SECTION 00 01 05

PROFESSIONAL CERTIFICATIONS

ARCHITECT

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Architect under the laws of the State of Wisconsin.
Responsible for Sections 040513, 040519, 042200, 055113, 061000, 072100, 072616, 078400, 079200, 081100, 083613, 085113, 087100, 088100, 089119, 092900, 093113, 096519, 097720, 098813, 099100, 099723, 101400, 102813, 104400, and 133419 of the Specifications.

Bruce P. Paulson
Date: November 18, 2022
License # 9354-005

CIVIL ENGINEER

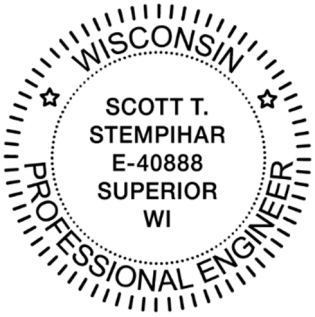
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin. Responsible for Sections 011000, 012000, 013100, 013300, 014000, 015000, 015526, 015713, 016000, 017000, 017823, 017836, 024113, 311000, 312300, 312313, 312319, 313219, 321123, 321201, 321314, 321613, 323113, 329200, 330505, 330517, 330522, 330523.13, 330830, 331000, 331212, 333100, 333900, 334000, 334724, and 347823.1 of the Specifications.

DocuSigned by:
Christian Moring
918F953A92D44F9...

Christian Moring, PE
Date: November 18, 2022
License # 48772-6

CIVIL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin. Responsible for Sections 015526, 015713, 017823, 017836, 312300, 312313, 313219, 321123, 321201, 321723, 330505, 330517, 330522, 330830, 333100, 334000, 341110, 344105, and 347823 of the Specifications.



DocuSigned by:
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Scott T. Stempihar, PE
Date: November 18, 2022
License # 40888-6

STRUCTURAL ENGINEER

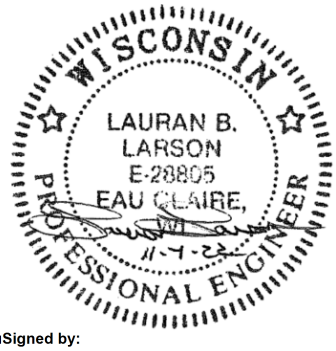
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Structural Engineer under the laws of the State of Wisconsin. Responsible for Sections 014100, 031000, 032000, 033010, 033500, 034000, 040513, 040519, 042200, of the Specifications.

DocuSigned by:
Dan Weston
6CE41C67EF93425...

Dan Weston, PE, SE
Date: November 18, 2022
License # 42026-006

STRUCTURAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Structural Engineer under the laws of the State of Wisconsin. Responsible for Sections 014100, 024113, 031000, 032000, 033010, 033500, 354213.19, 354213.20, 354213.21, 354213.23, 354234.10, 354234.20, 354234.30, and 355933 of the Specifications.



DocuSigned by:
Lauran Larson
2D8E936225F94F5...

Lauran Larson, PE
Date: November 18, 2022
License # 28805-6

ELECTRICAL ENGINEER

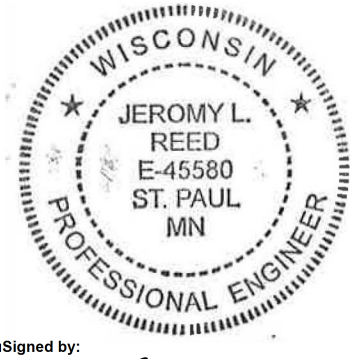
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin. Responsible for Sections 260505, 260519, 260526, 260533, 260800, 262200, 262413, 262416, 262726, 262816, and 265000 of the Specifications.

Michael T. FitzPatrick

Michael T. FitzPatrick, PE, LC, IES
Date: November 18, 2022
License # 44771-6

MECHANICAL ENGINEER

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Architect under the laws of the State of Wisconsin. Responsible for Sections 220500, 220700, 221100, 221300, 221400, 221500, 223100, 223300, 223400, 224000, 230500, 230593, 230700, 230800, 230900, 230993, 231123, 232300, 233100, 233300, 233400, 233700, 236200, 237423, and 238239 of the Specifications.



DocuSigned by:
Jeromy L Reed
09037B670C0E4BD...

Jeromy L. Reed, PE
Date: November 18, 2022
License # 45580

END OF SECTION

SECTION 00 01 10

TABLE OF CONTENTS

END OF SECTION

SECTION 00 31 00

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Technical Data.
   2. Other Site Related Documents.

B. Reports and Drawings regarding the Project are attached to this Section.

1.02 TECHNICAL DATA

A. Report of Geotechnical Exploration – C. Reiss Dock Development, St. Louis Bay, Superior, Wisconsin.

B. Geotechnical Evaluation Report – Sheet Pile Bulkhead Wall, C Reiss Dock, Superior, Wisconsin.

1.03 OTHER SITE RELATED DOCUMENTS

A. Materials Management Plan and Chapter NR 718 Exemption, C. Reiss Coal Dock Property.

B. Site Investigation Report – C. Reiss Coal Dock Property, Superior, Wisconsin.

C. Assured Wetland Delineation Report – Reiss Superior Dock, The C. Reiss Coal Company, LLC.

D. Boundary Survey – C. Reiss Terminals LLC.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.01 SUMMARY

Section Includes

1. Basic description of the Project and Work restrictions.

1.02 PRICE AND PAYMENT PROCEDURES

Measurement and Payment

1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 SUMMARY OF WORK

Project Name: C. Reiss Dock for C. Reiss Company, LLC, located in Superior, WI.

Description of Work: The proposed "C. Reiss Dock" is a development adjacent to the Saint Louis Estuary in Superior, WI. The purpose of the project is to redevelop an abandoned and contaminated industrial shipping and receiving dock in the Port of Superior to provide waterfront, rail, and site improvements and restore its navigational use. The project will involve dredging contaminated sediment from the existing slip (work by others) and dispersing material within the Site area, containing this material within proposed berms to be capped per WDNR and USACE regulatory requirements. In addition to the earth moving and capping work, the site improvements include repairing the existing dock wall, construction of a rail line, office building, maintenance garage, parking lot, and necessary access roads and utilities for Site operation. The Project will also consist of several permanent stormwater BMPs, including a wet pond with forebay, grassed swales, and designated dewatering areas to achieve post construction performance standards for water quality, as well as provide a functional draining site to accommodate the future site's function.

1.04 COMPLETION DATES

Substantial Completion: Set forth in the Agreement.

Final Completion: Set forth in the Agreement.

1.05 LIQUIDATED DAMAGES

Provisions for liquidated damages, if any, are set forth in the Agreement.

