3/8 inch diameter may be used in lengths not to exceed 6 foot, to serve individual lighting fixtures installed in a suspended accessible ceiling system.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC sunlight resistant jacket.

B. Fittings: NEMA FB 1. Liquid tight, suitable for grounding, suitable for wet locations, tapered threaded hub, non-metallic materials.

2.06 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron, compression, threaded, insulated throat, gland compression type, rain and concrete tight type.

2.07 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 or 80 PVC, UL listed, and as required by NEC. Sunlight resistant.

B. Rated for 90 degrees C. cable.

C. Fittings and Conduit Bodies: NEMA TC 3, schedule 40 or 80, to match conduit.

D. Expansion fittings. PVC material, Carlon series E945 or equivalent.

E. Expansion straps. PVC material, Carlon series E978 or equivalent.

2.08 EXPANSION FITTINGS

A. Expansion fittings: Copper bonding jumper, Crouse-Hinds Type XJ.

B. Expansion/deflection fittings: Copper bonding jumper, Crouse-Hinds Type XD.

2.09 WIREWAY

A. Product Description: Raintight type wireway.

B. Knockouts: Manufacturer's standard.

C. Size: 6 x 6 inch; length as indicated on Drawings.

D. Cover: Hinged cover with full gaskets.

E. Connector: Flanged.

F. Fittings: Lay-in type with drip shield.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.10 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

D. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.11 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Cast aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Material: Cast aluminum.
   2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: "ELECTRIC".

E. Polymer concrete composite Handholes: Die-molded, polymer concrete composite hand holes:
   1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
   2. Cover: polymer concrete composite, weatherproof cover with nonskid finish. Secure cover with stainless steel hex bolts.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.02 RESTRICTIONS

A. Split, crushed, or scarred conduit is not acceptable.

B. Welded conduit is not acceptable.

C. Do not route conduit over boiler, under boiler or in slabs below boiler, incinerator, or other high temperature equipment.

D. PVC conduit may not be used in the interior of building except at following locations.
   1. PVC conduit may be used for grounding conductors.
   2. Greenhouses.
   3. Pool Equipment Rooms.

3.03 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

B. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

C. Underground More than 5 feet outside Foundation Wall: Provide schedule 40 nonmetallic conduit, unless otherwise noted on drawings.

D. Provide cast metal boxes in pavement or sidewalks and nonmetallic handhole in grass areas, unless otherwise noted.

E. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit.

F. In or Under Slab on Grade: Provide schedule 40 nonmetallic conduit.

G. Outdoor Locations, Above Grade: Provide rigid steel conduit, unless otherwise noted. Provide cast metal outlet, pull, and junction boxes.

H. In Slab Above Grade: Feeder conduit shall not be installed in slab. Provide schedule 40 nonmetallic conduit with EMT elbow so any conduit above slab shall be metallic.

I. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal junction and pull boxes. Provide flush mounting outlet box in finished areas.

J. Concealed Dry Locations: Provide rigid steel, intermediate metal conduit or electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

K. Exposed Dry Locations: Provide rigid steel, intermediate metal conduit or electrical metallic tubing, unless otherwise noted. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

L. Provide separate conduit system for each of the following systems:

1. 240 volt normal power wiring systems.
2. Low voltage lighting control systems.

3.04 INSTALLATION

A. Install Work in accordance with State and Municipality standards.

B. All conduits containing service entrance conductors shall be rigid metal conduits.

C. Ground and bond raceway and boxes in accordance with Section 26 05 26.

D. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

E. Identify raceway and boxes in accordance with Section 26 05 53.

F. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.05 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Secure conduits in place with malleable corrosion-proof alloy straps or hangers. Conduit straps used in corrosive areas shall be PVC coated.

F. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

G. Do not attach raceway to ceiling support wires or other piping systems.

H. Construct wireway supports from steel channel specified in Section 26 05 29.

I. Route exposed raceway parallel and perpendicular to walls.

J. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

K. Route conduit under slab from point-to-point.

L. Conduits routed within concrete construction such as poured walls, floor slabs, topping slabs, shall comply with following requirements.

1. Conduits shall be parallel to each other, spaced on center to center distance of at least three times conduit trade diameter, and provided with a minimum of 2 inches of concrete.
2. Contractor shall note that precast planks below topping slabs may camber. Topping slab thickness will be less at high point of camber.
3. Conduits larger than 1-1/4 inch inside diameter shall not be installed in floor slabs. Conduits over 3/4 inch ID shall not be installed in topping slabs.
4. Conduits embedded in a structural frame slab shall comply with applicable provisions of American Concrete Institute (ACI), Standard 318. Refer to structural drawings for locations of structural frames.
5. Conduits used for feeders shall not be embedded in concrete floor slabs or concrete topping slabs.
6. Conduits in poured concrete construction shall not cross other conduits or other piping.
7. Unless specifically indicated on electrical drawings, conduits installed in poured concrete construction shall be approved by Structural Engineer prior to conduit installation.
8. Contractor will be required to submit drawings showing conduit sizes and routings to Structural Engineer for their review. Approval may not be given prior to bidding. Contractors who base their bid on assumption that conduits will be allowed in concrete construction do so at their own risk. No changes will be made to contract if, during construction, Structural Engineer prohibits installation of conduit in concrete construction.
9. In areas constructed of precast concrete conduits may be run in cores of planks.

M. Maintain clearance between raceway and piping for maintenance purposes.

N. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

O. Where conduits must cross or follow the same path as water, steam or other fluid piping, run electrical conduits above such piping wherever possible.

P. Cut conduit square using saw or pipe cutter; de-burr cut ends.

Q. Bring conduit to shoulder of fittings; fasten securely.

R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

S. Install conduit hubs to fasten conduit to cast boxes in damp and wet locations.

T. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size.

U. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

V. Provide a watertight conduit system where installed in wet locations such as underground, or where embedded in concrete.

W. Install fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

X. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

Y. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

Z. Close ends and unused openings in wireway.

AA. Conduit runs that extend through areas of different temperature or atmospheric conditions or that are partly indoors and partly outdoors shall be sealed, drained, and installed in a manner that will prevent drainage of condensed or entrapped moisture into cabinets, motors, or equipment enclosures.

BB. Conduit connections at motors, transformers, and other equipment that vibrates.
1. Flexible metal conduit between 18 inches and 36 inches long for conduit connections at equipment that vibrates.
2. Liquid-tight flexible metal conduit where flexible connections are required and where conduit will be exposed to moisture, dirt, fumes, oil, corrosive atmosphere, etc. Provide with connectors to assure a liquid-tight, permanently grounded connection. Locate so it is least subject to physical abuse. Corrosive areas are identified on floor plan.
3. Use double locknuts and insulated bushings with threads fully engaged.

CC. Direct buried underground conduit.
1. Exterior underground direct buried conduits shall be buried at a depth of not less than 30 inches below grade.
2. Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture.
3. Underground conduits shall slope 1/8 inch per foot for proper drainage. Conduits shall drain toward manholes and junction boxes, not the electrical equipment.

3.06 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

3.07 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified in Division 07.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.08 ADJUSTING

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.09 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 33

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SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Branch Circuit Panelboards.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.
3. Section 26 05 26 - Grounding and Bonding.
4. Section 26 05 53 - Electrical Identification.

1.02 REFERENCES

A. Institute of Electrical and Electronic Engineers (IEEE):
1. IEEE C62.41 – Recommended Practice on Surge Voltages in Low Voltage AC Power Circuits.

B. National Electrical Manufacturers Association (NEMA):
1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 – Low Voltage Cartridge Fuses.
3. NEMA ICS 2 – Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
5. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
6. NEMA PB 1 - Panelboards.
7. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association (NETA):
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc. (UL):
1. UL 67 - Safety for Panelboards.
2. UL 1283 – Electromagnetic Interference Filters.
3. UL 1449 – Transient Voltage Surge Suppressors.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Procedures for submittals.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

C. Product Data: Submit catalog data showing specified features of standard products.

1.04 CLOSEOUT SUBMITTALS

A. Division 01 – Execution Requirements: Procedures for closeout submittals.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.05 QUALIFICATIONS

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

1.06 MAINTENANCE MATERIALS

A. Division 01 – Execution Requirements: Requirements for maintenance products.

B. Furnish two of each panelboard key. Panelboards shall be keyed alike.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Do not store panelboards exposed to weather.

B. Protect panelboards against damage from work of other trades.

PART 2 - PRODUCTS

2.01 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers:
   1. Square D, NQOD or NF Series.
   2. GE Electrical.
   3. Siemens.
   4. Cutler-Hammer.

5. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings, 100 amp minimum. Furnish copper ground bus in each panelboard.

D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt or 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, unless otherwise indicated on Drawings. Panels shall be fully rated, series rating is not acceptable.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles; no handle ties of any sort will be approved. Type HACR for air conditioning equipment circuits, HID rated for high intensity discharge lighting systems, or as indicated on Drawings.

F. Provide metal directory holders with clear plastic covers.

G. Do not use tandem circuit breakers.

H. Enclosure: NEMA PB 1, Type 1 indoors, Type 3R outdoors and damp or wet locations.

I. Cabinet Box: 6 inches deep, 20 inches (508 mm) wide.

J. Furnish wiring gutters in accordance with NEC.

K. Top or bottom feed as required.

L. Furnish with branch breaker positions and nominal current rating as indicated on Drawings.

M. Fronts:
1. Dead front safety type.
2. Door shall be built into panel front cover trim which allows access to breakers as well as to trim screw fasteners. Front cover construction with concealed trim screws and door hinges. Breaker access door shall have the following features:
   a. Concealed piano hinge.
   b. Flush stainless steel cylinder tumbler type lock with spring loaded door pulls.
   c. Locks keyed alike.
   d. Code gauge steel with rust inhibiting primer and baked enamel finish.

N. Circuit Directory:
1. Suitable for complete descriptions.
2. Clear plastic cover.
3. Typewritten card, describing the loads served.
4. Provide steel frame holder on inside cover of door to hold directory. Directory shall be covered with a sheet of clear plastic.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instruction, applicable requirements of NEC, NECA's "Standard of Installation," NEMA PB1.1, and in accordance with recognized industry practices.

B. Install flush or surface mounted as specified on drawings and schedules.

C. Support panel cabinets independently to structure with no weight bearing on conduits.

D. Install recessed panelboards to allow cover to be drawn tight against wall to provide neat appearance.

E. Install surface mounted panelboard interior so there is no gap between the panelboard back-box and cover.

F. Adjacent panel cabinets shall be of same size and mounted in horizontal alignment.

G. Attach nameplates. Nameplates for panels in public areas shall be attached to the inside face of the cover. Nameplates for panels in equipment rooms and other non-public areas shall be attached to the outside face of the cover.

H. Install panelboards plumb.

I. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

J. Install filler plates for unused spaces in panelboards.

K. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.

L. Install engraved plastic nameplates in accordance with Section 26 05 53.

M. Install spare conduits out of each recessed panelboard to accessible location: (2) 1 inch to above ceiling, (2) 1 inch to floor below. Identify each as SPARE.

N. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.02 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

3.03 INSPECTION

A. Examine area to receive new panelboards to assure adequate clearance for installation.

B. Start work only after unsatisfactory conditions are corrected.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

3.04 ADJUSTING

A. Adjust doors and operating mechanisms for free mechanical movement.

B. Tighten lugs and bus connections.

C. Clean interior of panelboard.

D. Sand, prime and paint scratched or marred surfaces to match original finish.

E. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 26 24 16

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Wall Switches.
2. Receptacles.
3. Occupancy Sensors.
4. Device Plates.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 05 33 - Raceway and Boxes.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA):
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Procedures for submittals.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

C. Submit Lighting Plan marked by manufacturer showing location, orientation and model number of occupancy sensors and power packs. Provide interconnecting wire diagrams and catalog cut sheets of occupancy sensors and power packs.

1.04 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide all wiring device types from a single manufacturer.
   1. Use of a manufacturer's name and model or catalog number is for purpose of establishing standard of quality and general configuration desired.
   2. Substitutions: In accordance with Division 01 - Product Requirements.

B. Devices and Cover Plate Colors:
   1. Coordinate device and cover plate color with final wall finish; verify color with Engineer/Architect before ordering.
   2. Unless noted otherwise, receptacles and light switches controlling emergency or critical loads shall be red in color.
   3. Adjustments in device or cover plate color shall be made in the field without additional compensation.

C. Unless otherwise indicated acceptable manufacturers are:
   1. Hubbell.
   2. Leviton.
   3. Arrow-Hart, Inc.
   4. Pass & Seymour.
   5. Substitutions: As approved by Engineer/Architect.

2.02 WALL SWITCHES

A. Switches:
   1. Single Pole Switch: 20 amps, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1221.
   2. Pilot Light (lighted) - Single Pole Switch: 20 amp, 120-277 volt, specification grade, clear polycarbonate toggle, back or side wired equal to Hubbell cat. No. HBL1221ILC.
   3. Keyed Single Pole Switch: 20 amp, 120-277 volt, specification grade, back or side wired equal to Hubbell cat. No. HBL1221L. Provide owner with a minimum of 4 keys for switches.
   4. Momentary Contact Switch: 20 amps, 120-277 volt, specification grade, back or side wired, three positions, center off equal to Hubbell cat. No. HBL1557.

2.03 RECEPTACLES

A. General:
   1. Receptacles shall be flush mounted.
   2. Receptacles shall have full grounding straps and be suitable for side or side and back wiring.
   3. Receptacles shall be Hubbell Nos. listed below or equal by approved manufacturer.
   4. Unless noted otherwise, receptacles shall be 125 volt, 2 pole, 3 wire grounding.

B. Receptacles
   1. Single Convenience Receptacle Where a single receptacle is wired to a dedicated 20 ampere: heavy duty, specification grade, 20 amp, 125 volt, NEMA 5-20R Hubbell cat. No. HBL5361.

2. General use Duplex Convenience Receptacle: heavy duty, specification grade, 15 amp, 125 volt, NEMA 5-15R Hubbell cat. No. HBL5262.
3. Duplex Receptacle Where a single duplex receptacle is wired to a dedicated 20 ampere: heavy duty, specification grade, 20 amp, 125 volt, NEMA 5-20R Hubbell cat. No. 5362.
4. Weather-Resistant: Corrosion resistant heavy duty, specification grade, 20 amp duplex, 125 volt, NEMA 5-20R, HBL53CM62 (Color – Yellow)
5. GFCI Receptacle: heavy duty, specification grade, self-testing, 20 amp, 125 volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFST20.
6. Weather-Resistant GFCI: Extra heavy duty grade, 20 amp duplex, 125 volt, NEMA 5-20R, UL 2006 compliant, Hubbell cat. No. GFR5362.

C. Weatherproof Cover Plate: Gasketed die cast metal plate with hinged and gasketed device covers. Cover shall allow cords to be plugged in and cover closed. Provide Intermatic WP1010MC for single duplex receptacles or WP1030MC for double (quad) duplex receptacles.

D. Receptacles fed from emergency circuits shall be red.

2.04 SPECIAL PURPOSE OUTLETS

A. Refer to "Special Outlet Schedule" on Drawings.

B. Electrical Contractor shall be responsible for coordinating the following items with actual equipment being furnished for the project prior to installation of outlet.
1. Exact location and orientation of outlet. Field coordinate location of outlet with Engineer/Architect's field representative, location shall not be scaled off electrical drawings.
2. Electrical characteristics of equipment, including voltage, phasing, ampacity, etc.
3. Physical characteristics of termination, e.g. receptacle configuration, cord-and-plug versus hard-wired equipment, etc.

2.05 WALL PLATES

A. Provide wall plates for wiring devices, with ganging and cutouts as indicated and with metal screws for securing plates to devices, screw heads colored to match finish of plate.