1.06 WORK RESTRICTIONS

Use of Site

1. Contractor responsible for snow removal and disposal from the Owner's property if necessary to maintain access and working space during construction.
2. Keep existing driveways and entrances clear and available to the Owner.
3. If additional space is needed, obtain and pay for such space off Site.

Access to Site

1. No parking is allowed on Winter Road or the frontage road north of the rail line. All parking shall be on Site.

1.07 OTHER WORK AT SITE

The US Army Corps of Engineers will be performing Dredging work as part of a separate contract, but dredged material will be placed on this site, and earth moving work dictated under this contract.

The installation and revision of electric power and gas lines by private utilities is anticipated.

Allow private utility crews free access to the Site and a reasonable amount of time to complete their work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
Administrative and procedural requirements for allowances, Alternates, pricing of Work, and request for payment procedures.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 ALTERNATES

A. This article identifies each Alternate by number and describes the basic changes to be incorporated into the Work as part of that Alternate. Refer also to the Specifications and Drawings for information.

B. Alternates may be accepted by the Owner in any order and may be used to determine the award of Contract consistent with the Instructions to Bidders.

C. Alternate No. 1 – Select Borrow – Add to Total Base Bid
In general, the Work of this Alternate No. 1 consists of all costs to provide select borrow material in areas of the rail embankment, in which existing on-site cut material is unsuitable for structural embankment. Costs for the work shall include clearing, grubbing, excavating, sloping, shaping, trimming, loading, hauling, placing; compacting; disposing of surplus and unsuitable material; and for salvaging, stockpiling, rehandling, and spreading salvaged material for covering the surfaces of excavated areas within borrow sites.

1.04 BID UNIT PRICES

A. Provide access and assist Engineer in determining actual quantities of Bid Unit Price work.

B. Provide documentation to substantiate Bid Unit Price work.

C. If the Contractor delivers and places more of any material that is paid for on a Bid Unit Price basis than is required to perform the Work and thereby causes the materials to be wasted, the quantity wasted will be deducted from the final measurement for that Bid Item.

1.05 INCREASED/DECREASED QUANTITIES

A. No claim for adjustment in unit price compensation due to increased or decreased quantities is allowed.

B. Certain proposal work items are included in anticipation of the possibility that conditions may be encountered which require this work. The estimates of quantities for these proposal items are based upon general experience in the area. They are included in the work to establish a bid unit price in the event that such work is necessary to complete the project. The quantity is not guaranteed and the extent of the work required will be dependent upon prevailing conditions. As such, no unit price adjustments for any magnitude of increased or decreased quantities is allowed for such work.

1.06 PAYMENT PROCEDURES

A. Engineer will provide initial Application for Payment Form at the Preconstruction Conference.

B. Submit 1 preliminary copy of progress payment application for review, consistent with the General Specifications. Submit 4 signed copies of Application for Payment to Engineer prior to the dates identified at the Preconstruction Conference.

C. Attach the following supporting documentation, in addition to the requirements of the General Specifications:
Documentation to substantiate Bid Unit Price work.
Updated construction schedule consistent with Section 01 33 00.
Wage reports, etc. required for funded portions of the project.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. General requirements for overall Project coordination.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 UTILITIES

A. Notify Diggers Hotline of Wisconsin before starting construction in a given area requesting utility locates in the Site.

B. Project Utility Sources: Coordinate Work with the following utility owners. The following utilities are known to be on the Site and are shown on the Drawings in a general way:
   1. Water: Superior Water, Light & Power.
   2. Sanitary Sewer: City of Superior.
   3. Storm Sewer: Owner.
   4. Electric: Superior Water, Light & Power.
   5. Gas: Superior Water, Light & Power.

C. Owner requires a 48-hour notice for all utility interruptions.

1.04 PERMITS

A. Comply with the stipulations of the following permits, which have been applied for and will be furnished by the Owner:
   1. City of Superior – Special Area Management Plan.
   2. City of Superior – Post-Construction Stormwater Management Permit.
   3. City of Superior – Erosion Control Permit.
   4. WDNR – General Permit to Discharge Under the Wisconsin Pollutant Discharge Elimination System – WPDES Permit No. WI-S067831-6.
   5. WDNR – Chapter 30 Permit – Dredge & Dock Wall Work.
   6. WDNR – Chapter 30 Permit – Stormwater Pond.
   7. ACOE – Dredging Permit.
   8. WDNR – Dredging Permit.
   9. WDNR – Small Capacity Non-Domestic Wastewater Holding Tank Plan Approval.

B. Apply for, obtain, and comply with the provisions of the following permits:
   1. Superior Water, Light & Power – Construction Request – Commercial.
   2. City of Superior – Building Permit.
   3. City of Superior – Electrical Permit.

4. City of Superior – Excavation Permit.
5. City of Superior – Plumbing Permit.
6. Wisconsin DSPS – Building / Water.

C. Apply for, obtain, and comply with other permits, licenses, and approvals which may be required for the Project.

1.05 SURVEYING AND CONSTRUCTION OBSERVATION

A. Provide Engineer a minimum of 48-hours' notice in advance of the need for establishing lines, grades, measurements, grade checks, and observation of Work.

B. The Owner/Engineer will provide survey as necessary to accomplish the work.
   1. The Contractor shall check for accuracy of the survey and shall be responsible for the protection and preservation of such stakes. Any expense incurred for additional staking caused by Contractor's neglect will be charged to the Contractor and deducted from sums due to him/her under this Contract.
   2. The Contractor shall be responsible for all lines, elevations, and measurements of all work executed by them under the contract. Contractor must exercise proper precaution to verify figures before laying out work, and will be held responsible for any error resulting from their failure to exercise such precaution.

C. Engineer will furnish a Resident Project Representative consistent with Paragraph 9.03 of the Supplementary Conditions.

D. Construction Observation
   1. All services rendered by the Owner's Engineer will consist of professional opinions and recommendations in accordance with the generally accepted construction Engineering practices. Under no circumstances is it the intent of the site representative to directly control the physical activities of the Contractor or the Contractor's workers accomplishment of work on this project. The purpose of the field representatives at the site is to provide monitoring of the Contractor's work, and does not include any superintending, supervising, or direction of the actual work.

E. Inspection by Public Authority
   1. If any of the Work is required to be inspected, or approved by any public authority, the Contractor shall cause such inspection or approval to be performed. No inspection performed or failed to be performed by the Owner hereunder shall be a waiver of any of the Contractor's obligations hereunder or be construed as an approval or acceptance of the Work or any part thereof.

1.06 PROJECT MEETINGS

A. Administrative Requirements
   1. Project Superintendent or persons designated by the Contractor to attend and participate in the Project meetings shall have all required authority to commit the Contractor to solutions agreed upon in the Project meetings.
   2. Engineer will set the time, sites, and prepare the agenda for the meetings.
   3. Engineer will prepare meeting minutes and distribute 1 copy to Contractor. Notify Engineer of inaccuracies or discrepancies in the meeting minutes within 5 calendar days of receipt of the minutes.
   4. The attendance and cooperation of subcontractors and suppliers may be required.

B. Preconstruction Conference
   1. Provisions for the Preconstruction Conference are set forth in the General Specifications.
   2. Requirements for preconstruction submittals are set forth in the General Specifications. Submittal procedures shall be consistent with Section 01 33 00.

C. Progress Meeting Procedures
   1. Engineer will schedule construction progress meetings throughout the duration of the Project to assess the progress of the Work, identify and discuss Project related issues, and discuss near-term construction activities.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. General procedures and requirements for submittals during the course of construction.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 SEQUENCING AND SCHEDULING

A. Schedule submittals consistent with the Contractor's schedule of shop drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 CONSTRUCTION SCHEDULE

A. Submit preliminary schedule and progress schedule consistent with the General Specifications.

B. Prepare schedules on 11 inch by 17 inch sheets showing overall sequence of construction. Organize the schedule by work activity. Identify separate stages of each work activity:
   1. List work items in chronological sequence. Show beginning and completion dates of each activity. Include all activities with an estimated duration of 3 days or longer.
   2. Format schedule as a horizontal bar chart. Provide separate bars for each activity or trade.
   3. Provide space for revisions and notations.
   4. Identify interrelations between activities.
   5. Include estimated times for preparation of submittals by Contractor, processing and review of submittals by Engineer, fabrication, delivery, installation, testing, start-up, instruction of Owner, and clean-up.

C. As Work progresses, revise, update, and resubmit schedule as requested by Engineer. At a minimum, update schedule with each Application for Payment. Show all activities started or finished since previous schedule was submitted and show percentage of completion for each activity.

3.02 EMERGENCY CONTACT LIST

A. Before any Work at the Site is started, submit a typed list on 8.5 by 11-inch paper outlining 24-hour on-call contacts for the Project. This list shall include the Contractor's safety representative, key representatives from the Contractor, subcontractors, and suppliers. Include the following information for each contact:
   1. Company name.
   2. Contact person(s).
   3. Local and mobile phone numbers.
   4. Email address.
   5. Fax number.

3.03 SHOP DRAWINGS AND MANUFACTURERS' INFORMATION

A. Conform to the requirements of the General Specifications, except as modified herein.

B. The minimum sheet size shall be 8.5 inches by 11 inches. Non-legible copies will not be reviewed.

C. Submit electronic copies of shop drawings. Each shop drawings submittal shall contain the following information:
   1. Date of submission and date of any previous submittals.
   2. Project Title.
   3. Names Of: Contractor, subcontractor, supplier, and manufacturer.
   4. Identification of product and Specification Section number.
   5. Identification of revisions from previous submittals.
   6. A 4-inch by 4-inch blank space for the Engineer's stamp.

D. Engineer's review will be in conformance with the requirements of the General Specifications, except as modified herein.

E. Engineer will stamp shop drawings and indicate requirements for Contractor's review or resubmittal as follows:
   1. "Reviewed" – Appears that items covered by the submittal will, after installation or incorporation into the Work, conform to the Contract Documents and appears to be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
   2. "Reviewed as Noted" – Appears that items covered by the submittal will, after installation or incorporation into the Work, conform to the Contract Documents and appears to be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, except as noted by Engineer.
   3. "Revise and Resubmit" – Appears that items covered by the submittal will not, after installation or incorporation into the Work, conform to the Contract Documents and will not be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Work cannot proceed until the submittal is revised and resubmitted conforming to the resubmittal procedures described in the General Specifications.

F. Engineer will return reviewed submittals to Contractor by electronic delivery.

3.04 OPERATION AND MAINTENANCE MANUALS

A. Conform to the requirements of Section 01 78 23.

3.05 TEST REPORTS

A. Submit electronic copies of all inspections, tests, and approvals required in the Specification.

3.06 WELDING CERTIFICATES

A. Submit welding certificates for each person by name assigned to do field welding of materials installed under this Contract. Certificates shall indicate that each person has passed tests specified by AWS and shall be submitted prior to execution of any welding.

3.07 MATERIAL AND SAFETY DATA SHEETS

A. Furnish Owner with current copies of Material Safety Data Sheets for all chemicals and products on Site.

3.08 WARRANTIES

A. Conform to the requirements of Section 01 78 36.

END OF SECTION

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SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Information required for conformance to regulatory requirements.
   2. Quality assurance.
   3. Procedures to measure and report the quality and performance of the Work.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCE STANDARDS

A. Whenever reference is made to the Wisconsin Department of Transportation Specifications, such reference shall mean "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and all subsequent revisions and supplements. The word "Engineer" is understood to refer to the Engineer for the Owner.

1.04 SUBMITTALS

A. Prior to start of Work, submit testing laboratory name for various specified tests for approval by Engineer.

B. Laboratory test results or analysis.

C. Manufacturer's certificates of quality control or performance.

1.05 WORKMANSHIP

A. Comply with industry standards of the region, except where more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

1.06 TESTS AND INSPECTIONS

A. Conform to the requirements of the General Specifications, except as modified herein.

B. Notify Engineer 48 hours prior to expected time for operations requiring tests and inspections.

C. Provide incidental labor and facilities to obtain and handle samples at Site or source, transport samples to laboratory, and facilitate tests and inspections for storing and curing of test samples.

D. Structural Tests and Special Inspections: Conform to the requirements of Section 01 41 00.

1.07 LABORATORY REPORTS

A. After each inspection and test, submit electronic copy of Laboratory Report to Engineer.

B. Include: Date issued, Project title and number, name of inspector, date and time of sampling or inspection, identification of product and Specifications Section, location in the Project, type of inspection or test, date of test, results of tests, and conformance with Contract Documents.

1.08 LABORATORY RESPONSIBILITIES

A. Test samples and perform field tests.

B. Provide qualified personnel. Cooperate with Engineer and Contractor in performance of services.

C. Ascertain compliance with the requirements of the Contract Documents.

D. When requested by Engineer, provide interpretation of test results.

1.09 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop Work.

1.10 MANUFACTURER'S CERTIFICATES

A. If requested by Engineer, submit manufacturer's certificate with shop drawings certifying that products meet or exceed specified requirements executed by responsible officer.

1.11 MANUFACTURER'S FIELD SERVICES

A. Provide qualified representative to observe field conditions; conditions of surfaces and installation; quality of workmanship; start-up of equipment; and test, adjust, and balance of equipment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 41 00

STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. This Section includes testing and inspection requirements to comply with the special inspection requirements of the International Building Code Section 1704.
   2. The Owner will designate a special inspector and testing agency prior to Project award.