B. Decorative Cover Plate for flush mounted devices: Smooth, 302 stainless steel.

C. Device plates for surface mounted 4 inch square boxes; 1/2-inch raised galvanized steel covers.

D. Do not use jumbo cover Plates.

E. Weatherproof Cover Plate: Gasketed die cast metal plate with hinged and gasketed device covers. Cover shall allow cords to be plugged in and cover closed. Provide Intermatic WP1010MC for single duplex receptacles or WP1030MC for double (quad) duplex receptacles.

2.06 OCCUPANCY SENSORS

A. General:
   1. Unit shall have a convenient means to bypass sensor in case of failure so lighting can be operated manually.
   2. Unit shall be provided with a readily viable test LED to indicate when sensor detects motion.
   3. Sensor sensitivity and time delay shall be adjustable. Time delay shall be adjustable from 1 minute to 30 minutes at a minimum.
   4. Unit shall be UL or ETL listed.
   5. Unit shall be provided with a 3 year warranty.
   6. Occupancy sensors may be infrared, ultrasonic or combination type. Chosen manufacturer shall provide optimum technology needed for each space where a sensor is shown.

B. Manufacturers:
   1. Watt Stopper.
   2. Leviton.
   3. MyTech.
   4. Hubbell.
   5. Substitutions: As approved by Engineer/Architect.

C. Passive Infrared Wall Switch:
   1. Sensor shall use passive infrared detection method for detecting room occupancy. Unit shall fit in/on a standard single gang switch box and require only two wires and a grounded box for operation.
   2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz, 1000 watts minimum at 277 volts, 60 Hz for fluorescent lamps, larger size to accommodate load as shown on Drawings.
   3. Switch shall have manual override for positive off.
   4. Area of coverage shall be 250 square feet minimum, greater range to accommodate room size as shown on Drawings.
   5. Model Watt Stopper: DI Series.

D. Ceiling-Mounted Dual Technology Occupancy Sensor:
   1. Sensor shall employ both infrared and ultrasonic sensing methods to detect room occupancy. Unit shall fit in/on a standard octagon box.
   2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps.
   3. Area of coverage shall be adjustable. Unit shall be provided with a dip switch to allow either detection technology to be independently configured.
   4. Unit shall be provided with a dip switch to select one of five different sensing modes as dictated by environmental factors.
   5. Model: Watt Stopper: DT-300.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Switches controlling equipment operation of which is not evident from switch position shall include pilot light in conjunction with proper switch.

B. Each switch shall be complete with engraved plate to identify equipment being controlled. Provide black letters on clear background, 1/8-inch high, minimum.

C. Do not install devices until after wall finishes have been completely applied.

D. Any outlets installed prior to walls being finished and used for construction power shall be replaced at time of substantial completion.

E. Install devices and wall plates plumb and level.

F. Install switches with OFF position down.

G. Do not share neutral conductor on load side of dimmers.

H. Install receptacles with grounding pole on top.

I. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

J. Route continuous green equipment grounding conductor with branch circuit conductors serving isolated ground receptacles. Terminate equipment ground on isolated ground bus in panelboards.

K. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

L. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller.

M. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

N. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

O. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise make circuit connections via wire connectors and pigtails.

P. Provide a layer of electrical tape around perimeter sides of each wiring device so that terminations are insulated.

Q. Where GFI protected receptacles are indicated on Drawings, each receptacle indicated shall be a GFI receptacle. Standard receptacles protected with an upstream GFI receptacle shall not be approved.

R. Provide arc-fault circuit interrupter (AFCI) for Branch Circuits feeding receptacles in dwelling unit bedrooms. AFCI protection may be provided by an AFCI receptacle or AFCI device in circuit breaker panel feeding dwelling unit bedrooms.

S. Multiple or Special Switch Stations:
   1. Grouped local switches under common cover plate as scheduled or noted on the drawings. Provide pilot lights on all circuits remote from general area or exterior to building. Eight-gang plate maximum - where two plates are required, same shall be equal in size and located one above the other. Switch plates shall include an engraved, Bakelite nameplate to identify function of each switch. Nameplate shall be screwed in place.

T. Occupancy Sensors:
   1. Install sensors within rooms in accordance with manufacturer's guidelines and recommendations.
   2. Infrared sensors shall be placed where they will have a direct line of sight to occupied areas.
   3. Ultrasonic sensors shall not be placed immediately adjacent to HVAC diffusers. High velocity air movement may result in nuisance tripping of sensor.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 – Raceway and Boxes to obtain mounting heights as indicated on Drawings.

B. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 26 05 39 – Underfloor Raceway Assemblies.

C. Coordinate installation of wiring devices with floor box service fittings provided under Section 26 05 34 – Floor Boxes.

3.05 FIELD QUALITY CONTROL

A. Division 01 – Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

G. Occupancy Sensors:
   1. Sensitivity Test: After sensor has been energized for at least 15 minutes, walk to middle of room (if conference room) or sit at normal desk position (if an office). Make no motion for 20 seconds. Move one arm up and down slowly. Test LED should blink.
   2. Time Delay Test: Set time delay for 10 minutes. Walk into room to activate sensor, then leave room. Sensor must turn lights off at approximately 10 minutes.

H. If a device fails to properly operate, replace at no extra charge to Owner.

3.06 ADJUSTING

A. Devices and face plates on a common wall with common mounting heights shall be level and square to each other. Adjustments required after installation shall be made without additional compensation.

B. Mark conductors with panel and circuit number serving device, at device.

C. Mark panel and circuit number serving device on backside of device plate with a permanent marking system that does not show through front of plate.

3.07 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 26 27 26

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SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fuses.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 26 00 00 – Basic Electrical Requirements.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA):
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.03 DESIGN REQUIREMENTS

A. Select fuses to provide appropriate levels of short circuit and over-current protection for the following components: wire, cable, bus structures, and other equipment. Design system to maintain component damage within acceptable levels during faults.

B. Select fuses to coordinate with time current characteristics of other over-current protective elements, including other fuses, circuit breakers, and protective relays. Design system to maintain operation of device closest to fault operates.

1.04 FUSE PERFORMANCE REQUIREMENTS

A. Load Feeder Switches: Class RK1. Bussmann low-peak or equivalent, one-end rejection, 0-600 amp, 200,000 ampere interrupting rating.

B. Motor Load Feeder Switches: Class RK1. Bussmann low-peak or equivalent, one-end rejection, 0-600 amp, 200,000 ampere interrupting rating.

C. Motor and general purpose Branch Circuits: Class RK1. Bussmann low-peak, LPS-R or equivalent, dual element, time delay with short circuit protection, 200,000 ampere interrupting rating.

D. Lighting Branch Circuits: Class G.

E. Control Power Transformer Circuits: Class CC.

1.05 SUBMITTALS

A. Division 01 - Submittal Procedures: Procedures for submittals.

B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.06 CLOSEOUT SUBMITTALS

A. Division 01 – Execution Requirements: Procedures for closeout submittals.

B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.07 QUALIFICATIONS

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

1.08 MAINTENANCE MATERIALS

A. Division 01 – Execution Requirements: Spare parts and maintenance products.

B. Furnish two fuse pullers.

1.09 EXTRA MATERIALS

A. Division 01 – Execution Requirements: Requirements for extra materials.

B. Furnish three spare fuses of each Class, size, and rating installed.

PART 2 - PRODUCTS

2.01 FUSES

A. Manufacturers:
1. Bussmann.
2. Ferraz-Shawmut.
3. Littlefuse.
4. Substitutions: In accordance with Division 01 - Product Requirements.

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.02 SPARE FUSE CABINET

A. Manufacturers:
   1. B-Line.
   2. Ferraz-Shawmut.
   3. Unity Mfg.
   4. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.

C. Doors: Hinged, with hasp for Owner's padlock.

D. Finish: Gray enamel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fuse with label oriented so manufacturer, type, and size are easily read.

B. Install spare fuse cabinet as indicated on Drawings.

END OF SECTION 26 28 13

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SECTION 26 28 19

ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fusible and Non-fusible switches.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 26 00 00 – Basic Electrical Requirements.
   3. Section 26 28 13 - Fuses.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA):
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association (NETA):
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Procedures for submittals.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.04 CLOSEOUT SUBMITTALS

A. Division 01 – Execution Requirements: Procedures for closeout submittals.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.05 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Square D.
   2. Cutler Hammer/Westinghouse.
   3. Siemens.
   4. General Electric.
   5. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Provide means to temporarily override interlock and allow door to be opened with switch on.

C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.

D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
   1. Type 3R.

E. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

F. Furnish switches with entirely copper current carrying parts.

G. Provide ANSI/UL Class RK1, dual element, time delay, 600 volt fuses in disconnect switches, sized as shown on drawings.

H. Quick make and break operator mechanism.

I. Handle attached to box, not cover.

J. Handle position indication, ON in up position and OFF in down position.

K. Padlock provisions for up to three padlocks in OFF position.

L. UL listed lugs for type and size of wire specified.

M. Spring reinforced fuse clips for Type R fuses.

N. Provisions for insulated or grounded neutral.

2.02 NONFUSIBLE SWITCH ASSEMBLIES

A. Manufacturers:
   1. Square D.
   2. Cutler Hammer/Westinghouse.
   3. Siemens.

4. General Electric.
5. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Provide means to temporarily override interlock and allow door to be opened with switch on.

C. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.
3. Wet Locations: Type 4.

D. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.

E. Furnish switches with entirely copper current carrying parts.

F. Quick make and break operator mechanism.

G. Handle attached to box, not cover.

H. Handle position indication, ON in up position and OFF in down position.

I. Padlock provisions for up to three padlocks in OFF position.

J. UL listed lugs for type and size of wire specified.

K. Provisions for insulated or grounded neutral.

2.03 SWITCH RATINGS

A. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.

B. Short Circuit Current Rating: UL listed for 200,000 rms symmetrical amperes when used with or protected by Class R fuses (30-600 ampere switches employing appropriate fuse rejection schemes).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide disconnect switches for loads as required by code. Review HVAC and Plumbing specifications to determine what equipment is furnished with disconnect switches.

B. Install all disconnect switches whether furnished under this contract.

C. Electrical Contractor shall determine need for a disconnect switch requirements for each specific load.

D. Contractor shall include in their bid all disconnect switches required whether indicated on the drawings or not.

E. Install enclosed switches plumb.

F. Height: 5 feet to operating handle.

G. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

H. Install engraved plastic nameplates in accordance with Section 26 05 53.

I. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

J. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices.

K. Locate disconnect switches as shown on drawings or as required by NEC.

L. Install on equipment support where feasible, or anchor firmly to wall or structural surface.

M. Provide control circuit interlock as required by NEC.

3.02 ADJUSTMENT

A. Adjust covers and operating mechanism for free mechanical movement.

B. Verify overcurrent protection to provide proper operation and compliance with NEC.

C. Tighten wire and cable connections.

D. Clean interior of enclosure.

E. Touch up scratched or marred surfaces to match original finish.

3.03 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION 26 28 19

SECTION 26 29 33

MOTOR WIRING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Connections and wiring to motors.

B. Related Sections:
   1. Applicable provisions of Division 01 shall govern all work under this Section.
   2. Section 26 00 00 – Basic Electrical Requirements.
   3. Section 26 05 19 - Building Wire and Cable.
   4. Section 26 05 26 - Grounding and Bonding.
   5. Section 26 05 53 - Electrical Identification.
   6. Section 26 28 19 - Enclosed Switches.

1.02 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electric Code.

1.03 QUALITY ASSURANCE

A. Installation shall conform to the requirements of the following agencies:
   1. National Electrical Code (NEC).
      a. Including State of Wisconsin and local supplements.
   2. National Electrical Contractors Association (NECA).
      a. NECA - Standard of Installation.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 GENERAL

A. Motor starters shall be furnished by Contractor supplying motor requiring a starter.

B. Drawings show anticipated horsepower loads and circuit sizes. Loads and circuit sizes shall be used as a guide to provide final performance requirements. Verify actual requirements with Contractor and install accordingly under this Contract.

C. Contractor to verify, and correct if necessary, if heater elements in starters match installed motor characteristics.

D. Contractor shall check drawings and specifications of other trades to determine requirements for motor disconnect switches. In each case, Contractor shall install all required disconnect switches.

E. Contractor shall provide, where required by Code and for motors out of sight of controller, all disconnect switches not specifically supplied by others.

F. Unless otherwise indicated on drawings or elsewhere in these specifications, all motors shall be furnished by others.

G. Motors shall be set in place by others and associated motor starters and controllers shall be turned over to Electrical Contractor for installation.

H. Contractor supplying starters and controllers shall index same and provide Electrical Contractor with written instructions as to proper location in sufficient time to permit installation of a concealed raceway system.

I. Control wiring shall be responsibility of HVAC Contractor. Electrical Contractor shall extend circuit to control transformers and make final 120V transformer connections. Transformers will be supplied by HVAC Contractor. Control transformer shall be in starter enclosure.

J. Review HVAC and plumbing specifications and provide all line voltage wiring and connections to controls and auxiliary equipment specified as to be provided by Electrical Contractor or Division 26.

K. On motor wiring schedule, column stating "starter wiring" refers to line voltage wiring from starter to motor.

L. Final conduit connection to motor shall be made with liquid-tight flexible metal conduit or flexible metal conduit, except where prohibited by any other section of these specifications.

M. All conductors serving motors shall be stranded.

N. Install a separate green equipment grounding conductor, with circuit conductors, to all motors.

O. Verify proper rotation of each motor as it is being wired or before motor is energized for any reason.

END OF SECTION 26 29 33

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Interior Luminaires.
2. Interior Lamps.
3. Ballasts.
4. Accessories.

B. Related Sections:
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI C82.1 - Electric Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
2. ANSI C82.4 - Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Procedures for submittals.

B. Shop Drawings:
1. Include outline drawings, catalog cut sheets, lamp and ballast data, support points, weights, accessory information, and performance data for each luminaire type.
2. For all luminaries with paint color or finish options, include single color original of manufacturers color or finish choices for Architects review.

C. Product Data: Submit dimensions, ratings, and performance data.

D. Record Drawings: For installations utilizing remotely mounted low voltage transformers, Electrical Contractor shall provide set of record drawings indicating location of installed transformers to facilitate future maintenance.

E. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

1.04 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.01 GENERAL – INTERIOR LIGHTING

A. Furnish all labor, materials, tools, equipment, and services for all interior lighting, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for sound, secure and complete installation.

2.02 INTERIOR LUMINAIRES

A. Subject to compliance with requirements, fixtures that may be incorporated into work include products specified in lighting fixture schedule on Drawings, and equals listed in accompanying notes.

B. Basic catalog number only is indicated in lighting fixture schedule. Electrical Contractor shall furnish complete lighting fixtures in quantities, and row lengths as shown on Drawings, including plaster frames, ends, or caps, couplings, connectors, suspension assemblies, mounting brackets and all auxiliary accessories as required.

C. Reference schedule for description of fixture nomenclature and associated ceiling type and suspension system.

D. Housing:
   1. Shall be free from burrs, sharp corners and edges.
   2. Shall be steel, unless noted otherwise, formed and supported to prevent warping and sagging.
   3. Provide spring loaded latches for all troffers.

E. Mounting Accessories:
   1. Recessed fixtures:
      a. Provide trim type and accessories required for installation in ceiling types specified shown on reflected ceiling plan.
      b. Fixtures mounted in sloped ceilings shall be provided with sloped ceiling adapters and appropriate trim rings and other accessories as required.
   2. Surface mounted fixtures: Provide ceiling spacers as required for fixtures not labeled as suitable for direct mounting to a low density ceiling.
   3. Suspended fixtures:
      a. Provide swivel canopy to accommodate any sloped ceilings shown on plans.
      b. Provide pendant or cable length required to suspend luminaries at indicated height.

c. Swivel hangers in mechanical equipment areas shall be shock absorbing type.