1.02 PRICE AND PAYMENT PROCEDURES

A. The Contractor shall pay for all testing described in the individual Technical Sections of the Contract Specifications.

B. The Owner will hire and pay for those inspection and testing services of the designated special inspector which are not specified to be the Contractor's responsibility.

1.03 SPECIAL INSPECTOR RESPONSIBILITIES

A. Observe the Work assigned for conformance with the approved Drawings and Specifications.

B. Submit inspection reports to the Building Official, the Engineer of Record, and the Owner.

C. Bring non-conforming items to the immediate attention of the Contractor for correction. If uncorrected, report non-conforming items to the Engineer of Record and the Building Official.

D. Submit a final signed report stating whether the Work requiring special inspection was to the best of their knowledge in conformance with the approved Drawings and Specifications and the applicable workmanship provision of the International Building Code.

1.04 TESTING AGENCY RESPONSIBILITIES

A. Test the Work assigned for conformance with the approved Drawings and Specifications.

B. Submit reports of the test results to the Building Official, the Engineer of Record, and the Owner.

C. Bring non-conforming items to the immediate attention of the Contractor for corrections. If uncorrected, report non-conforming items to the Engineer of Record and the Building Official.

D. Submit a final signed report stating whether the Work requiring special inspections was to the best of their knowledge in conformance with the Drawings and Specifications.

1.05 CONTRACTOR RESPONSIBILITIES

A. Post the Structural Tests and Special Inspections Schedule within the office at the Site.

B. Provide not less than 24-hour notification to the parties designated on the schedule for inspection and testing.

C. Provide the special inspector and testing agent access to the approved Drawings and Specifications at the Site.

D. Retain at the Site all reports submitted by the special inspector and testing agent.

E. Correct in a timely manner all deficiencies identified by the special inspector and testing agent.

F. Provide the special inspector and testing agent safe access to the Work requiring observation or testing.

1.06 FABRICATOR RESPONSIBILITIES

A. Submit a Certificate of Compliance to the Building Official and the Engineer of Record that all Work was performed in accordance with the approved Drawings and Specifications.

1.07 SPECIAL INSPECTION AND TESTING SCHEDULE – UPLAND AND BUILDINGS

A. Site Preparation
   1. Conform to Sections 31 20 00, 31 23 00 & 31 23 13.
   2. Geotechnical Engineer
      a. Inspect preparation/placement of fill soils.

B. Concrete Formwork
   1. Conform to Section 03 10 00.
   2. Special Inspector
      a. Inspect formwork prior to placing concrete.

C. Concrete Reinforcement
   1. Conform to Section 03 20 00.
   2. Special Inspector
      a. Inspect placement of reinforcing steel prior to placing concrete.

D. Reinforced Cast-In-Place Concrete
   1. Conform to Section 03 30 10.
   2. Special Inspector
      a. Inspect placement of concrete.
   3. Testing Agency
      a. Test concrete in accordance with Section 03 30 10. Payment for testing shall be as specified in Section 03 30 10.

E. Bolts Installed in Concrete
   1. Conform to Section 03 30 00 and 05 50 00.
   2. Special Inspector
      a. Inspect installation of bolts prior to placing concrete.

b. Inspect placement of concrete around bolts.

F. Precast Concrete
1. Conform to Section 32 13 14.
2. Special Inspector
a. Inspect installation of precast units.
b. Inspect installation of connections.
3. Fabricator
a. Submit certificate of compliance.

G. Structural Steel
1. Conform to Section 05 12 00.
2. Special Inspector
a. Verify AWS certification of all welders.
3. Testing Agency
a. Visually inspect field welding.
b. Perform radiographic testing of full penetration butt welds.
4. Fabricator
a. Submit certificate of compliance and verification of AWS certificates for all welders working on Project.
b. High Strength Bolting
1) Conform to Section 05 12 00.
2) Special Inspector
a) Inspect tension indicating device for high strength bolts.

1.08 SPECIAL INSPECTION AND TESTING SCHEDULE – BULKHEAD WALL

A. Piling
1. Conform to Section 35 42 13.19.
2. Independent Inspector
a. Piling - Full time inspection.
b. Verify pile material, size and length comply with Contract Documents.
c. Observe driving operations and maintain records for each pile.
d. Verify placement locations and plumbness, confirm size of hammer.

B. Concrete Formwork
1. Conform to Section 03 10 00.
2. Special Inspector
a. Inspect formwork prior to placing concrete.

C. Concrete Reinforcement
1. Conform to Section 03 20 00.
2. Special Inspector
a. Inspect placement of reinforcing steel prior to placing concrete.

D. Reinforced Cast-In-Place Concrete
1. Conform to Section 03 30 10.
2. Special Inspector
a. Inspect placement of concrete.
3. Testing Agency
a. Test concrete in accordance with Section 03 30 10. Payment for testing shall be as specified in Section 03 30 10.

E. Structural Steel
   1. Conform to Section 05 12 00.
   2. Special Inspector
      a. Verify AWS certification of all welders.
   3. Testing Agency
      a. Visually inspect field welding.
   4. Fabricator
      a. Submit certificate of compliance and verification of AWS certificates for all welders working on Project.
   5. High Strength Bolting
      a. Conform to Section 05 12 00.
      b. Special Inspector
         1) Inspect tension indicating device for high strength bolts.

F. Helical Anchors
   1. Independent testing agency.
   2. Date and time of installation.
   3. Name and model of installation equipment.
   4. Verify shaft connection details and termination cap.
   5. Verify shaft diameter, length, thickness, and number of extension sections.
   6. Record type of torque indicator used.
   7. Record installation torque for each anchor.
   8. Record installed length.
   9. Record installed angle of inclination.
   10. Note observations of obstacles encountered or installation inconsistencies.

PART 2 PRODUCTS

2.01 NOT USED.

PART 3 EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Temporary utilities and miscellaneous temporary facilities required during construction.

B. Products furnished but not installed under this Section or products installed but not furnished under this Section.

C. Related Sections
   1. Section 31 23 00 - Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Mobilization**. Measurement is Lump Sum. This will be considered payment in full for all work and costs of this Bid Item. The amount of the Lump Sum Bid shall not exceed **5 percent** of the Total Base Bid
      a. Partial payment of the Lump Sum Bid Item "Mobilization" will be made using a percentage based on the following:

	Cumulative Percent of Mobilization Item Paid
First Partial Payment	50
Percent of original contract amount earned – 25	70
Percent of original contract amount earned – 50	90
Percent of original contract amount earned – 100	100

   2. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT) and supplements.

B. The Wisconsin Manual on Uniform Traffic Control Devices – Latest edition.

C. Wisconsin Department of Transportation Traffic Engineering, Operations, and Safety Manual (TEOpS).

D. BNSF Railway Company "Guidelines for industrial Track Projects", August 2018.

1.04 SUBMITTALS

A. Construction Staging Plan consistent with Section 01 33 00, including the following information:
   1. Sequence of construction and traffic control.
   2. Streets closed or restricted during any stage of construction.
   3. Provisions for routing any detoured traffic as permitted.
   4. Specific signs, striping, and other traffic control devices to be utilized.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 MOBILIZATION

A. Move personnel, equipment, materials, and all other items required to complete the Work at the Site.

B. Establish Contractor offices, building, or other facilities necessary for Work on the Project.

C. Temporarily hold or relocate utilities and any miscellaneous structures, such as signs, power poles, guy wires, and mailboxes disturbed.

3.02 SIGNS, MAILBOXES, ETC. REMOVAL AND REPLACEMENT

A. Remove, store carefully, and replace all non-City or County owned signs, posts, etc. that may be within the Site as directed by Engineer. Owner will remove and replace Owner's signs.

B. Remove existing mailboxes and posts, and temporarily install in locations determined by Engineer or as shown on Drawings. Replace mailboxes prior to Substantial Completion. Removal, temporary reinstallation, and replacement shall occur such that mail delivery is not interrupted. Mailboxes, posts, and appurtenances damaged during construction shall be replaced with new at no charge to Owner.

3.03 TEMPORARY UTILITIES

A. Provide and maintain all temporary facilities, utilities, and controls as long as needed for the safe and proper completion of the Work. Remove all temporary facilities, utilities, and controls as rapidly as progress will permit or as directed by Engineer.

B. Temporary Water for Construction
   1. Use of new or existing hydrants is prohibited, except for testing and flushing of newly installed mains.
   2. Obtain water for construction from locations designated by the Owner.

C. Temporary Water Services
   1. Maintain temporary potable water service to the structures identified on the Drawings.

D. Temporary Sewer Services
   1. Maintain temporary sewer service to the structures identified on the Drawings.

E. Temporary Electricity
   1. Provide all necessary temporary electric service and temporary wiring needed for construction activities. Contractor shall pay for all temporary electricity.
   2. Contractor may use permanent electric service after service is installed. Contractor shall pay for all electrical usage until Substantial Completion. After Substantial Completion, Owner will pay for electricity.

F. Temporary Heating
   1. Provide and pay for temporary heating.
   2. Contractor may use permanent HVAC system after Substantial Completion. After Substantial Completion, Owner will pay for heat.

3.04 CONSTRUCTION FACILITIES

A. Sanitary Facilities
   1. Comply with all governing regulations, including safety and health codes, for sanitary fixtures and facilities.
   2. Provide self-contained toilet units, or water and sewer connected temporary toilet facilities, consistent with governing regulations. Contractor may not use Owner's toilet facilities.
   3. Provide and maintain adequate supply of toilet tissue, paper towels, paper cups, and similar disposable materials appropriate for each facility. Provide appropriate covered waste containers for used material.

3.05 TEMPORARY CONSTRUCTION

A. Bypass Pumping
   1. All sanitary flows shall be pumped around areas with no spillage allowed.
   2. Any spill needs to be reported as required by law.

B. Pumping and Dewatering
   1. Provide draining, pumping, dewatering, and cleaning operations necessary to complete the Work.
   2. Provide all necessary pumping to remove all surface water and groundwater from structures as required for the Work. Provide erosion control measures for discharge of water.
   3. Protect Site and adjacent property to avoid damage.

3.06 TEMPORARY BARRIERS AND ENCLOSURES

A. Temporary Barriers
   1. Provide temporary covers, enclosures, markers, and barriers as necessary to protect Work.
   2. Damage to the Site caused by removal of temporary fencing, including postholes, shall be promptly repaired by Contractor. During removal at no time shall the Work remain unattended if a dangerous condition exists because of incomplete removal or Site repairing.

3.07 CONTRACTOR'S OFFICE

A. Provide and maintain an office at the Site for the duration of the Project.

B. The office shall be of sufficient size and have adequate furnishings to provide a comfortable work environment for the Contractor and provide a 10-foot by 24-foot space with table and chairs for monthly progress meetings and other use.

C. Keep 1 complete set of Contract Documents, 1 copy of all approved shop drawings, and 1 complete set of up-to-date Record Drawings in the field office for use by the Engineer and Owner.

3.08 WORKING ON BNSF RIGHT OF WAY

A. Contractor must not at any time foul the main line tracks. A BNSF flagman will be required, at the Contractor's expense, when working within 25 feet from centerline of the track, which would include, but not limited to, work that could foul a track, such as with a large crane, excavation activities that could undermine a track, and overhead wire work which could potentially fall onto the track.

B. Contractor shall comply with Section 7, Requirements for Working on BNSF Right of Way of the BNSF Railway Company "Guidelines for industrial Track Projects", August 2018.

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 GENERAL

1.01 SECTION DESCRIPTION

A. This section describes providing, maintaining, repositioning, and removing temporary traffic control devices for the project.

1.02 PRICE AND PAYMENT PROCEEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Traffic Control**. Measurement will be as a single lump sum for the item acceptably completed as shown on the plans regardless of the number of set ups and removals or duration of closure throughout the entire project duration. The unit price for Traffic Control is full compensation for furnishing and maintaining signs and devices and for costs associated with traffic control required for the project.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT) and supplements.

B. The Wisconsin Manual on Uniform Traffic Control Devices – Latest edition.

C. Wisconsin Department of Transportation Traffic Engineering, Operations, and Safety Manual (TEOpS).

D. BNSF Railway Company "Guidelines for industrial Track Projects", August 2018.

1.04 SUBMITTALS

A. Traffic Management Plan consistent with Section 01 33 00, including the following information:
   1. Haul and access routes.
   2. Permits or applications required by local authorities.
   3. Temporary facilities required.

PART 2 PRODUCTS

2.01 GENERAL

A. Furnish materials and devices conforming to WisDOT Standard Specification 643.2.

PART 3 EXECUTION

3.01 GENERAL

A. Provide and maintain traffic control devices as specified in WisDOT Standard Specification 643.3 and in accordance with the plans.

3.02 NOTIFICATION

A. Contractor shall provide notification to the local municipality and emergency services divisions (police, fire, ambulance services) at least 10 days prior to the date Contractor plans to restrict traffic or close roadways.