F. Finishes:
1. Painted finishes shall be polyester powder painted enamel finish, and painted after fabrication unless noted otherwise.
2. Polished, brushed or other metal finishes shall be finished with clear coat to inhibit finish deterioration and corrosion.
3. Finish types and colors shall be verified with Architect/Engineer prior to ordering.

G. Louvers, Reflectors, Lenses:
1. Louvers and reflectors shall be semi-specular, low iridescent, clear alzak, unless noted otherwise.
2. Parabolic louver depth shall have minimum actual dimension of 3 inches, unless noted otherwise.
3. Acrylic lenses shall be pattern 12 prismatic, overall 0.125 inch minimum thickness.

H. Provide IC rated light fixtures for light fixtures that will be in contact with insulation.

2.03 FLUORESCENT BALLASTS

A. Manufacturers:
1. Advance Transformer.
2. Universal.
3. Osram/Sylvania.
4. Substitutions: As approved by Engineer.

B. Product Description: Electronic ballast, Program Start, suitable for lamps specified, with universal input voltage that will accept any line voltage between 120 volt.

C. Fluorescent ballasts shall be electronic type, unless noted otherwise, and shall meet the following standards:
1. UL Listed (Class P) Sound Rating A and CSA certified.
2. Comply with EMI and RFI limits set by FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
3. Meet applicable standards designated by ANSI.
4. Be potted or conformal coated in metallic case and not contain PCB's.
5. Provide normal rated lamp life as stated by lamp manufacturers with rated life at 3 hour burn time for each start.

D. Compact fluorescent ballasts shall be electronic type, unless noted otherwise, and shall meet the following requirements, in addition to those listed above:
1. Provide with ballast shut-off circuit for protection of ballast at end of lamp life.

E. Nominal power factor of 0.95 or higher.

F. Total harmonic distortion of less than 10 percent at 120 or 277 volts.

G. Ballast factor 0.85 or better.

H. Frequency of operation shall be 20 khz – 50 khz and units shall operate without visible flicker.

I. Operating temperature shall not exceed 65 degrees C at any point on case at 40 degree C ambient.

J. Ballasts shall carry minimum three (3) year warranty covering replacement parts and labor for life of warranty.

K. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL Listing.

L. Ballasts shall withstand line transients as defined in IEEE 587, Category A.

M. Fluorescent ballasts, other than electronic type, shall only be used where specifically noted on Drawings, shall be of High Power Type, CBM and ETL Certified, Best Energy Saving Type and Sound Rated where available.

N. Luminaires located within same room shall be tandem wired, masterslave, or provided with three (3) lamp ballasts in following areas:
   1. One (1) lamp or three (3) lamp fluorescent luminaries recess mounted within ten (10) feet center-to-center of each other.
   2. One (1) lamp or three (3) lamp fluorescent luminaries pendant or surface mounted within one (1) foot edge-to-edge of each other.

2.04 LAMPS

A. General – Lamps:
   1. Lamps shall be provided new.
   2. Approved manufacturers;
      a. Fluorescent:
         1) Philips.
         2) Osram/Sylvania.
         3) General Electric.
         4) Substitutions: As approved by Engineer.

B. Fluorescent:
   1. Color temperature: 3,500K unless noted otherwise.
   2. Minimum Color Rendering Index (CRI): 85 unless noted otherwise.
   3. Non-compact lamps:
      a. Lamp life: Minimum 20,000 hours average based on three hours per start when used on rapid start circuits.
      b. Lamps shall be 32 watt, T8, minimum 2,900 lumens initial, rapid start, unless noted otherwise.
      c. Lamps shall meet EPA TCLP standards for disposal as non-hazardous waste.
   4. Compact Fluorescent:
      a. Lamp life: Minimum 10,000 hours average based on three hours per start.
      b. Lamps shall be four pin type, unless noted otherwise.

2.05 MAINTENANCE MATERIALS

A. Division 01 – Execution Requirements: Spare parts and maintenance products.

B. Furnish two of each plastic lens type.

C. Furnish six replacement lamps for each lamp installed.

D. Furnish two of each ballast type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.

B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.

C. Locate recessed ceiling luminaires as indicated on Drawings. Coordinate all discrepancies between lighting and reflected ceiling plans with architect.

D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Install recessed luminaires to permit removal from below.

F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

G. Install earthquake clips to secure recessed grid-supported luminaires in place.

H. Install wall-mounted luminaires at height as indicated on Drawings.

I. Install accessories furnished with each luminaire.

J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

K. Install specified lamps in each luminaire.

L. Electrical Contractor shall check Structural Drawings, architectural reflected ceiling plans, General Construction Drawings and Mechanical Drawings to verify construction and type of surface on or in which lighting fixtures are installed, for ceiling construction proper type of suspended ceiling and space above same and possible conflicts with equipment of other trades.
   1. Determine specific ceiling construction including ceiling materials and ceiling suspension system in each area where suspended ceiling is to be provided.
   2. Verify suspended ceiling type with ceiling contractor prior to releasing lighting fixtures for delivery.
   3. Furnish fixture of type scheduled complete with accessories necessary to make installation accordance with manufacturer's recommendations including plaster frames, couplings and connectors, suspension assemblies mounting brackets and other auxiliary equipment.

M. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

N. Fixture Connections:
1. Surface and wall recessed fixtures shall be connected directly to junction box or solid conduit.
2. Ceiling recessed fixtures shall be connected to flexible metal conduit, originating at solidly supported J-Box.
3. Flexible metal conduit shall be minimum 3/8 inch diameter. Conduit length shall allow movement of fixture for maintenance purposes.
4. Minimum wire size shall be #12 AWG.

O. Provide box-outs and other accessories around recessed fixtures as required to maintain fire ratings for spacing required from insulation in ceiling space. Final installation shall meet regulatory requirements and manufacturer's recommendations.

P. Contractor shall verify exit signs are provided and visible along all exit paths shown on Architectural Life Safety Plan.

3.02 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection.

B. Inspect for proper connection and operation.

3.03 ADJUSTING

A. Aim and adjust luminaires as indicated on Drawings and adjust as directed by designated Owner personnel.

3.04 CLEANING

A. Remove dirt and debris from enclosures.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

3.05 PROTECTION OF FINISHED WORK

A. Division 01 - Quality Requirements: Protecting finished work.

B. Relamp luminaires having failed or noticeable dim lamps at Substantial Completion.

END OF SECTION 26 51 00

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
1. Exterior Luminaries.
2. Accessories.

B. Related Sections
1. Applicable provisions of Division 01 shall govern all work under this Section.
2. Section 26 00 00 – Basic Electrical Requirements.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. ANSI C82.1 - Electric Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
2. ANSI C82.4 - Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.

1.03 SUBMITTALS

A. Division 01 - Submittal Procedures: Procedures for submittals.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

D. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

1.04 QUALIFICATIONS

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products under provisions of Division 01 - Product Requirements.

B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.06 COORDINATION

A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.07 MAINTENANCE MATERIALS

A. Division 01 – Execution Requirements: Spare parts and maintenance products.

B. Furnish two of each lamp installed.

C. Furnish two gallons of touch-up paint for each different painted finish and color.

D. Furnish two ballasts of each lamp type installed.

PART 2 - PRODUCTS

2.01 LUMINARIES

A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.

B. Substitutions: In accordance with Division 01 - Product Requirements: Requirements for product options.

2.02 FLUORESCENT BALLASTS

A. Manufacturers:
1. Cooper Industries Inc.
2. Duro-Test Corp.
3. General Electric Co.
4. Hubbell Lighting
5. Magnetek Inc.
6. Pass & Seymour
7. Philips Electronic North America
8. Thomas Industries, Inc.
9. Substitutions: In accordance with Division 01 - Product Requirements.

B. Product Description: High-power-factor type electromagnetic ballast certified by Certified Ballast Manufacturers, Inc. to comply with ANSI C82.1, suitable for lamps and environmental conditions specified, with voltage to match luminaire voltage.

2.03 FLUORESCENT LAMPS

A. Manufacturers:
   1. Duro-Test Corp.
   2. General Electric Co.
   3. Hubbell Inc.
   4. Philips Electronics
   5. Siemens Corp.
   6. Substitutions: In accordance with Division 01 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify foundations are ready to receive fixtures.

3.02 INSTALLATION

A. Install lamps in each luminaire.

B. Bond and ground luminaries, metal accessories in accordance with Section 26 05 26.

3.03 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

3.04 ADJUSTING

A. Division 01 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Aim and adjust luminaries to provide illumination levels and distribution.

3.05 CLEANING

A. Division 01 - Quality Requirements: Final cleaning.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

3.06 PROTECTION OF FINISHED WORK

A. Division 01 - Quality Requirements: Protecting finished work.

B. Relamp luminaries at Substantial Completion.

END OF SECTION 26 56 00

SECTION 31 02 00

GENERAL REQUIREMENTS FOR SITEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. This Section governs only technical specifications related to site work construction.

B. Section Includes:
1. Definitions.
2. Field Engineering.
3. Pre-installation Meeting.
4. Submittal Procedures.
5. Quality Control Requirements.
6. Erosion and Sediment Control.
7. Product Requirements.
8. Project Closeout Procedures.

C. Related Divisions:
1. Division 02 – Existing Conditions.
2. Division 31 – Earthwork.
3. Division 32 – Exterior Improvements.
4. Division 33 – Utilities.

1.02 DEFINITIONS

A. Field Engineering: Contractor's establishment of elevations, lines, and levels as indicated on Drawings, utilizing recognized engineering survey practices.

B. Pre-installation Meeting: Meeting to discuss a product or material, typically complex in nature, and review manufacturer's precautions, restrictions, and installation procedures.

C. Submittal Procedures: Specified requirements regarding procedures related to submission of product data, Shop Drawings, manufacturer's certificates, and substitutions.

D. Quality Control: Inspection, analysis, and other relevant actions taken to provide control over what is being done, manufactured, or fabricated, so that a desirable level of quality is achieved and maintained during duration of the Work.

E. Erosion and Sediment Control: Enforcement of state law and city or county ordinance for erosion and sediment control including installation, maintenance, and regular Contractor inspection and repair.

F. Product Requirements: Product information regarding manufacturer's data, preparation, fabrication, conveying and erection of Work including material, machinery, components, equipment, fixtures, and systems incorporated in Work.

G. Project Closeout Procedures: Process that provides acceptance of project by Owner and Engineer/Architect including verification and documentation of required project records, and retention of other essential project documentation.

1.03 FIELD ENGINEERING

A. Employ Land Surveyor registered in State of Wisconsin and acceptable to Owner.

B. Contractor shall locate and protect survey control and reference points. Promptly notify Owner of discrepancies discovered.

C. Control datum for survey is that established by Owner provided survey.

D. Verify setbacks and easements; confirm drawing dimensions and elevations.

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

F. Submit copy of site drawing and certificate signed by registered 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. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

I. Promptly report to Construction Manager loss or destruction of reference point or relocation required because of changes in grades or other reasons.

J. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Owner.

K. A Registered Land Surveyor shall replace damaged property corners at Contractor's expense.

1.04 PREINSTALLATION MEETING

A. When required in individual specification sections, convene preinstallation meeting at Project site prior to commencing work of specific section.

B. Require attendance of parties directly affecting, or affected by, Work of specific section.

C. Notify Owner and Construction Manager four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Owner and Construction Manager and those affected by decisions made.

1.05 DEMONSTRATION AND TRAINING MEETING

A. Contractor shall schedule and administer demonstration and training sessions for Owner for each portion of equipment and products that are required to have training in proper operation and maintenance.

B. Contractor shall schedule representatives of equipment manufacturer to attend demonstration and training sessions to provide additional information as necessary.

1.06 SUBMITTAL PROCEDURES

A. Contractor shall provide Engineer/Architect specific submittal information regarding products and materials of this specification section with extended permission of Architect.

B. Submit Shop Drawings and product data covering identified equipment and materials that will become a permanent part of Work to Engineer/Architect for review.

C. Shop Drawings and product data shall include drawings, descriptive information, and sufficient detail to show kind, size, arrangement, and operation of component materials and devices needed for installation and coordination with other materials and equipment.

D. All submittals, regardless of origin, shall be stamped with approval of Contractor and identified with name of the Project, Contractor's name, and references to applicable specification sections and Drawings.

E. Each submittal shall indicate intended use of item in Work. When manufacturer data sheets are submitted, clearly identify applicable items and cross out inapplicable data.

F. Manufacturer's data sheets shall be current and include issue number and date.

G. Contractor's stamp of approval is a representation to Engineer/Architect that Contractor accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that Contractor reviewed and coordinated each submittal with requirements of the Work.

H. Contractor shall accept full responsibility for completeness of each submission. When an item consists of components from several sources, Contractor shall submit a complete initial submittal including all components.

I. Identify deviations from Specifications and Drawings on each submittal and tabulate in Contractor's letter of transmittal. Such submittals shall indicate details of proposed changes, including modifications to other facilities that may result from deviation, and required piping and wiring diagrams.

J. Submit six (6) copies of each drawing and necessary data to Engineer/Architect. Engineer/Architect will return two marked copies to Contractor. Electronic copies will not be acceptable.

K. Engineer/Architect will not accept submittals from anyone but Contractor.

L. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

M. Review of Shop Drawings and Product Data:
1. Engineer/Architect's review of Shop Drawings and product data will cover only general conformity to Drawings and Specifications, external connections, and dimensions that affect layout. Engineer/Architect's review does not indicate a thorough review of all dimensions, quantities, and details of material, equipment, device, or item shown.
2. Engineer/Architect's review shall not relieve Contractor of Contractor's responsibility for errors, omissions, or deviations in drawings and data, or of sole responsibility for compliance with the Work.
3. Engineer/Architect's submittal review period shall be a maximum of fifteen (15) calendar days from date of submittal or resubmittal.
4. When Shop Drawings and data are returned marked "NOT ACCEPTABLE" or "RETURNED FOR CORRECTION", Contractor shall make corrections as noted by Engineer/Architect and resubmit six (6) corrected copies. Electronic copies will not be acceptable.
5. When Shop Drawings and product data are returned marked "EXCEPTIONS NOTED" or "APPROVED AS SUBMITTED", no additional copies need be submitted unless requested by Engineer/Architect at time of review.

N. Re-submittal of Shop Drawings and Product Data:
1. Contractor shall accept full responsibility for completeness of each re-submittal.
2. Contractor shall verify that resubmittal provides all corrected data and additional information previously requested by Engineer/Architect.
3. When corrected copies are re-submitted, Contractor shall indicate in writing revisions made.
4. Requirements specified for initial submittals also apply to re-submittals.
5. Re-submittals shall bear number of first submittal followed by a letter (A, B, etc.) to indicate sequence of re-submittal.
6. Make re-submittals within fifteen (15) days of date of letter returning material to be modified or corrected.

O. Substitutes and "Or-Equal" Items:
1. Whenever a material or article is specified or described by using a single name of a proprietary product or a single name of a particular manufacturer or vendor, specified item mentioned shall be understood as establishing type, function, and quality desired.
2. Whenever two or more names of proprietary products or particular manufacturers or vendors are used, it shall be understood that products of one named supplier shall be furnished with no options or substitutions allowed.
3. Products, materials, or equipment not specified by proprietary name and submitted as a proposed substitute shall be reviewed and approved or rejected by Engineer/Architect.

4. Cost of proposed substitution review is subject to financial reimbursement from Contractor to Engineer/Architect for time taken for review and verification in the amount of $200.00 dollars for each hour of review and verification.
5. Contractor shall be liable for all costs incurred by Engineer/Architect related to each substitution review, including proposed substitutions which are rejected.

1.07 QUALITY CONTROL REQUIREMENTS

A. Construction Notification:
1. Contractor shall be responsible for locating existing underground installations in advance of excavating or trenching by contacting local utility identification agency.