3.03 TRAFFIC CONTROL

A. General
   1. The Contractor shall provide and maintain all traffic control devices in accordance with the approved Construction Staging Plan. All traffic control devices and other protective measures shall conform to WMUTCD.
   2. The Contractor will not be permitted to park vehicles as to obstruct a traffic control device. The parking of workers' vehicles will not be allowed within the Project limits, unless so approved by the Engineer.
   3. The Contractor will not be permitted to store materials or equipment within 30 feet of through traffic, unless approved by the Engineer. If materials or equipment must be stored within 30 feet of through traffic, the Contractor shall provide barricades or barriers, as directed by the Engineer, to warn and protect traffic.
   4. The Contractor shall conduct Work in a manner which will allow access to all properties within and adjacent to the Project by fire, police, and emergency vehicles.
   5. The Contractor is responsible to maintain all unpaved surfaces. The surface shall be watered and bladed as directed by the Engineer.

B. Construction Staging Plan
   1. Within 10 days following the approval of the Contract, the Contractor shall provide the Engineer with a Construction Staging Plan and a Traffic Management Plan. The Engineer may accept, reject, or suggest alterations to the plans. These plans shall reflect the following conditions:
      a. The Contractor shall provide a method of protecting traffic from open excavation areas.
      b. Minimum thru-lane lane widths of 10 feet will be maintained at all times.
      c. The Contractor may request changes to the Construction Staging Plan at any time. No change or deviation will be permitted without approval of the Engineer.
      d. Provide access for emergency vehicles and busses to all residences at all times.
      e. The Contractor will re-establish access to all driveways at the end of each day.
      f. For all traffic lane switches, interim pavement markings shall be installed in accordance with Part 6 of the Traffic Engineering Manual. There will be no direct compensation for interim pavement markings.
      g. The Contractor shall furnish, install, and maintain "ROAD WORK AHEAD" and "END ROAD WORK" signs in advance of and beyond each end of the construction limits. The Contractor shall also furnish, install, and maintain "ROAD WORK AHEAD" signs in advance of the construction limits on all intersecting roads and streets.
      h. The staging shall be undertaken to provide street access and local access to adjacent properties as directed by the Engineer. The Engineer may modify the requirements for traffic control as deemed necessary due to field conditions.

i. Contractor shall remove traffic control devices at the conclusion of the Work.

C. Vehicle Warning Light
1. All Contractors, subcontractors, and suppliers mobile equipment, which are working in the lane closure or within 15-feet of the lane closure, shall be equipped with operable warning lights which meet the appropriate requirements of the SAE Specifications. This would include any vehicle which enters the traveled roadway at any time. The SAE Specification requirements are as follows:
   a. 360-Degree Rotating Lights - SAE Specification J845.
   b. Flashing Lights - SAE Specification J595.
   c. Flashing Strobe Lights - SAE Specification J1318.

D. Temporary Lane Closures
1. Temporary Lane Closures shall conform to the following:
   a. A "short-term" lane closure or traffic restriction shall be one that is in-place only during the Contractor's work hours.
   b. Temporary "short-term" lane closures by the Contractor, consistent with time restrictions, will be permitted during those hours and at those locations approved by the Engineer. Requests for "short-term" lane closures shall be made at least 24-hours prior to such closures. The Contractor shall furnish, erect, and maintain all traffic control devices required for these closures. No direct compensation will be made for temporary lane closures.
   c. Application of traffic control devices shall be in accordance with the Field Manual.
   d. Lane closures will not be permitted during inclement weather, nor any other time when, in the opinion of the Engineer, the lane closures will be a hazard to traffic.
   e. When a temporary lane closure is used by the Contractor, the closure shall be incidental work and no direct compensation will be made therefore.

E. Traffic Control Devices
1. Daily inspect and insure that all traffic control devices required by the construction are in accordance with the WMUTCD. Any discrepancy between the actual devices in use and the required devices shall be immediately rectified. At least 1 nighttime inspection shall be made each week.
2. The Contractor shall complete the checklist attached to the end of this Section, each day of each week that traffic control devices for any overnight lane closure or detour are being used on the Project. The completed checklist shall be submitted each working day to the Engineer or the Engineer's designated representative at some mutually agreeable time.
3. The Contractor shall furnish qualified flagpersons to adequately control traffic when needed or as directed by the Engineer. Qualified flagpersons shall comply with the requirements set forth in the Flagging Handbook Section of the Field Manual. Flagpersons are required to protect construction vehicles during unloading of construction materials.
4. Furnish names, addresses, and phone numbers of at least 3 individuals responsible for the placement and maintenance of traffic control devices. At least 1 of these individuals shall be "on call" 24 hours per day, 7 days per week during the time any traffic control devices furnished and installed by the Contractor are in place.
5. Respond to any request from the Engineer to improve or correct the usage of traffic control devices on or related to this Project within 1 hour of the time of notification.
6. Keep all traffic control signs and devices in a legible condition. This shall include but not be limited to removing grime and dust deposited on any device by traffic, natural causes, or when requested by Engineer.

7. The Contractor shall store at least 10 extra Type 1 barricades with flashers, 5 extra Type III barricades, and 10 extra drums, at a convenient location within the Project limits for use in an emergency, as approved by the Engineer. No direct compensation will be made to the Contractor for furnishing and erecting these traffic control devices.

F. Failure to Complete the Work On Time
   1. The Contractor will be subject to an hourly charge for failure to maintain the traffic control devices. Non-compliance charges, for each incident, will be assessed at a rate of $250 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.
   2. The Contractor will be subject to an hourly charge for failure to remove temporary lane restrictions within the permitted hours, unless authorized by the Engineer. Non-compliance charges, for each incident, will be assessed at a rate of $500 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.

3.04 ADDITIONAL TRAFFIC CONTROL DEVICES

A. General
   1. In addition to the traffic control devices shown on the Traffic Control Layouts, the Engineer may require more traffic control as traffic conditions may warrant.
   2. The Contractor shall furnish the additional traffic control devices as ordered by the Engineer.
   3. The devices shall be installed and maintained in a functional and/or legible condition at all times, to the satisfaction of the Engineer.

3.05 WORKING ON BNSF RIGHT OF WAY

A. Contractor must not at any time foul the main line tracks. A BNSF flagman will be required, at the Contractor's expense, when working within 25 feet from centerline of the track, which would include, but not limited to, work that could foul a track, such as with a large crane, excavation activities that could undermine a track, and overhead wire work which could potentially fall onto the track.

B. Contractor shall comply with Section 7, Requirements for Working on BNSF Right of Way of the BNSF Railway Company “Guidelines for industrial Track Projects”, August 2018.

END OF SECTION

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Managing storm water runoff and other Project related water discharges to minimize sediment pollution during construction.