B. Licenses, Permits, and Certificates:
1. All licenses, permits, and certificates, required for, and in connection with site and utility work shall be secured by Contractor at their sole cost and expense.
2. Contractor will be required to pay any permit fees for required for utility work.
3. Contractor shall comply with all requirements and recommendations of authority or authorities issuing license, permit, or certificate.

C. Easements and Rights-of-Way:
1. Contractor will confine construction operations to areas designated on Drawings or identified by Engineer/Architect and Owner's Representative.
2. Contractor shall use care in placement of construction tools, equipment, excavated materials, pipe materials, and supplies so as to minimize damage to property and minimize interference with the public.

D. Protection of Property:
1. Contractor shall protect from damage or injury all property including survey monuments, property markers, and benchmarks. Items damaged shall be replaced or repaired at Contractor's expense.
2. Locate existing utilities and utility services in advance of excavation and protect against damage. Changes in grade and alignment may be made to Work to avoid conflicts with existing structures if approved by Engineer/Architect.

E. Reference Standards:
1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean latest edition of appropriate standard, specification, manual, code, law, or regulation in effect on date of first advertisement for the Work, unless specifically stated otherwise in Contract Documents.
2. Should there be a conflict in Reference Standards, Contractor shall request clarification from Engineer/Architect before proceeding.

F. Compaction and Gradation Testing:
1. Contractor shall provide and pay for compaction and gradation testing by a Construction Manager approved independent testing laboratory.
   a. Make two initial gradation tests for each type of bedding and backfill material, and make one additional gradation test for each additional 500 tons of each material.

b. Moisture-density (Proctor) tests and relative density tests on materials, and in-place field density tests, shall be made at intervals determined by testing agency.
c. Perform compaction (Proof roll) testing in accordance with procedures specified in Section 31 23 17 – Site Excavation, Backfill, and Compaction and Section 32 11 23 – Aggregate Base Course.

1.08 EROSION AND SEDIMENT CONTROL

A. Comply with requirements specified in Section 31 25 13 – Erosion Controls, and as indicated on Drawings.

1.09 PRODUCT REQUIREMENTS

A. Products include material, equipment, and systems.

B. Comply with specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a Specification section shall be same, and shall be interchangeable.

D. Do not use materials and equipment removed from existing structure, except as specifically required or allowed by Contract Documents.

E. Products Specified by Reference Standards or by Description Only: Furnish any product meeting those standards.

F. Products Specified by Naming Two or More Manufacturers: Furnish products of one named manufacturer meeting specifications; no options or substitutions allowed.

G. Products Specified by Naming One or More Manufacturers or with a Provision for Substitutions: Submit a request for substitution of a proposed equal.

1.10 PROJECT CLOSEOUT PROCEDURES

A. Project Records Documents:
1. Contractor shall maintain, on site, one set of the following record documents:
   a. Drawings.
   b. Specifications.
   c. Approved Shop Drawings.
   d. Product data.
   e. Samples.
2. Contractor shall store Record Documents separate from documents used for construction.
3. Contractor shall record actual revisions to the Work and maintain information concurrent with construction progress.
4. Contractor shall legibly mark each item to record actual construction including:

a. Measured horizontal and vertical locations of new utilities and existing underground utilities and appurtenances referenced to permanent surface improvements.
b. Field changes of dimensions and Drawing details.
c. Details not on original Drawings.

5. Submit Record Documents to Engineer/Architect at Final Inspection, including:
   a. Project Drawings.
   b. Survey notes.
   c. Approved submittals.
   d. Operation and Maintenance Manuals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 31 02 00

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SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Subsoil materials.
2. Topsoil materials.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 – Aggregates for Earthwork.
3. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
4. Section 31 25 13 - Erosion Controls: Slope protection and erosion control.
5. Section 32 91 19 - Landscape Grading.
6. Section 32 92 00 – Turf and Grasses.

1.02 REFERENCES

A. State of Wisconsin Department of Transportation
1. Standard Specifications for Highway and Structure Construction, Current Edition. (WISDOT)

B. ASTM International (American Society for Testing and Materials)
1. ASTM D2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
2. ASTM D5268 – Topsoil Used for Landscaping Purposes.

1.03 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Samples: Submit, in airtight containers, 10 lb. sample of each type of fill to testing laboratory.

C. Product Data: Submit testing laboratory results for each type of specified soil.

D. Materials Source: Submit name of source of imported materials.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Wisconsin Department of Transportation standards.

PART 2 - PRODUCTS

2.01 SUBSOIL MATERIALS

A. Subsoil Type S1:
1. Excavated and re-used material.
2. Graded.
3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
4. Contractor shall provide 10 lb sample of existing site material to laboratory for soil classification analysis conforming to ASTM D2487.

B. Subsoil Type S2:
1. Structural.
2. Graded.
3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
4. Imported subsoil and borrow shall be similar in composition when compared to existing site subsoil.
5. Contractor shall provide 10 lb sample of proposed imported borrow material to laboratory for soil classification analysis conforming to ASTM D2487.

2.02 TOPSOIL MATERIALS

A. Topsoil Type T1:
1. Excavated and reused material.
2. Graded.
3. Soil shall be free of roots, twigs, stones, subsoil, debris, weeds, and foreign matter larger than 1/2 inch.
4. Topsoil shall be evaluated in accordance with ASTM D5268.
5. Contractor shall provide 10 lb sample of excavated and reused material to laboratory for soil classification analysis conforming to ASTM D2487.

B. Topsoil Type T2:
1. Imported borrow.
2. Friable loam.
3. Soil shall be free of roots, twigs, stones, subsoil, debris, weeds, and foreign matter larger than 1/2 inch.
4. Acidity range (pH) of 5.5 to 7.5.
5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.
6. Limit decaying matter to 5 percent of total content by volume.
7. Topsoil shall be evaluated in accordance with ASTM D5268.
8. Contractor shall provide 10 lb sample of proposed imported borrow material to laboratory for soil classification analysis conforming to ASTM D2487.

2.03 SOURCE QUALITY CONTROL

A. Section 31 02 00 – General Requirements for Sitework: Testing and analysis of soil material.

B. Testing and Analysis of Topsoil Material designated for Landscaping Purposes: Perform in accordance with ASTM D5268.

C. When tests indicate materials do not meet specified requirements, change material and retest.

D. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

Not Used

END OF SECTION 31 05 13

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SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Aggregate materials and designations for building aggregate base course.
2. Aggregate materials and designations for pavement aggregate base course.
3. Aggregate materials and designations for backfill.
4. Aggregate materials and designations for grading purposes.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 13 – Soils for Earthwork.
3. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
4. Section 31 25 13 - Erosion Controls: Slope protection and erosion control.
5. Section 32 11 23 - Aggregate Base Course.
6. Section 32 91 19 - Landscape Grading.

1.02 REFERENCES

A. ASTM International:
1. ASTM C33 – Standard Specification for Concrete Aggregates.
2. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B. State of Wisconsin Department of Transportation:
1. Standard Specifications for Highway and Structure Construction, Current Edition. (WISDOT).

1.03 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Product Data: Submit gradation information for each type of aggregate specified. Gradation results shall be taken within the past (3) months from contract date.

C. Samples: Submit, in airtight containers, 10 lb sample of each type of fill to testing laboratory.

D. Materials Source: Submit name of source of imported materials.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Wisconsin Department of Transportation standards.

PART 2 - PRODUCTS

2.01 AGGREGATE MATERIALS

A. Aggregate Type A1 (Gravel): Crushed Gravel: free of organic matter and debris; graded in accordance with:
   1. WISDOT 3/4-Inch Gradation.

B. Aggregate Type A2 (Gravel): Crushed Gravel: free of organic matter and debris; graded in accordance with:
   1. WISDOT 1-1/4-Inch Gradation.

C. Aggregate Type A3 (Recycled): Crushed Concrete; free of from wood, steel, roots, bark or other extraneous material; graded in accordance with:
   1. WISDOT 3/4-Inch Gradation.

D. Aggregate Type A4 (Recycled): Crushed Asphaltic Concrete; free of from wood, steel, roots, bark or other extraneous material; graded in accordance with:
   1. WISDOT 1-1/4-Inch Gradation.

E. Aggregate Type A5 (Stone): Crushed Stone; free of clay, shale, organic matter; graded in accordance with:
   1. WISDOT Open-Graded Gradation.

F. Aggregate Type A6 (3/8-Inch Stone Chips): Crushed stone; free of clay, shale, organic matter; graded in accordance with the following limits:

Sieve Size	Percent Passing
1/2-inch	100
3/8-inch	90 - 100
No. 8	0 - 15
No. 30	0 – 3

G. Aggregate Type A12 (Bedding Sand): Unwashed bank-run sand or rejected concrete sand; approximately 6 percent fine clay or loam particles but free of silt and clay or loam lumps consisting of durable particles ranging in size from fine to coarse in uniform combinations; maximum moisture content shall be 10 percent, graded within following limits:

Sieve Size	Percent Passing
1-inch	100
No. 16	45 - 80
No. 200	2 – 10

2.02 SOURCE QUALITY CONTROL

A. Section 31 02 00 – General Requirements for Sitework: Testing and analysis of aggregates.

B. When tests indicate materials do not meet specified requirements, change material or material source and retest.

C. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

Not Used

END OF SECTION 31 05 16

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SECTION 31 13 00

TREE REMOVAL AND GRUBBING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Removal of designated trees on site and disposal off site.
   2. Grubbing and disposal off site of stumps and tree/sapling root systems.
   3. Protection of existing trees, saplings, shrubs and other plant life designated to remain.

B. Related Sections:
   1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.

1.02 REFERENCES

A. State of Wisconsin Department of Transportation
   1. Standard Specifications for Highway and Structure Construction, Current Edition. (WISDOT)

B. State of Wisconsin Department of Natural Resources
   1. Construction Site Erosion & Sediment Control.
      http://www.dnr.state.wi.us/runoff/stormwater/techstds.htm

C. U.S. Environmental Protection Agency
   1. Developing Your Stormwater Pollution Prevention Plan, A Guide for Construction Sites.
      http://www.epa.gov/npdes/pubs/sw_swppp_guide.pdf.

D. Waukesha County
   1. Stormwater Index.
      http://www.waukeshacounty.gov/defaultwc.aspx?ID=39369

1.03 DEFINITIONS

A. Tree - Woody perennial plant, single main stem with trunk, diameter of 6 inches or greater. Multiple-stem trees with forks up to 4 feet from ground elevation shall be considered a cluster of trees. Trees that fork above 4 feet shall be considered a single tree.

B. Root Zone - Area around a tree extending as far from tree base as longest horizontal branches.

C. Surface Water - Soil water that flows through ditch lines, creeks, and streams by gravity.

D. Grubbing - Clearing project site by removing roots and stumps.

E. Clearing - Cutting down bushes and trees and digging and removing their roots and stumps.

F. Clearing Limits - Area designated on Drawings scheduled for clearing operations within project site, right-of-way, or easement.

1.04 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Submit product data for herbicide, including manufacturer's instructions, usage, and hazardous materials sheets.

1.05 REGULATORY REQUIREMENTS

A. Contractor shall comply with local, state, and federal regulations applicable to Work of this Section.

B. Contractor shall comply with and be solely responsible for compliance with U.S. Department of Labor OSHA Part 1926 Safety and Health Regulations for Construction for this Work.

C. Contractor performing Work of this Section shall be solely responsible for identifying, furnishing, installing and maintaining equipment and materials required by State and Federal regulations to establish safe working conditions during Work of this Section.

D. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

E. Coordinate clearing Work with utility companies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Herbicide:
   1. Pre-emergence Herbicide: Liquid or wetable powder form; type which controls plants emerging from seed, but has no harmful effect on established plants when applied at recommended rates; resist leaching and remain effective throughout one growing season.

PART 3 - EXECUTION

3.01 NOTIFICATION

A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, entities, known to, or which can reasonably be assumed to,

have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.

B. In accordance with Wisconsin Statute 182.0175, "Damage to Transmission Facilities," Excavator, as defined in 182.0175(1)(bm), shall be solely responsible to provide advance notice to "Diggers Hotline, Inc." (800-242-8511) not less than three working days prior to commencement of any Excavation, as defined in the statute, required to perform work contained in this Project, and further, Excavator shall comply with all other requirements of this Statute relative to Excavation.

3.02 PREPARATION

A. Verify erosion control is in place prior to start of Work.

B. Verify that existing plant life designated to remain is tagged or identified and protected.

3.03 PROTECTION

A. Maintain and repair damaged erosion control items throughout Work.

B. Protect utilities that remain from damage.

C. Do not divert or relocate surface water without prior written approval from Owner's Representative.

D. Protect trees, plant growth, and features designated to remain as final landscaping.

E. Protect benchmarks, survey control points and existing structures from damage or displacement.

F. Keep entrances, exits, and adjacent affected roadways free of debris from clearing operations.

3.04 CLEARING

A. Clear area required for access to site and execution of Work.

B. Remove trees and shrubs, within marked areas, completely.

C. Clear undergrowth and deadwood, without disturbing subsoil.

D. Remove surface rock larger than 2 inches

E. Apply herbicide to remaining stumps to inhibit growth.

3.05 REMOVAL

A. Remove tree and grubbing debris, and extracted plant life from site.

B. Notify Owner and Construction Manager if underground storage tanks or piping are uncovered during Work.

C. Cease work in immediate area of tanks until direction is given to proceed.

END OF SECTION 31 13 00

SECTION 31 23 17

SITE EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Verification of subsurface conditions and utilities prior to excavation.
2. Saw cutting of pavements prior to excavation.
3. Excavation for building foundation.
4. Excavation for slabs-on-grade.
5. Excavation of trenches for sanitary sewer collection system.
6. Excavation of trenches for water distribution system.
7. Building backfilling to subgrade elevations.
8. Backfill under slabs-on-grade.
9. Backfill requirements for utility trenches.
10. Backfill for over-excavation corrections.
11. Consolidation and compaction.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 – Aggregates for Earthwork: Aggregate backfill materials.
3. Section 31 25 13 – Erosion Controls.
4. Section 32 11 23 – Aggregate Base Course: Preparation for aggregate base course.
5. Section 32 91 19 - Landscape Grading: Topsoil placement.
6. Section 33 12 13 – Water Service Laterals: Installation of water service laterals.

1.02 REFERENCES

A. ASTM International (American Society for Testing and Materials)
1. ASTM C518 - Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. ASTM C578 – Specification for Rigid, Cellular Polystyrene Thermal Insulation.
3. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft.-lbf/ft^3.
4. ASTM D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
5. ASTM D2842 - Test Method for Water Absorption of Rigid Cellular Plastics.
6. ASTM D2487 - Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D6072 - Practice for Obtaining Samples of Geosynthetic Clay Liners.
8. ASTM D6938 – Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. State of Wisconsin Department of Transportation
   1. Standard Specifications for Highway and Structure Construction, Current Edition. (WISDOT)

1.03 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Samples: Submit 10 lb. sample of each type of specified fill to testing laboratory, in airtight containers.

C. Provide certified analysis of material(s) to Engineer prior to any use on Work.

1.04 REGULATORY REQUIREMENTS

A. Contractor shall comply with all local, state, and federal regulations applicable to Work of this Section.

B. Contractor shall comply with and be solely responsible for compliance with U.S. Department of Labor OSHA Part 1926 Safety and Health Regulations for Construction for this Work.

C. Contractor performing Work of this Section shall be solely responsible for identifying, furnishing, installing and maintaining equipment and materials required by state and federal regulations to establish safe working conditions during Work of this Section.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS

A. Water Main Bedding: Type A12, as defined in Section 31 05 16 – Aggregates for Earthwork.

B. Sewer Bedding (18 Inches in Diameter and Less): Type A6, as defined in Section 31 05 16 – Aggregates for Earthwork.

C. Crushed Gravel Backfill: Type A2 as defined in Section 31 05 16 – Aggregates for Earthwork.

D. Crushed Stone Backfill: Type A5 as defined in Section 31 05 16 – Aggregates for Earthwork.

E. Site Excavated Material (Spoil) Backfill: Type S1 as defined in Section 31 05 13 – Soils for Earthwork.

F. Imported Subsoil Material Backfill: Type S2 as defined in Section 31 05 13 – Soils for Earthwork.

PART 3 - EXECUTION

3.01 NOTIFICATION

A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) all utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.

B. In accordance with Wisconsin Statute 182.0175, "Damage to Transmission Facilities," Excavator, as defined in 182.0175(1)(bm), shall be solely responsible to provide advance notice to "Diggers Hotline, Inc." (800-242-8511) not less than three working days prior to commencement of any Excavation, as defined in the statute, required to perform work contained in this Project, and further, Excavator shall comply with all other requirements of this Statute relative to Excavation.

3.02 SITE VERIFICATION

A. Verify that survey benchmark and intended elevations for Work are as indicated.

3.03 FIELD MEASUREMENTS

A. Verify that survey benchmark and intended elevations for the Work are as shown on Drawings.

B. Primary line and grade will be furnished by Owner and will be established by Contractor.

C. Contractor shall employ a Registered Land Surveyor, registered in the State of Wisconsin to perform all survey work related to primary line and grade for project utilities.

D. Contractor shall check accuracy of line and grade stakes by means of visual and taping checks and shall be responsible for protection and preservation of such stakes established by Registered Land Surveyor.

E. Contractor shall bear sole responsibility for correct transfer of all construction lines and grades from primary line and grade points and for correct alignment and grade of finished structure, based upon primary line and grade established by Registered Land Surveyor.

F. Except for those lot corners and survey monuments that fall within trench excavation, Contractor shall be solely responsible for protection and/or replacement of all survey corners that exist throughout work area.

G. Corners will be located and marked by Owner, upon request by Contractor, prior to commencing its work.

H. A Registered Land Surveyor shall replace damaged corners at Contractor's expense.

3.04 SAWING AND BREAKING PAVEMENT

A. Saw concrete pavement, slabs or bases to a minimum 1/2 of depth of existing pavement, slab, or base prior to removal.

B. Saw cut asphalt surface course and asphalt binder course full depth before removal.

C. Cut pavements evenly along edges of excavation prior to their removal in such a way as to avoid excessive removal or ragged, uneven edges.

D. A drop weight or other type of machinery for breaking pavement when approved by Owner's Representative may be used when such usage does not become a nuisance or a source of damage to underground or adjacent structures.

E. Prior to employing a drop weight, Contractor shall verify that there are no nearby underground structures that would be injured by its use.

F. Contractor shall be solely responsible for any damage caused thereby.

G. Owner's Representative reserves right to order discontinuance of use of such drop weight at any time.

3.05 PREPARATION FOR EXCAVATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Notify utility company to remove and relocate utilities that interfere with Work.

D. Protect above and below grade utilities indicated to remain.

E. Protect plant life, lawns and other features remaining as portion of final landscaping.

F. Protect benchmarks, survey control points, existing structures, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

G. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with Type A2, as specified in Section 31 05 16 – Aggregates for Earthwork, fill and compact to density equal to or greater than requirements for subsequent backfill material.

3.06 FIELD QUALITY CONTROL FOR EXCAVATION

A. Field inspection will be performed under provisions of Section 31 02 00 – General Requirements for Sitework.

B. Provide for visual inspection of bearing surfaces.

3.07 BUILDING AND STRUCTURE EXCAVATION

A. Underpin adjacent structures that may be damaged by excavation work, including utilities and pipe chases.

B. Excavate subsoil required to accommodate building foundation, slabs-on-grade and site structures, and construction operations.

C. Machine slope banks to angle of repose or less, until shored.

D. Excavation cut not to interfere with normal 45 degree bearing splay of foundation.

E. Grade top perimeter of excavation to prevent surface water from draining into excavation.

F. Hand trim excavation. Remove loose matter.

G. Remove lumped subsoil, boulders, and rock.

H. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

I. Correct unauthorized excavation at no extra cost to Owner.

J. Correct areas over-excavated in error.

K. Stockpile excavated material in area designated on site and remove excess material not being reused, from site.

3.08 EXPOSING EXISTING SANITARY SEWER AND WATER MAIN

A. Before excavation of trench is begun, Contractor shall uncover stub end of existing utility to which new utility is to be connected. This will permit adjustments in line and grade and verify connection required.

B. Securely plug existing terminations in manholes to which new utilities are to be connected to prevent entry of construction water and debris into active system.

C. Contractor shall be responsible to verify that plug(s) are in place at end of each workday.

D. Contractor shall remove any water or debris from terminal manhole as required but not less than once a week.

3.09 TRENCH EXCAVATION

A. Excavate subsoil required for installation of utility.

B. Excavate trenches at top of pipe to a maximum width based on dimension of outside diameter of pipe plus 24 inches to enable installation of pipe and to allow inspection.

C. Width at top of pipe may be increased with prior approval of Owner's Representative to allow for stringers and sheathing when required.

D. Provide pipe laid in open-cut trench with 6-inch minimum clearance between outside face of pipe barrel and face of sheathing or sidewall of trench.

E. Maximum width of trench at ground surface shall not exceed width of trench at top of pipe by more than 2 feet without prior request to Owner's Representative, unless it is specifically allowed on Drawings.

F. Place excavated material stored along trench excavation a minimum distance back from edge of trench. Determine distance by angle of repose of trench material to prevent surcharging of trench wall material leading to potential shearing of trench wall and collapse of trench.

G. Store excavated material to be used for trench backfilling so that it will not interfere with:
   1. Public travel.
   2. Adjacent property owners or tenants.
   3. Other Contractors.

H. Contractor shall immediately remove and dispose of excavated material which is not to be used as trench backfill, unless directed otherwise by Contract Documents.

I. Owner reserves right to order up to 10 percent of surplus excavated material to be delivered to Owner's streets, alleys, public properties, or locations designated by Owner.

J. Cost of delivering and leveling such surplus material to any point within a driving distance of two miles from site of work shall be include in unit prices bid for work.

K. After delivery to designated location, material shall be leveled off at direction of Owner's Representative.

L. Contractor shall maintain all finished excavations free of water or sewage during Work.

M. Hand trim excavation. Remove loose matter.

N. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume.

O. Correct unauthorized excavation and over-excavated areas at no cost to Owner.

P. Excavate no more trench in advance of completed pipe laying operations than can be completed and backfilled by end of workday.

Q. Do not obstruct more than one street crossing by same trench at any one time.

3.10 TRENCH BEDDING

A. Keep trench bottom free of water prior to placement of bedding and laying of pipe.

B. Place and shape bedding material to pipe, to a minimum depth of three inches under bell and four inches under spigot and compact to 95 percent modified Proctor density.

C. Support pipe during placement and compaction of bedding material.

D. Bring bedding and cover material over top of pipe to a minimum compacted depth of 12 inches, compact to specified density.

E. Where sand is used for cover material, compact sand with portable plate compactor to a depth of twelve inches in two lifts of six inches each for initial cover over pipe.

3.11 PROTECTION

A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

3.12 EXAMINATION PRIOR TO BACKFILLING

A. Verify fill material to be reused are acceptable.

B. Verify foundation perimeter drainage installation has been inspected.

3.13 BACKFILLING

A. Backfill with materials and to contours and elevations shown on Drawings. Generally, compact subgrade to density requirements for subsequent backfill materials.

B. Place specified backfill in loose lift layers. Use compaction equipment that will achieve desired compaction requirements.

C. Systematically backfill to allow for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

D. Where sidewall material is loose or unstable, place geotextile cloth material over sidewall prior to backfilling.

E. Employ a placement method that does not disturb or damage pipe in trench.

F. Maintain optimum moisture content of backfill materials to attain required compaction density.

G. Backfill simultaneously on each side of unsupported non-basement foundation walls.

H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise.

I. Make grade changes gradual. Blend slope into level areas.

J. Leave fill material stockpile areas completely free of excess fill materials.

K. Remove surplus backfill materials from site.

3.14 MECHANICAL COMPACTION

A. Mechanically compact backfill by means of a tamping roller, sheepsfoot roller, pneumatic tire roller, vibrating roller, or other mechanical tampers. Impact, free-fall, or "stomping" type compaction equipment shall not be allowed.

B. Flooding or jetting of backfill for compaction purposes shall not be allowed.

C. Contractor shall furnish written notification to Construction Manager prior to start of work as to size and type of mechanical compaction equipment to be used.

D. Place material for mechanically compacted backfill in lifts, which, prior to compaction, shall not exceed thickness specified below for type of compaction equipment used:
   1. Vibratory equipment including vibratory plate, vibratory smooth-wheel rollers, and vibratory pneumatic-tired rollers: maximum lift thickness two (2) feet.
   2. Rolling equipment, including sheepsfoot (both vibratory and non-vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels: maximum lift thickness one (1) foot.
   3. Hand-directed mechanical tampers: maximum lift thickness of six (6) inches.

3.15 TOLERANCES FOR BACKFILL

A. Top Surface of Backfill: Plus or minus 1 inch from required elevations.

3.16 COMPACTION REQUIREMENTS

A. Granular Material shall be compacted to 95 percent of modified Proctor density.

B. Excavated Material to be used for backfill shall be compacted to a density equal to adjacent undisturbed trench wall or as specified.

3.17 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 31 02 00 - General Requirements for Sitework.

B. Testing and analysis of fill material will be performed in accordance with ASTM D1557 and Section 31 02 00 - General Requirements for Sitework.

C. Compaction and moisture testing will be performed in accordance with ASTM D6938 and Section 31 02 00 - General Requirements for Sitework.

D. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no cost to Owner.

3.18 PROTECTION OF FINISHED WORK

A. Reshape and recompact fills subjected to vehicular traffic.

B. Contractor shall have available a supply of steel plates with minimum dimensions of four (4) feet by eight (8) feet by one (1) inch.

C. Use plates to bridge open trenches crossing roadways and secure against possibility of shifting or dropping into excavation.

D. During winter months, do not leave plates in roadway over night.

3.19 SCHEDULE OF BACKFILL

A. Section 31 05 16 – Aggregates for Earthwork defines "A" designated fill materials and Section 31 05 13 – Soils for Earthwork defines "S" designated fill materials.

B. Fill to Correct Over-Excavation:
   1. Aggregate Type A2 fill, flush to required elevation, compacted to 90 percent modified Proctor density.

C. Foundations:
   1. Aggregate Type A2 fill. Place materials in continuous loose lifts layers not exceeding 7-inch depth, compacted to 95 percent modified Proctor density.

D. Interior Slab-On-Grade:
   1. Aggregate Type A2 fill. Place materials in continuous loose lifts layers not exceeding 7-inch depth, compacted to 95 percent modified Proctor density.

E. Exterior Slab-On-Grade:
   1. Aggregate Type A1 and A2 fill. Place materials in continuous loose lifts layers not exceeding 7-inch depth, compacted to 95 percent modified Proctor density.

F. Foundation Drainage - Stone Cover:
   1. Aggregate Type A5 fill. Place materials in continuous loose lifts layers not exceeding 9-inch depth, compacted to 95 percent modified Proctor density.

G. Utility Piping - Stone Bedding and Cover:
   1. Aggregate Type A6 fill. Place materials in continuous loose lifts layers not exceeding 9-inch depth, compacted to 95 percent modified Proctor density.

H. Utility Piping - Sand Bedding and Cover:
   1. Aggregate Type A12 fill. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 95 percent modified Proctor density.

I. Utility Trench – Backfill in Paved Areas:
   1. Aggregate Type A2 fill. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 95 percent modified Proctor density.

J. Utility Trench – Backfill in Non-paved Areas:
   1. Subsoil Type S1 or S2 fill, to 6 inches below finish grade. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 90 percent modified Proctor density.

K. Fill Under Grass Area.
   1. Subsoil Type S1 fill, to 6 inches below finish grade. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 90 percent modified Proctor density.

L. Fill Under Landscaped Areas:
   1. Subsoil Type S1 fill, to 18 inches below finish grade. Place materials in continuous loose lifts layers not exceeding 12-inch depth, compacted to 85 percent modified Proctor density.

END OF SECTION 31 23 17

SECTION 31 25 13

EROSION CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Equipment and materials for erosion and sediment control to minimize erosion and siltation during construction.
2. Erosion and sediment control provisions detailed on Drawings and specified herein are minimum requirements for erosion control program.
3. Contractor to provide additional erosion and sediment control materials and methods required by state or local ordinances, whichever is more stringent.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 32 92 00 - Turf and Grasses: Seeding of site as part of final landscaping features.

1.02 REFERENCES

A. ASTM International (American Society for Testing and Materials):
1. ASTM D4355 – Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
2. ASTM D4491 – Test Methods for Water Permeability of Geotextiles by Permittivity.
3. ASTM D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
4. ASTM D4751 - Test Method for Determining Apparent Opening Size of a Geotextile.

B. State of Wisconsin Department of Natural Resources (WDNR)
1. Construction Site Erosion & Sediment Control.
http://www.dnr.state.wi.us/runoff/stormwater/techstds.htm

C. State of Wisconsin Department of Natural Resources – Conservation Practice Standards (WDNR - CPS);
1. Silt Fence: WDNR – CPS 1056.
2. Stone Tracking Pad and Tire Washing: WDNR – CPS 1057.
3. Mulching for Construction Sites: WDNR – CPS 1058.
4. Seeding for Construction Site Erosion Control: WDNR – CPS 1059.
5. Storm Drain Inlet Protection for Construction Sites: WDNR – CPS 1060.
6. Construction Site Diversion: WDNR – CPS 1066.
7. Temporary Grading Practices for Erosion Control (Surface Roughening and Temporary Ditch Sumps): WDNR – CPS 1067.

D. State of Wisconsin Department of Transportation
   1. Standard Specifications for Highway and Structure Construction, Current Edition. (WISDOT).
   2. Erosion Control Product Acceptability Lists for Multi–Modal Applications. (PAL)

E. U.S. Environmental Protection Agency
   1. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites. http://www.epa.gov/npdes/pubs/sw_swppp_guide.pdf

F. County of Waukesha
   1. Stormwater Management and Erosion Control Ordinance, Chapter 14, Article 8 of the County Code.

1.03 DEFINITIONS

A. Definitions shall be in accordance with Wisconsin Department of Natural Resources – Construction Practice Standards, as defined by each standard.

1.04 SUBMITTALS

A. A narrative describing the proposed land disturbing activity, construction timeline and sequencing, temporary BMPs to be used to minimize off-site impacts during construction phase, and proposed methods to stabilize the site following construction in accordance with the requirements of the County ordinance.

B. A survey map or scaled site plan drawing of sufficient clarity showing a north arrow, location of proposed land disturbance, direction of flow for runoff entering and leaving the disturbed area, upslope drainage area (if known), proposed BMPs, existing and proposed slopes, ground cover, buildings, roads, access drives, property boundaries, drainage ways, water bodies, trees, culverts, utilities and other structures within 50 feet of proposed land disturbance.

1.05 REGULATORY REQUIREMENTS

A. Comply with County of Waukesha ordinance for construction site erosion control.

B. Comply with applicable state and federal rules and regulations governing erosion and siltation on construction sites.

C. Permit
   1. Waukesha County Parks will obtain a County Stormwater Permit.
   2. Obtain all other local permits needed from the City of Waukesha, City of New Berlin, and Town of Mukwonago.