B. Related Sections
1. Section 31 23 00 – Excavation and Fill.
2. Section 32 92 00 – Turf and Grasses.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Bid Items have been provided for temporary measures to control soil erosion and sedimentation. Payment at the Bid Unit Price will be considered compensation in full for all Work necessary to complete the Bid Item in full, including installation, maintenance, sediment removal, repairs, and removals. 80-percent partial payment will be made upon installation and 20-percent payment will be made upon removal and restoration.
2. Measurement will be based upon the units as listed below. The actual quantity installed multiplied by the appropriate Bid Unit Price will be compensation in full for all Work and costs of the following Bid Items.
   a. **Temporary Sediment Basin**: Measurement will be by Lump Sum. Payment shall include compensation for maintaining excavated storage area, removal of accumulated sediment, and removal of temporary orifice restrictor upon final site stabilization.
   b. **Silt Fence**: Measurement will be per Lineal Foot, along the base of the fence, from outside to outside of the end posts for each section of fence.
   c. **Silt Curtain**: Measurement will be by linear foot installed.
   d. **Inlet Protection**: Measurement will be by Each, no matter the type.
   e. **Stone Tracking Pad**: Measurement will be by Each.
   f. **Erosion Matting**: Payment will be by type installed. Measurement will be by square yard.
   g. **Straw Bale Ditch Check**: Measurement will be by Each.
   h. **Interim Manufactured Perimeter Control**: Measurement will be by the linear foot.
   i. **5 Mil. Polyliner with 6 inch Crushed Washed Stone**: Measurement will be by the square yard.
   j. **Temporary Diversion Berm:** Measurement will be by linear foot installed.
3. Dust Control shall be incidental to the Project and included in the Total Base Bid.
4. Sediment Basin and Temporary Orifice Restrictor shall be incidental to the Project and included in the Total Base Bid.
5. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT) and supplements
   1. 623 – Dust Control Surface Treatment.
   2. 628 – Erosion Control.

B. Wisconsin Department of Natural Resources Storm Water Construction Technical Standards (DNR).

C. WDNR's WPDES General Stormwater Permit for Construction Activity.

1.04 SUBMITTALS

A. Contractor Prepared Schedules and Plans
   1. Erosion Control Schedule: Conforming to Wisconsin Administrative Code NR 216.46 and submitted each week that construction is active.
   2. Site Management Plans in conformance with Wisconsin Administrative Code 216.41 and Chapter NR 151.
      a. Submitted when requested by the Engineer.
      b. Site plans prepared by Contractor will indicate Contractor operations, erosion and sediment control measures, and a schedule of starting and completion times.

B. Certification and Sampling
   1. Furnish a manufacturer's certification stating that the erosion and sediment control materials supplied conforms to the requirements of this Section. The certification shall include or have attached typical results of tests for the specified properties, representative of the materials supplied.

1.05 QUALITY ASSURANCE

A. Erosion Control Supervisor: Provide an Erosion Control Supervisor to direct the erosion control operations and ensure compliance with Federal, State, and Local ordinances and regulations.

1.06 PERMITS

A. Adhere to the WDNR's General Stormwater Permit for Construction Activity.

1.07 SEQUENCING AND SCHEDULING

A. Install sediment control measures prior to grading activities.

B. Schedule and coordinate the Work so that permanent erosion and sediment control BMPs, such as basin construction, rip rap placement, and permanent seeding, are directly incorporated into the supplement permanent erosion and sediment control BMPs with temporary BMPs. Place temporary BMPs when permanent erosion control cannot be achieved. Coordinate construction operations so that erosion and sediment control measures (permanent or temporary) are installed and maintained concurrently with the rest of the Work of the Project.

C. Coordinate and schedule the Work of subcontractors such that erosion and sediment control measures are fully executed for each operation and in a timely manner over the duration of the Project. Develop a chain of responsibility for all subcontractors and operators on the Project to ensure that permit provisions are adhered to.

D. Stabilization timeframes shall conform to the NPDES General Stormwater Permit for Construction Activity.

E. Prior to Project shutdown for the winter or other periods of a week or more, the Site shall be adequately protected from erosion and off-Site damage by covering exposed soils with mulch and establishing perimeter controls.

F. If the Contractor fails to install erosion or sediment measures, the Engineer may withhold payment from related work until the control measures are undertaken by the Contractor
   1. When the Contractor fails to conduct the quality control program, does not conduct the inspection required in the NPDES permit, or fails to take action ordered by the Engineer to remedy erosion or sediment control problems, the Engineer shall issue a Written Order to the Contractor.
   2. The Contractor shall respond within 24 hours with sufficient personnel, equipment, materials, and conduct the required Work or be subject to a $1,000 per calendar day deduction for noncompliance.

G. Establish permanent turf in accordance with Section 32 92 00 to prevent excessive soil erosion.

PART 2 PRODUCTS

2.01 SILT FENCE

A. Conform to WDNR Technical Standard 1056.

B. Conform to WisDOT Spec. 628.2.6.

2.02 STONE TRACKING PAD

A. Conform to WisDOT Spec. 628.2.14.

B. Conform to WDNR Technical Standard 1057.

2.03 MULCH MATERIAL:

A. Conform to WDNR Technical Standard 1058.

B. Conform to WisDOT Spec. 628.2.11.

C. Hydraulic soil stabilizer may be used in lieu of mulch with the approval of the Engineer.

2.04 HYDRAULIC EROSION CONTROL PRODUCTS

A. Conform to WDNR Technical Standard 1050.

B. Conform to WisDOT Spec. 628.2.11.

2.05 EROSION MATTING

A. Channel: Conform to WDNR Technical Standard 1053.

B. Non-Channel: Conform to WDNR Technical Standard 1052.

C. Conform to WIsDOT Spec. 628.2.2: Class 1, Type B Matting.

2.06 STORM DRAIN INLET PROTECTION

A. Conform to WDNR Technical Standard 1060.

B. Inlet protection for paved streets with concrete curb and gutter: The following methods are acceptable:
   1. Conform to the details on the Drawings.
   2. Catch Basin Inserts:
      a. Road Drain by Wimco, LLC (www.roaddrain.com).
      b. Lange Industries (www.langeindustries.com) or approved equal.
      c. Filter bag insert conforming to DNR No. 1060 subject to Site and approved by the Engineer [Sometimes they need to be used but avoid if feasible].
   3. Rock Bags:
      a. Conform to WisDOT Spec. 628.2.13.

C. Inlet protection for non-paved surfaces without curb or areas where vegetation will be established. The following methods are acceptable:
   1. Conform to the details on the Drawings.
   2. Silt fence ring, or approved equal:
      a. Place wire mesh cage in a circular or square confirmation to form a minimum 5-foot diameter zone of protection.
      b. Geotextile shall be monofilament/monofilament meeting the requirements of WisDOT Spec. Heavy Duty.
      c. Loose aggregate or a rock log(s) around perimeter of ring to anchor geotextile.
   3. Sediment control inlet hat conforming to WisDOT Spec. 628.3.13:
      a. InfraSafe Sediment Control Barrier by Royal Enterprises (http://www.royalenterprises.net/).