1.06 EROSION CONTROL PRINCIPLES

A. Keep disturbed area small.

B. Stabilize disturbed areas with mechanical or structural and vegetative methods.

C. Keep runoff low through use of short slopes, low gradients, and preservation of natural vegetative cover.

D. Protect disturbed areas from storm water runoff.

E. Retain sediment within site boundaries.

F. Implement a thorough maintenance and follow-up program.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Silt Fence: (WDNR – CPS 1056)
   1. Provide temporary silt fencing designed to intercept and slow the flow of sediment-laden sheet flow runoff from areas of disturbed soil.
   2. Fence Geotextile Fabric:
      a. Geotextile fabric shall consist of either woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride.
      b. Non-woven fabric may be needle punched, heat bonded, resin bonded of a combination of.
      c. All silt fence geotextile fabric shall meet the following requirements;

Test Requirement	Method	Value
Minimum Grab Tensile Strength In the Machine Direction	ASTM D4632	120 lbs.
Minimum Grab Tensile Strength In the Cross Machine Direction	ASTM D4632	100 lbs.
Maximum Apparent Opening Size Equivalent (Standard Sieve)	ASTM D4751	No. 30
Minimum Permittivity	ASTM D4491	0.05 scc^{-4}
Minimum Ultraviolet Stability Percent of Strength Retained after 500 Hours of Exposure.	ASTM D 4355	70%

      d. Silt fence shall have a maximum a maximum flow rate of 10 gallons/minute/square foot at 50mm constant head as determined by multiplying permittivity in 1/second as determined by ASTM D4491 by a conversion factor of 74.

3. Silt Fence Supports: Silt fences shall be supported by either steel or wood supports specified as follows;
   a. Steel Supports:
      1) The full height of the silt fence shall be supported by steel posts at least 5 feet long with a strength of 1.33 pounds per foot and have projections for the attachment of fasteners.
   b. Wood Supports:
      1) The full height of the silt fence shall be supported by 1-1/8 inch by 1-1/8-inches air or kiln-dried posts of hickory or oak.

B. Stone Tracking Pad and Tire Washing: (WDNR – CPS 1057)
1. Tracking Pad:
   a. Tracking pad shall be installed prior to any construction traffic leaving the site.
   b. Aggregate for tracking pads shall be 3 to 6 inch clear or washed stone. All material to be retained in a 3-inch sieve.
2. Tire Washing:
   a. Tire wash rack shall consist of a heavy grating over a lowered area. The rack shall be strong enough to support the vehicles that will cross it.

C. Mulching for Construction Sites: (WDNR – CPS 1058)
1. Mulch shall consist of natural biodegradable material such as plant residue, including but not limited to straw, hay, wood chips, bark and wood cellulose fiber, or other Engineer approved equivalent materials of sufficient dimension, depth or thickness, and durability to achieve the intended effect for the required time period.
2. Selected mulch shall be environmentally harmless to wildlife and plants. Materials such as gravel, plastic, fabric, sawdust, municipal solid waste, solid waste by-products, shredded paper and non-biodegradable products shall not be used.
3. Mulch shall be free of diseased plant residue, weed seeds, chemical residues, heavy metals, hydrocarbons and other known environmental toxicants.
4. Marsh hay shall not be used as mulch in lowland areas, but may be used in upland sites to prevent the spread of invasive, non-native species commonly found in marsh hay.
5. Straw and hay mulch that will be crimped shall have a minimum fiber length of 6 inches.
6. Wood chips or wood bark shall only be used for sites that are not seeded.

D. Seeding for Construction Site Erosion Control: (WDNR – CPS 1059)
1. Seed Selection:
   a. Seed mixtures that will produce dense vegetation shall be selected based on soil and site conditions and intended final use.
   b. All seed shall conform to the requirements of the Wisconsin Statutes and of the Administrative Code Chapter ATCP 20.01 regarding noxious weed seed content and labeling.
   c. Seed mixtures that contain potentially invasive species or species that may be harmful to native plant communities shall be avoided.
   d. Seed shall not be used later than one (1) year after the test date that appears on the label.
   e. Seed shall be tested for purity, germination and noxious weed seed content and shall meet the minimum purity and germination requirements as prescribed in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.
2. Seed Rates:

a. Temporary Seeding (Cover Crop):
   1) Areas needing protection during periods when permanent seeding is not applied shall be seeded with annual species for temporary protection.
   2) Temporary Seeding Species and Rates as follows:

Species	lbs/Acre	Percent Purity
Oats	131[1]	98
Cereal Rye	131[2]	97
Winter Wheat	131[2]	95
Annual Ryegrass	80[2]	97

[1] Spring and Summer Seeding
[2] Fall Seeding

b. Permanent Seeding:
   1) Rates shall be based on pounds or ounces of Pure Live Seed (PLS) per acre.
   2) Seed mixtures shall be selected by Landscape Architect in accordance with WisDOT Section 630 – Seeding of the Standard Specifications.
   3) Permanent seeding rates may be increased above the minimum rates identified by WisDOT Section 630 to address land use and environmental conditions.
   4) If a nurse crop is used in conjunction with permanent seeding, the nurse crop shall not hinder establishment of the permanent vegetation.
   5) Nurse crop shall be applied at 50 percent of its temporary seeding when applied with permanent seed.

E. Construction Site Diversion: (WDNR – CPS 1066)
   1. Provide temporary berms and channels as indicated on Drawings and as specified.
   2. Temporary berms and channels shall have stable side slopes and shall not be overtopped during a 2-year frequency, 24-hour duration storm.
   3. Minimum berm cross section shall be as follows;
      a. Side slopes of 2:1 (horizontal:vertical) or flatter.
      b. Top width of two (2) feet.
      c. Berm height of 1.5 feet.

F. Temporary Grading Practices for Erosion Control: (WDNR – CPS 1067)
   1. Provide the following surface roughening techniques to reduce surface soil erosion during site grading activities;
      a. Directional Tracking – The process of creating ridges with tracked vehicles on non-vegetated slopes. Provide this technique at the end of each work day.
      b. Tillage – Utilize conventional tillage equipment to create a series of ridges and furrows on the contour no more than 15 inches apart.
   2. Provide temporary ditch sumps in drainageways during grading operations to slow and pond runoff during the time that the drainageways are being graded. Provide ditch sumps prior to anticipated rain events.

G. Dust Control on Construction Sites: (WDNR – CPS 1068)
   1. Provide one of or a combination of one of the following dust control practices for the duration of the project or until site is fully vegetated or paved.
      a. Asphalt and petroleum-based products shall not be used for project dust control.

b. Provide mulch or seed and mulch to protect exposed site soil from both wind and water erosion. Reference WDNR – CPS 1058 and 1059 specified previously in this section.
c. Provide water applications until surface is wet and repeat as necessary. Water shall be applied so it does not cause runoff.
d. Provide tilling of soil with chisel type plows on exposed soils. Tillage shall be utilized only on flat areas of the project site.
e. Provide tackifiers and soil stabilizers, Type A – Products shall be selected from and installed at rates in accordance with WisDOT Erosion Control PAL.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Silt Fence: (WDNR – CPS 1056)
1. When silt fence is installed as a stand-alone practice on a slope, silt fence shall be placed on the contour.
2. The parallel spacing shall not exceed the maximum slope lengths for the appropriate slope as follows:

Slope	Fence Spacing
<2%	100 feet
2 to 5%	75 feet
5 to 10%	50 feet
10 to 33%	25 feet
>33%	20 feet

3. Silt fences shall not be placed perpendicular to the contour.
4. The ends of the silt fence shall be extended upslope to prevent water from flowing around the ends of the fence.
5. Installed silt fences shall be a minimum 14 inches high and shall not exceed 28 inches in height measured from the installed ground elevation.
6. Steel Supports:
   a. The full height of the silt fence shall be supported by steel posts at least 5 feet long with a strength of 1.33 pounds per foot and have projections for the attachment of fasteners.
   b. Silt fence shall be attached in at least 3 places on the support, on the upslope side with 50 pound plastic tie straps or wire fasteners.
   c. To prevent damage to the fabric from wire fastener, the protruding ends shall be pointed away from fabric.
7. Wood Supports:
   a. The full height of the silt fence shall be supported by 1-1/8 inch by 1-1/8-inches air or kiln-dried posts of hickory or oak.
   b. Silt fence fabric shall be stapled, using at least 0.5-inch staples, to the upslope side of the posts in at least 3 places.
   c. Wood posts shall be a minimum of 3 feet long for 24-inch high silt fence, and a minimum of 4 feet for 36-inch silt fence fabric.

8. The maximum spacing of posts for non-woven silt fence shall be 3 feet and for woven fabric, 8 feet.
9. Silt fence shall have a support cord.
10. Where joints are required to join the ends of fabric, each end of the fabric shall be securely fastened to a post. Posts shall then be wrapped around each other to produce a stable, secure joint or shall be overlapped the distance between two posts.
11. A minimum of 20 inches of the post shall extend into the ground after installation.
12. Silt fence shall be anchored by spreading at least 8 inches of the fabric in a 4-inch wide by 6-inch deep trench, or 6-inch deep V-trench on the upslope side of the fence.
13. Backfill anchoring trench and compact.
14. On the terminal ends of silt fence the fabric shall be wrapped around the post such that the staples are not visible.
15. Silt fencing shall at a minimum be inspected by the Contractor weekly and within 24 hours after every rain event that produces 1/2-inch of rain or more during a 24-hour period.
16. Damaged or decomposed fences, undercutting, or flow channels around the ends of silt fencing shall be repaired immediately after discovery.
17. Silt fencing and all accessories shall be removed completely once the disturbed area is permanently stabilized and no longer susceptible to erosion.

B. Stone Tracking Pad and Tire Washing: (WDNR – CPS 1057)
1. Tracking Pad:
   a. Tracking pad shall be installed prior to any traffic leaving the site.
   b. Aggregate shall be placed in a layer at least 12 inches thick. Contractor shall supplement additional aggregate over life of project for repair or replenish aggregate to maintain functional tracking pad as specified.
   c. For sites with high water tables, or where saturated conditions are expected throughout the duration of the project, stone tracking pads shall be underlain with a WisDOT Type R Geotextile Fabric to prevent migration of underlying soil into the stone.
   d. Tracking pad shall be the full width of the egress point and a minimum 50 feet long.
   e. Contractor shall prevent surface water from passing through the tracking pad.
   f. Surface water flow shall be diverted away from tracking pads or conveyed under and around the tracking pad by Contractor's selected method of conveyance or diversion.
2. Tire Washing:
   a. If tracking pad does not remove sediment from tires prior to entering roads or streets, Contractor shall provide pressurized water removal operation to wash tires clean prior to entering streets or roads.
   b. Rocks lodged between the tires of dual wheel vehicles shall be removed prior to leaving the construction site.

C. Mulching for Construction Sites: (WDNR – CPS 1058)
1. Prepare soil surface prior to application of mulch in order to achieve the desired purpose and to ensure optimum contact between soil and mulch.
2. All areas to be mulched shall be reasonably free of rills and gullies.
3. Mulch shall cover a minimum of 80 percent of the soil surface for unseeded areas.
4. For seeded area, mulch shall be placed loose and open enough to allow some sunlight to penetrate and air to circulate, but still cover a minimum of 70 percent of the soil surface.

5. Mulch shall be applied at uniform rate of 1-1/2 to 2 tons per acre for sites that are seeded, and 2 to 3 tons per acre for sites that are not seeded.
6. This application results in a layer of 1/2 to 1-1/2 inches thick for seeded sites, and 1-1/2 to 3 inches thick for sites that are not seeded.
7. Wood chips or wood bark shall be applied at a rate of 6 to 9 tons per acre to achieve a minimum of 80 percent ground cover.
8. This application should result in a layer of wood chips or wood bark 1/2-inch to 1-1/2 inches thick.
9. Anchoring of mulch shall be based on the type of mulch applied, site conditions, and accomplished by one of the following techniques:
    a. Crimping: Immediately after spreading mulch, the mulch shall be anchored by a mulch crimper or equivalent device consisting of a series of dull flat discs with notched edges spaced approximately 8 inches apart. Mulch shall be impressed into the soil to a depth of 1 to 3 inches.
    b. Polypropylene Plastic or Biodegradable Netting: Apply plastic netting over placed mulch and staple according to netting manufacturer's written instructions.
    c. Tackifier shall be sprayed in conjunction with mulch or immediately after the mulch has been placed. Tackifiers shall be selected from those approved by WISDOT PAL.
    d. Tackifiers shall be applied at the following minimum application rates per acre, for each type of tackifier mixture defined as follows:
        1) Latex-Base: Mix 15 gallons of adhesive, or the manufacturer's recommended rate, whichever is greater, and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 1,300 gallons of water.
        2) Guar Gum: Mix 50 pounds of dry adhesive, or the manufacturer's recommended rate, whichever is greater, and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 1,300 gallons of water.
        3) Other Tackifiers (Hydrophilic Polymers): Mix 100 pounds of dry adhesive or the manufacturer's recommended rate, whichever is greater, and a minimum of 250 pounds of recycled newsprint (pulp) as a tracer with 1,300 gallons of water.

D. Seeding for Construction Site Erosion Control: (WDNR – CPS 1059)
1. Contractor shall perform site assessment to evaluate soil characteristics, topography, exposure to sunlight, proximity to natural plant communities, proximity to nuisance, noxious and invasive species, site history, moisture regime, climatic patterns, soil fertility, and previous herbicide applications prior to commencing any seeding operations.
2. Contractor shall use this information to establish seeding schedule including adjustment to existing soils in regards to preparation, fertility and seeding operations.
3. Use newly introduced seed species only in places where they will not spread into existing natural areas.
4. Seed grasses and legumes no more than 1/4-inch deep. Distribute seed uniformly.
5. Mixture with low seeding rates requires special care in sowing to achieve proper seed distribution.
6. Seed may be broadcast, drilled, or hydroseeded depending on site conditions.
7. Seeding shall be done in two equal passes in opposite directions to ensure adequate coverage.
8. Soils that are compacted shall require chisel plowing or other approved method to loosen compacted soil in preparation for seeding.

9. After seeding operations, lightly roll and compact the seeded area. Water and fertilize.
10. Do not over water seeded areas to prevent runoff, erosion and loss of seed.
11. Seed when soil temperatures remain consistently above 53 degrees F.
12. Dormant seed when the soil temperatures consistently below 53 degrees F, typically November 1st until snow cover.
13. Turf seedlings shall not be mowed until the stand is at least 6 inches tall. Leave cut turf at a minimum of 3 inches tall after mowing during the first year of turf establishment.

E. Construction Site Diversion: (WDNR – CPS 1066)
1. When diverting clean water, the diversion channel and its outfall shall be immediately stabilized for the 2-year frequency, 24-hour duration storm.
2. Build and stabilize clean water diversions before initiating down-slope land distributing activities.
3. Temporary diversions shall be protected from damage by construction activities. At all points where construction equipment will be crossed by construction equipment, the diversion shall be stabilized and shaped back to specified dimensions. Contractor shall provide culverts as needed for construction equipment traffic crossing.
4. Upon completion of construction activities, fill, grade and compact temporary berms and channels to designed elevations.

F. Temporary Grading Practices for Erosion Control: (WDNR – CPS 1067)
1. Provide the following surface roughening techniques to reduce surface soil erosion during site grading activities;
   a. Directional Tracking – The process of creating ridges with tracked vehicles on non-vegetated slopes. Provide this technique at the end of each work day.
   b. Tillage – Utilize conventional tillage equipment to create a series of ridges and furrows on the contour no more than 15 inches apart.
2. Provide temporary ditch sumps in drainageways during grading operations to slow and pond runoff during the time that the drainageways are being graded. Provide ditch sumps prior to anticipated rain events.

G. Dust Control on Construction Sites: (WDNR – CPS 1068)
1. Provide one of or a combination of one of the following dust control practices for the duration of the project or until site is fully vegetated or paved.
   a. Asphalt and petroleum-based products shall not be used for project dust control.
   b. Provide mulch or seed and mulch to protect exposed site soil from both wind and water erosion. Reference WDNR – CPS 1058 and 1059 specified previously in this section.
   c. Provide water applications until surface is wet and repeat as necessary. Water shall be applied so it does not cause runoff.
   d. Provide tilling of soil with chisel type plows on exposed soils. Tillage shall be utilized only on flat areas of the project site.
   e. Provide tackifiers and soil stabilizers, Type A – Products shall be selected from and installed at rates in accordance with WisDOT Erosion Control PAL.

3.02 MAINTENANCE

A. Inspect erosion control devices within 24 hours after each rainfall or daily during periods of prolonged rainfall.

B. Repair or replace damaged or defective materials or installation immediately.

C. Remove sediment deposits within 24 hours after each storm event or when deposits reach one-half height of fence or barrier, whichever occurs first.

D. Apply replacement bales or additional mulch, netting, or matting immediately to maintain suitable cover.

E. Where vegetative cover has been placed, inspect until vegetative cover is established and functioning as intended.

3.03 REMOVAL OF EROSION CONTROL DEVICES

A. Maintain erosion control measures disturbed earth has been paved or vegetated.

B. Remove erosion control devices prior to final inspection and acceptance of Project site by Owner.

C. Restore or replace areas disturbed or damaged by removal of erosion control devices to satisfaction of Owner's Representative.

END OF SECTION 31 25 13

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Aggregate Materials.
2. Sub-grade Preparation.
3. Test Rolling Equipment and Procedures.
4. Aggregate Installation Requirements.
5. Aggregate Shoulder.
6. Base Course Schedule.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 16 – Aggregates for Earthwork.
3. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
4. Section 32 13 13 - Concrete Paving: Finish concrete pavement.
5. Section 32 91 19 - Landscape Grading: Topsoil fill at areas adjacent to aggregate base course.

1.02 REFERENCES

A. State of Wisconsin Department of Transportation
1. Standard Specifications for Highway and Structure Construction, Current Edition. (WISDOT)

B. ASTM International (American Society for Testing and Materials)
1. ASTM D698 – Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft.-lbf/ft3.
2. ASTM D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft.-lbf/ft3.
3. ASTM D6938 – Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

PART 2 - PRODUCTS

2.01 AGGREGATE MATERIALS

A. Aggregate Material: Type A1 as specified in Section 31 05 16 – Aggregates for Earthwork.

B. Aggregate Material: Type A3 as specified in Section 31 05 16 – Aggregates for Earthwork.

C. Aggregate Material: Type A5 as specified in Section 31 05 16 – Aggregates for Earthwork.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify substrate is dry and has been inspected, and gradient and elevation are correct.

3.02 SUBGRADE PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and recompacting.

B. Do not place fill on soft, muddy, or frozen surfaces.

3.03 TEST ROLLING SUBGRADE

A. Test rolling shall be used to verify stability and uniformity of subgrade. Perform this Work in presence of Geotechnical Engineer.

B. Use test rolling equipment conforming to following description:
   1. Tandem axle, dual wheel dump truck.
   2. Tire pressure shall be no less than 90 percent of manufacturer's recommended maximum inflation.
   3. Minimum gross weight of loaded truck shall be 60,000 pounds.
   4. Provide weigh slip to Geotechnical Engineer.

C. Perform test rolling procedure as follows:
   1. Operate equipment at a rate not to exceed 3 to 5 mph or a comfortable walking pace. Adjust speed to allow Geotechnical Engineer to measure any deflections and areas of rutting.
   2. Operate test rolling equipment in a pattern so that affected areas are loaded with at least one pass.
   3. After test rolling, check subgrade for conformance to drawings, and correct any surface irregularities. Re-shape subgrade within tolerances specified.

D. Test Rolling Evaluation:
   1. Rutting up to 1-inch is acceptable. Rutting in excess of 1-inch but not more than 6 inches, shall be considered a failure and requires reworking soil and compaction to required density.
   2. Deflection (pumping) up to 1-inch is acceptable. Deflection in excess of 1-inch but not more than 2 inches shall be acceptable if there is not substantial cracking or lateral movement of soil.
   3. Deflection in excess of 2 inches but not more than 6 inches shall be considered a failure, and requires reworking soil and compaction to required density.

4. Rutting and deflection in excess of 6 inches will require review and recommendation for corrective action by an approved Geotechnical Engineer.
5. After remedial work is performed, a final test roll shall be performed upon completion of work.
6. If remedial work is performed as directed, second test roll may be waived at discretion of Geotechnical Engineer.

3.04 AGGREGATE INSTALLATION REQUIREMENTS

A. Spread aggregate over prepared substrate to a total compacted thickness as indicated on Drawings.

B. Place aggregate in maximum 7-inch loose lifts and compact to specified density.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.05 TOLERANCES

A. Section 31 05 16 – Aggregates for Earthwork defines "A" designated base course materials.

B. Flatness: Maximum variation of 1/4-inch measured with 10-foot straight edge.

C. Scheduled Compacted Thickness: Within 1/4-inch.

D. Variation from Design Elevation: Within 1/4-inch.

3.06 FIELD QUALITY CONTROL

A. Section 31 02 00 – General Requirements for Sitework: Field inspection.

B. Perform compaction testing in accordance with ASTM D1557, ASTM D6938, and Section 31 02 00 – General Requirements for Sitework.

C. Perform moisture content testing in accordance with ASTM D6938 and Section 31 02 00 – General Requirements for Sitework.

D. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

E. Frequency of Tests: As determined by Geotechnical Engineer.

3.07 BASE COURSE SCHEDULE

A. Section 31 05 16 – Aggregates for Earthwork defines "A" designated base course materials.

B. Under Concrete Pavement:
   1. Aggregate Type A1, compact to 95 percent modified Proctor density.

C. Under Sidewalk:
   1. Aggregate Type A1, compact to 95 percent modified Proctor density.

END OF SECTION 32 11 23

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Materials and Installation requirements for exterior concrete components as follows:
   a. Sidewalks.
   b. Aggregate base course.
2. Exterior Concrete Design Requirements as follows:
   a. Concrete mix design.
   b. Reinforcement.
   c. Concrete curing and sealing.
   d. Jointing.
   e. Quality control and testing.
   f. Concrete placement and finishing.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction: Compacted subbase for paving.
3. Section 32 11 23 - Aggregate Base Course: Compacted granular base for paving.
4. Section 32 91 19 - Landscape Grading: Preparation of subsoil at pavement perimeter.

1.02 REFERENCES

A. American Concrete Institute (ACI)
1. ACI 224.3R, Joints in Concrete Construction, Chapter 6 – Pavements.
2. ACI 301 – Structural Concrete.
3. ACI 304 - Guide for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305 – Hot Weather Concreting.
5. ACI 306 – Cold Weather Concreting.
6. ACI 308 – Standard Practice for Curing Concrete.
7. ACI 309 – Guide for Consolidation of Concrete.
8. ACI 325 – Guide for Construction of Concrete Pavements and Concrete Bases.
9. ACI 330 – Guide for Design and Construction of Concrete Parking Lots.
10. ACI 330.1 – Specification for Unreinforced Concrete Parking Lots.
11. ACI 347 – Guide to Formwork for Concrete.

B. ASTM International (American Society for Testing and Materials)
1. ASTM A82 – Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184 - Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A185 - Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A497 - Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
5. ASTM A615 - Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
6. ASTM A767 – Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
7. ASTM A775 - Specification for Epoxy-Coated Reinforcing Steel Bars.
8. ASTM A884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
9. ASTM A934 - Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
10. ASTM C31 – Practice for Making and Curing Concrete Test Specimens in the Field.
11. ASTM C33 - Specification for Concrete Aggregates.
12. ASTM C39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens.
13. ASTM C94 - Specification for Ready-Mixed Concrete.
14. ASTM C143 – Test Method for Slump of Hydraulic-Cement Concrete.
15. ASTM C150 - Specification for Portland Cement.
16. ASTM C172 - Practice for Sampling Freshly Mixed Concrete.
17. ASTM C231 – Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
18. ASTM C260 - Specification for Air-Entraining Admixtures for Concrete.
19. ASTM C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
20. ASTM C494 - Specification for Chemical Admixtures for Concrete.
21. ASTM C618 - Specification for Fly Ash as Admixture for Concrete.
22. ASTM C1116 - Specification for Fiber-Reinforced Concrete and Shotcrete.
23. ASTM C1193 - Guide for Use of Joint Sealants.
24. ASTM C1602 – Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
25. ASTM D1751 - Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction Nonextruding and Resilient Bituminous Types.
26. ASTM D1752 - Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
27. ASTM D5249 - Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.
28. ASTM D6690 – Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

C. United States Access Board:
1. ADA Accessibility Guidelines for Buildings and Facilities.(ADAAG)

1.03 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Submit proposed mix design of each class of concrete to Engineer not later than 10 days after Notice to Proceed or 15 days prior to the first concrete placement, whichever comes first.

C. Contractor shall submit a jointing plan for expansion, isolation, contraction and construction joints prior to placing any concrete.

D. Jointing plan shall include details for doweled joints indicating dowel bar size and length, dowel supports, and distance between dowels.

E. Jointing plan shall include details for tie bar joints indicating tie bar size and length, tie bar supports, and distance between tie bars.

F. Include sequence of concrete placement indicating location of construction joints.

G. Jointing plan shall meet the requirements of the referenced ACI Standards.

H. Failure to submit a jointing plan to the Engineer prior to the placement of any concrete will result in the rejection of concrete placed prior to Engineer review and approval of jointing plan.

I. Product Data: Submit data on joint filler, reinforcement, admixtures, and curing compounds.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with specified ACI requirements.

B. Maintain one copy of each document on site.

C. Obtain cementitious materials from same source throughout.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Conform to requirements of Section 31 02 00 – General Requirements for Sitework.

B. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Form Materials: Conform to ACI 301 and 347.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615; 60 ksi yield grade; deformed billet steel bars; with ASTM A775 epoxy coated finish.

B. Epoxy-Coated Joint Dowel Bars: ASTM A775; with ASTM A615, Grade 60, smooth steel bars. Cut bars true to length with ends flush and free of burrs.

C. Epoxy Repair Coating: Liquid, two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

D. Welded Steel Wire Fabric: Plain type, ASTM A185; in flat sheets; with ASTM A884 epoxy coated finish.

E. Reinforcement Supports:
   1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place.
   2. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.
      a. Provide wire bar supports with plates or horizontal runners where base material will not support chair legs.
      b. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer coated wire bar supports.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150 Normal – Type 1 or 1A, gray color.

B. Fine and Coarse Mix Aggregates: ASTM C33.

C. Water: ASTM C1602, potable, not detrimental to concrete.

D. Air Entrainment: ASTM C260.

E. Flyash: ASTM C618. Class C.

2.04 CHEMICAL ADMIXTURES

A. Chemical admixtures shall be in accordance with ASTM C494.

B. Concrete may contain Type A Water-reducing admixture and Type D Water-reducing and retarding admixture.

C. Admixtures are to be used in accordance with manufacturer's recommendations.

D. Chemical admixtures containing chlorides, sulfides, or nitrides are not permitted.

E. A single manufacturer shall supply permitted admixtures.

F. Admixture manufacturer's are to be approved in writing by Engineer prior to use.

2.05 ACCESSORIES

A. Joint Filler: ASTM D1751, Bituminous fiber, 1/2-inch wide by depth of concrete less 1/8-inch.

B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating, intended for use on concrete.

2.06 CURING AND TREATMENT MATERIALS

A. Water: Potable and clean.

B. Membrane Curing Compound, ASTM C309, Type I, Class A, free of oil, wax, or grease.

2.07 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.

B. Schedule of Mixes:

Class	Name	Maximum Aggregate Size (inch)	Maximum Slump** (inch)	Minimum Cement Sacks/cu.yd.	Minimum Compressive Strength (psi/28 days)	Maximum Water Cement Ratio
9*	Exterior Walks, Curbs, gutters Drives, Ramps	3/4	3	6.25	4000	0.45

* Air Entrained Concrete Mix. Normal Acceptable range of air content is 5-7 percent.
** Slump Tolerances Maximum slump of 4-inch plus 1-inch, minus 1/2-inch.

C. Prepare and submit concrete mix designs in accordance with Section 31 02 00 – General Requirements for Sitework, and include as part of cost of this Work.

D. A qualified agency acceptable to Engineer/Architect shall prepare mix designs. Submit six (6) copies of mix designs for Engineer/Architect's review prior to placing any concrete.

E. Mix design shall indicate brands, types, and quantities of admixtures included, compressive strength, slump, sieve analysis for fine and coarse aggregate, quantities of all ingredients, type and brand of cement, source of aggregate, and whether fine aggregate is natural or manufactured.

F. Use accelerating admixtures in cold weather only when approved by Engineer/Architect in writing. Use of admixtures will not relax cold weather placement requirements.

G. Use set retarding admixtures during hot weather only when approved by Engineer/Architect in writing.

2.08 SOURCE QUALITY CONTROL AND TESTS

A. Section 31 02 00 – General Requirements for Sitework: Provide mix design for Class 9 concrete.

B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

C. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 31 02 00 – General Requirements for Sitework: Coordination and project conditions.

B. Verify compacted subgrade and granular base is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. Section 32 11 23 - Aggregate Base Course, forms base construction for Work of this section.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Construction Manager minimum 24 hours prior to commencing concrete operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 PLACING REINFORCEMENT

A. Interrupt reinforcement at control isolation and expansion joints.

B. Position the reinforcement on approved chairs securely fastened to the subgrade prior to concrete placement.

C. Mechanically screed concrete after the steel has been placed.

D. Regardless of placement procedure, ensure the reinforcing steel is free from coatings which could impair bond between the steel and concrete, and indicate laps in the reinforcement as indicated.

E. In lieu of the above, automatic reinforcement depressing attachments may be used to position the reinforcement provided the entire operation is approved by Engineer.

F. Regardless of the equipment or procedures used for installing reinforcement, ensure that the entire depth of concrete is adequately consolidated by the mechanical screeding process.

G. The method used in installing and holding dowels in position must ensure that the error in alignment of any dowel from its required horizontal and vertical alignment after the pavement has been completed will not be greater than 1/8 in. per ft.

H. Horizontal spacing of dowels must be within a tolerance of plus or minus 5/8 inch.

I. Do not place dowels closer than 0.6 times the dowel bar length to the planned joint line.

J. If the last regularly spaced dowel is closer than that dimension, it must be moved away from the joint to a location 0.6 times the dowel bar length.

K. For contraction joints;
   1. Hold dowels in longitudinal and transverse contraction joints within the paving area securely in place by means of rigid metal frames or basket assemblies of an approved type.
   2. Hold the basket assemblies securely in the proper location by means of pins or anchors.

L. For construction joints in fixed form paving applications;
   1. Install dowels using the bonded-in-place method. Do not install by removing and replacing in preformed holes.
   2. Prepare dowels and place across joints where indicated on approved jointing plan, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms.

M. Wipe clean the portion of each dowel intended to move within the concrete or expansion cap and coat with a thin, even film of lubricating oil before the concrete is placed.

N. Add polypropylene fiber reinforcement in accordance with fiber reinforcement manufacturer's written instructions.

3.06 PLACING CONCRETE

A. Place concrete in accordance with specified ACI Requirements.

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

C. Place concrete continuously over full width of panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.07 JOINTS

A. Place joints as indicated on Drawings.

B. Place expansion joints using joint filler as follows for identified entities:
   1. Area Paving: Areas next to building foundation and fixed components with separate foundations.

C. Jointing shall be performed by hand tools. Jointing tools and equipment must provide minimum joint depth as specified by ACI requirements.

3.08 FINISHING

A. Sidewalk Paving: Broom finish. Edge sidewalk to 1/2-inch radius.

B. Direction of Texturing: Transverse to pavement direction.

C. Place curing compound on exposed concrete surfaces immediately after finishing.

3.09 TOLERANCES

A. Section 31 02 00 – General Requirements for Sitework: Tolerances.

B. Maximum Variation of Surface Flatness: 1/4-inch in 10 feet.

C. Maximum Variation from True Position: 1/4-inch.

3.10 FIELD QUALITY CONTROL

A. Section 31 02 00 – General Requirements for Sitework: Testing and inspection services.

B. Concrete testing shall be paid for by Contractor.

C. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

D. Take one additional test cylinder during cold weather and cure on site under same conditions as concrete it represents.

E. Take one slump test for each set of test cylinders taken.

F. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.11 PROTECTION

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

B. Do not permit pedestrian traffic over pavement for 2 days minimum after finishing and vehicular traffic over pavement for 7 days minimum after finishing.

END OF SECTION 32 13 13

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SECTION 32 91 19

LANDSCAPE GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Final grading requirements.
   2. Topsoil for finish.

B. Related Sections:
   1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
   2. Section 31 05 13 – Soils for Earthwork.
   3. Section 31 23 17 – Site Excavation, Backfill, and Compaction: Backfilling at building areas and utility trenches.
   4. Section 32 13 13 – Concrete Paving.
   5. Section 32 92 00 – Turf and Grasses.

1.02 REFERENCES

A. ASTM International (American Society for Testing and Materials)
   1. ASTM D5268 – Topsoil Used for Landscaping Purposes.

1.03 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Samples: Submit, in airtight containers, 10 lb. sample of topsoil to testing laboratory.

C. Materials Source: Submit name of source of imported materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil:
   1. Imported or salvaged surface soil in accordance with ASTM D5268, composed of a mixture consisting of humus, clay and sand, rich in nutrients and capable of supporting plant growth. Topsoil shall be free of debris, and rocks larger than 3/4-inch, with a pH range of 5.5 to 7.5.

2. Topsoil shall contain not less than five percent or more than 20 percent, by weight, of organic matter.
3. Topsoil shall be free from perennial weeds and perennial wood seeds, and shall not contain objectional plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 31 02 00 – General Requirements for Sitework: Coordination and project conditions.

B. Verify building and trench backfilling have been inspected.

C. Verify substrate base has been contoured and compacted.

3.02 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones, in excess of 1-inch in size. Remove contaminated subsoil.

C. Scarify surface to depth of 6 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 PLACING TOPSOIL

A. Place topsoil in areas where seeding to thickness as scheduled, to nominal depth of 6 inches. Place topsoil during dry weather.

B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.

C. Remove roots, weeds, rocks, and foreign material while spreading.

D. Manually spread topsoil close to plant material, structures, and paving to prevent damage.

E. Lightly compact placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.04 TOLERANCES

A. Section 31 02 00 – General Requirements for Sitework: Tolerances.

B. Top of Topsoil: Plus or minus 1/2-inch.

3.05 PROTECTION OF INSTALLED WORK

A. Section 31 02 00 – General Requirements for Sitework: Protecting installed Work.

B. Protect landscaping and other features remaining as final Work.

C. Protect existing structures, sidewalks, utilities, paving, and curbs.

D. Prohibit construction traffic over topsoil.

3.06 SCHEDULE

A. Compacted topsoil thicknesses:
   1. Seeded Grass: 6 inches.

END OF SECTION 32 91 19

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SECTION 32 92 00

TURF AND GRASSES

(FOR INFORMATION ONLY)

OWNER SHALL PROVIDE SEEDING, FERTILIZER, MULCHING, WATERING, AND MAINTENANCE.

CONTRACTOR SHALL PLACE TOPSOIL AND PREPARE FOR SEEDING OPERATIONS BY OWNER.

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Preparation of subsoil.
2. Placing topsoil.
3. Seeding.
4. Mulching.
5. Soil testing and fertilizer.
6. Maintenance.

B. Related Sections
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 05 13 – Soils for Earthwork: Topsoil material.
3. Section 31 23 17 – Site Excavation, Backfill, and Compaction.
4. Section 32 91 19 - Landscape Grading: Preparation of subsoil and placement of topsoil in preparation for the Work of this section.

1.02 REFERENCES

A. Association of Official Seed Analysts, Inc. (AOSA)
1. Rules for Testing Seeds.

B. ASTM International (American Society for Testing and Materials)
1. ASTM C602 – Specification for Agricultural Liming Materials.

1.03 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals

B. Product Data: Submit data for seed mix, fertilizer, mulch, and other accessories.

C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination

D. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates

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

1.05 CLOSEOUT SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; and types, application frequency and recommended coverage of fertilizer.

1.06 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging

B. Perform Work in accordance with State of Wisconsin Department of Transportation standards.

1.07 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum five (5) years documented experience

B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 31 02 00 – General Requirements for Sitework: Product storage and handling requirements.

B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.09 COORDINATION

A. Section 31 02 00 – General Requirements for Sitework: Requirements for coordination.

B. Coordinate with installation of underground sprinkler system piping and watering heads.

1.10 MAINTENANCE SERVICE

A. Section 31 02 00 – General Requirements for Sitework: Requirements for maintenance service.

B. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.01 SEED MIXTURE

A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for priority and germination established by AOSA Rules. Provide seed mixture composed of grass species, at proportions and percentages of purity and germination, and shall be composed of following.
   1. Highway Mix No. 40 (2 lbs. / 1000) (#3407-1400)
      a. 35 percent Kentucky Bluegrass.
      b. 25 percent VNS Fine leaf Perennial Rye.
      c. 20 percent Creeping Red Fescue.
      d. 20 percent VNS Hard Fescue.
   2. Or approved equal.
   3. Application Rate: 2lbs. per 1,000 sf.

2.02 SOIL MATERIALS

A. Topsoil: As specified in Section 31 05 13 –Soils for Earthwork.

2.03 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Commercial grade; recommended for grass; of proportion necessary to eliminate deficiencies of topsoil to the following minimum proportions: Nitrogen 10 percent, phosphoric acid 10 percent, and soluble potash 5 percent.

C. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

2.04 SOURCE QUALITY CONTROL

A. Section 31 02 00 – General Requirements for Sitework: Testing, inspection and analysis requirements.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 31 02 00 – General Requirements for Sitework: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.02 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to depth of 6 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.03 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 6 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low, or soft areas, and to ensure positive drainage.

E. Install edging at periphery of seeded areas in straight lines to consistent depth.

3.04 FERTILIZING

A. Apply fertilizer at application rate recommended by soil analysis.

B. Apply after smooth raking of topsoil.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Mix fertilizer thoroughly into upper 2 inches of topsoil.

E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.05 SEEDING

A. Apply seed at rate as specified, evenly in 2 intersecting directions.

B. Immediately following seeding, apply mulch to thickness of 1/8-inch. Maintain clear of shrubs and trees.

C. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.06 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 12 inches. Space stakes at 5 foot centers.

B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36-inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.07 MAINTENANCE

A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.

D. Water to prevent grass and soil from drying out.

E. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.

F. Immediately reseed areas showing bare spots.

G. Repair washouts or gullies.

H. Protect seeded areas with warning signs during maintenance period.

END OF SECTION 32 92 00

SECTION 33 12 13

WATER SERVICE LATERALS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Tapping new water mains for lateral services.
2. New lateral service extension.
3. Existing building lateral service connections.
4. Service piping.
5. Saddles.
6. Corporation stops.
7. Curb stops.
8. Curb boxes.
9. Insulation.

B. Related Sections:
1. Applicable provisions of Section 31 02 00 – General Requirements for Sitework shall govern Work under this Section.
2. Section 31 23 17 – Site Excavation, Backfill, and Compaction.

1.02 REFERENCES

A. Public Works Industry Improvement Program;
1. Standard Specifications for Sewer and Water Construction in Wisconsin, Current Edition, with Addendum.

B. ASTM International: (ASTM)
1. ASTM B62 – Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM B88 – Specification for Seamless Copper Water Tube.
3. ASTM C518 - Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
4. ASTM C578 – Specification for Rigid, Cellular Polystyrene Thermal Insulation.
5. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics.
6. ASTM D2842 - Test Method for Water Absorption of Rigid Cellular Plastics.

C. American Water Works Association: (AWWA)
1. AWWA C800 - Underground Service Line Valves and Fittings.
2. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service.

1.03 SUBMITTALS

A. Section 31 02 00 – General Requirements for Sitework: Requirements for submittals.

1.04 REGULATORY REQUIREMENTS

A. Contractor shall comply with applicable rules of:
   1. State of Wisconsin Department of Safety and Professional Services and Wisconsin Department of Natural Resources (WDNR) and local code if more stringent for materials and installation of the Work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Load and unload pipe, fittings, valves, and accessories by lifting with hoists to avoid shock or damage.

B. Under no circumstances shall material be dropped.

C. Keep stored material free of damage.

D. Keep interior of pipe, fittings, and other appurtenances free from dirt or foreign matter.

E. Use timbers to separate pipe stored on ground from ground and other pipe.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Pipe shall not be laid in water.

B. Pipe shall not be laid in trenches where, in opinion of Construction Manager, conditions are unsuitable.

PART 2 - PRODUCTS

2.01 WATER SERVICE PIPING – 2 INCH AND UNDER

A. Piping for water laterals shall be polyethylene tubing conforming to AWWA C901, Pressure Class 200.

B. Make pipe connections with pack joint connections including a Buna-N beveled gasket for sealing to outside diameter of pipe.

C. Integrate a split clamp locking device with stainless steel hardware into connection fittings to securely restrain the pipe from hydraulic pressure and external loading caused by shifting and settling.

D. Provide stainless steel insert stiffeners for pack joint connection fittings used with polyethylene tubing.

E. Fittings for polyethylene tubing shall conform to AWWA C800 and be of cast brass having an alloy of 85 percent copper, 5 percent tin, 5 percent zinc and 5 percent lead (copper alloy C83600 also known as "red brass") in accordance with ASTM B62.

F. Fittings shall have uniformity in wall thickness and strength, and free of any defect that may affect their serviceability.

G. Polyethylene tubing shall be single piece, without joints, from corporation stop to curb stop.

2.02 SERVICE FITTINGS

A. Manufacturers:
1. Mueller Company, Decatur, IL
2. The Ford Meter Box Company, Inc, Wabash, IN
3. A.Y. McDonald Mfg. Co., Dubuque, IA
4. Substitutions: In accordance with Section 31 02 00 – General Requirements for Sitework.

B. Saddles:
1. Mueller Company, H-10500 Series.
2. The Ford Meter Box Company, Style F202.
3. A.Y. McDonald Mfg., Model 3825.
4. Substitutions: In accordance with Section 31 02 00 – General Requirements for Sitework.

C. Corporation Stops:
1. Mueller Company, H-15000 Series.
2. The Ford Meter Box Company, FB-600.
3. A.Y. McDonald Mfg., 4701B.
4. Substitutions: In accordance with Section 31 02 00 – General Requirements for Sitework.

D. Curb Stops:
1. Mueller Company, H-15154 Series.
2. The Ford Meter Box Company, B22M Series.
3. A.Y. McDonald Mfg., 6104 Series.
4. Substitutions: In accordance with Section 31 02 00 – General Requirements for Sitework.

E. Service boxes shall have a minimum length of 7 feet when extended without use of extension sections.

PART 3 - EXECUTION

3.01 WATER AND SEWER SEPARATION

A. Water services 2-1/2 inches or larger shall be installed at least 8 feet horizontally from any sanitary sewer.

B. Water services 2 inches and smaller shall be installed at least 30 inches horizontally from any sanitary sewer.

C. No water service may be installed within 6 inches of a storm sewer.

D. Where water main crosses above a sanitary sewer, bottom of water main must be at least 12 inches above top of sewer within 10 feet of point of crossing.

E. Where water main crosses below a sanitary sewer, top of water main must be at least 18 inches below bottom of sewer within 10 feet of point of crossing.

3.02 NOTIFICATION

A. Contractor, prior to any excavation work, shall notify (1) a designated locating service; (2) utilities, governmental agencies, entities, known to, or which can reasonably be assumed to have above or below ground pipe, conduit cables, structures, or similar items within limits of project; to locate and mark location of such items.

B. In accordance with Wisconsin Statute 182.0175, "Damage to Transmission Facilities," Excavator, as defined in 182.0175(1)(bm), shall be solely responsible to provide advance notice to “Diggers Hotline, Inc.” (800-242-8511) not less than three working days prior to commencement of any Excavation, as defined in the statute, required to perform work contained in this Project, and further, Excavator shall comply with all other requirements of this Statute relative to Excavation.

3.03 PROTECTION

A. Perform excavation, backfilling and compaction in accordance with Section 31 23 17 – Site Excavation, Backfill, and Compaction for protection of public and private property.

B. Exercise care during excavation to avoid damage to existing buildings, structures, roadways, sidewalks, utilities, and survey identification markings.

3.04 INSTALLATION OF LATERAL

A. Lay and maintain water laterals to lines and grades established by Drawings with fittings and valves at required locations.

B. Trench preparation shall proceed in advance of lateral installation only as far as can be backfilled in same day.

C. Contractor shall not deviate from types of excavation indicated on Drawings or in Project Manual without prior concurrence of Owner’s Representative except in case of roadways, driveways, and obstructions requiring short tunnel sections that may be indicated on Drawings as open trench sections.

D. Support tunnel sections exceeding 2 feet in length in accordance with applicable codes.

E. Install water laterals without use of wood blocking.

F. Lower tubing or pipe, fittings, and valves carefully into trench by means of a derrick, ropes, or other suitable tools or equipment, in a manner to prevent damage to water main materials and protect coatings and linings.

G. Trench bottom shall be true and even in order to provide support for full length of lateral, except a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard, measured by volume. When rock is encountered, remove to provide a clearance of at least 6 inches below and on each side of pipe, valves, and fittings for pipe sizes 24 inches or smaller, and 9 inches for pipe sizes 30 inches and larger.

I. When excavation is complete, place a layer of appropriate bedding material on bottom of trench to depths indicated, level, and compact. Take every precaution to prevent foreign material from entering pipe while it is being placed in line.

J. If pipe laying crew cannot put lateral into trench and in place without getting earth into it, Construction Manager may require that before lowering pipe into trench, a heavy, tightly woven, canvas bag of suitable size be placed over each end and left there until connection is made to adjacent pipe.

K. Take precautions to prevent foreign materials from entering joint space and carefully check joint recess for foreign material before installing gasket.

L. Secure lateral in place with bedding material, placed by hand or equally careful means, keeping bell end open. Remove pipe and fittings that do not allow sufficient and uniform space for joints and replace with pipe and fittings of proper dimensions to insure such uniform space.

M. Upon daily and temporary completion of lateral installation, close open ends of pipe by a water-tight plug or other means approved by Engineer. This provision applies during daytime inactivity as well as overnight.

N. If water is in trench, maintain seal in place until water level is lowered four inches below lateral invert.

O. Whenever it becomes necessary to lay a lateral over, under, or around a known obstruction, furnish and install required fittings. Cost of such fittings will be paid for in lump sum or unit price bid for each size of lateral. No additional compensation will be paid to Contractor for any expenses incurred because of such obstruction.

P. When an unknown underground structure interferes with Work to such an extent that an alteration of Drawings is required and alteration results in a change in cost to Contractor, Construction Manager will issue a written order for such altered work, specifying basis of payment or credit for such altered work.

Q. Keep interior and exterior of lateral clean and free from foreign material before installation. Provide necessary means to wipe, brush, swab, or air blast to remove any foreign material from

interior of tubing or pipe as instructed by manufacturer and as directed by Construction Manager.

END OF SECTION 33 12 13