2.07 SILT CURTAIN

A. Conform to WDNR Technical Standards 1070.

2.08 DITCH CHECKS

A. Conforming to WDNR Technical Standard 1062.

2.09 DUST CONTROL

A. Water clear and free from suspended fine sediment.

B. The Owner may elect to have the Contractor apply a chloride solution for dust control
   1. Calcium Chloride: Conform to WisDOT Spec. 623.
   2. Magnesium Chloride Solution: Conform to WisDOT Spec. 623.

2.10 TEMPORARY SEED

A. Conform to Section 32 92 00.

B. General – Sizing, configuration, capacity, and selection of dewatering sediment capture techniques shall be based on Site and flow conditions. The Contractor shall submit the means and methods for review by the Engineer. Sizing of the sediment capture systems will have to be adjusted such that the ultimate discharge water is not visibly different from the receiving water.

2.11 FLOCCULANTS: CONFORM TO WDNR SPEC. 1051.

PART 3 EXECUTION

3.01 GENERAL

A. Comply with all applicable laws, ordinances, regulations, permit requirements, orders and decrees pertaining to erosion/sediment control and stormwater discharge during the conduct of the Work.

B. Take necessary precautions against damage to the Project by action of the elements.

C. Implement the Project's NPDES Stormwater Pollution Prevention Plan (SWPPP) and take necessary actions to prevent off Site damage resulting from Work conducted on the Project or Project related stormwater runoff.

D. Minimize the amount of disturbed land that is susceptible to erosion at any time. Delineate areas not to be disturbed
   1. Exclude vehicles and construction equipment from area not to be disturbed to preserve natural vegetation.
   2. Maintain and preserve riparian and naturally vegetated buffer strips (10 feet minimum distance) along water courses.

3.02 INSTALLATION

A. General: Install temporary stormwater management and sediment control devices in conformance with the details, typical sections, and elevations shown on the Drawings.

B. The location of temporary stormwater and sediment control devices may be adjusted from that shown on the Drawings to accommodate actual field conditions and increase the effectiveness of the installation.

C. Temporary Orifice Restrictor for Temporary Sediment Basin: Conform to Plan Detail.

D. Silt Fence: Conform to WisDOT Spec. 628.3.4
   1. Install in the locations shown on the Drawings using the machine sliced installation method, unless directed otherwise by the Engineer.
   2. Use additional measures, such as rock aggregate, placed along the base of the silt fence where the silt fence geotextile cannot be trenched in, i.e. tree roots, frost, bedrock.
   3. Use short sections of silt fence placed in J-hook patterns to
      a. Supplement the perimeter silt fence at corner locations and areas where sediment deposition will occur. No more than 100 feet of silt fence shall be installed per 1/4-acre of drainage.

   b. Break up flow path along silt fence running across contours to be no more than 100-feet between hooks or as directed by the Engineer.
4. Silt fence longer than 600-feet shall be constructed in separate independent units with each unit having a length less than 600-feet. Avoid splices whenever possible. If necessary, make splices at an opposing fence post and according to the manufacturer's specifications.

E. Stone Tracking Pad: Conform to WisDOT Spec. 628.3.16.
1. Install at locations shown on the Drawings.
2. Construct construction entrance before grading begins on the Site.
3. Inspect construction entrance daily for mud accumulation to minimize vehicle tracking of sediment onto public roadways. Remove fugitive rock or wood mulch from adjacent roadways daily.

F. Mulching: Conform to WisDOT Spec. 628.3.12
1. For seeded Sites, apply at a rate of 2 tons per acre (4,500 kg/ha).
2. For unseeded Sites, apply at a rate of 2 to 3 tons per acre (4,500 to 6,700 kg/ha), covering the entire soil surface.
3. Distribute mulch evenly by hand or machine and cover the exposed area to a uniform depth.
4. Disk anchor in conformance to DNR No. 1058.
5. Anchor mulch immediately to minimize loss by wind or water.

G. Hydraulic Erosion Control Products: Conform to WDNR Tech. Standard 1050.
1. Raking or harrowing of soil/seed and slope (cat) tracking shall be done before installation of hydromulch.
2. Apply hydromulch in at least 2 opposing directions so that a shadowing effect leaving the back side of a soil clod unprotected is minimized.
3. Type Hydraulic Mulch
   a. Application Rate for Slopes greater than 1:4: 2,800 lbs per acre. 2 applications may be necessary. All other slopes apply at a rate of 2,100 lbs per acre.
4. Type Bonded Fiber Matrix (BFM)
   a. Application Rate for Slopes less than 1:3: 3,000 lbs per acre.
   b. Application Rate for Slopes between 1:3 and 1:2: 3,500 lbs per acre. 2 applications shall be necessary.
   c. Application Rate for Slopes greater than 1:2: 4,500 lbs per acre. 2 applications shall be necessary.

H. Slope (Cat) Tracking
1. Slope tracking consists of operating a dozer up and down slopes so that the cleats of the tracks create grooves perpendicular to the slope. By operating the dozer up and down, the soil surface is firmed and miniature interceptor checks are created.
2. Required on all slopes equal to or steeper than 3:1 (H:V).

I. Erosion Matting: Conform to WisDOT Spec. 628.3.2.
1. Install immediately following seeding in accordance with WisDOT Spec. 628. and as modified below.
2. Install as shown on Drawings.
3. Raking or harrowing of soil/seed shall be done before installation of erosion control blanket.
4. Install blanket parallel to the direction of flow.

5. If permanent seeding is not available at the time of blanket installation, this material will have to be removed, re-seeded, and installed again as a permanent erosion control measure. If permanent seeding is available at the time of initial installation, a one-time proper installation is acceptable.

J. Storm Drain Inlet Protection: Conform to WisDOT Spec. 628.3.13.
   1. Provide effective storm drain inlet protection over the life of the Project until all sources with potential for discharging to inlets have been paved or stabilized.
   2. Place devices so that driving hazards or obstructions are not created. The devices must be cleaned out regularly and all devices must have an emergency overflow to reduce flooding potential.

K. Temporary Sediment Basins: Conform to WDNR Tech. Standard 1064.
   1. Sediment basins shall be excavated as a first priority when grading begins on the Project. The location and outlet configuration are shown on the Drawings.

L. Temporary Sediment Traps: Conform to WDNR Tech. Standard 1063.
   1. Temporary sediment traps are excavated in conjunction with other grading activities. Temporary traps are approximately 2-feet or less in depth with a length to width ratio of 2:4.
   2. Effectiveness of sediment traps can be increased by placing a rock weeper at the outlet.

M. Temporary Diversion Berm: Conform to WDNR Tech. Standard 1066.
   1. Temporary diversion berm shall be installed at locations shown on the Drawings. The berm shall be located to minimize damage by construction operations and traffic.
   2. Temporary diversion berm shall be installed as a first step in the land-disturbing activity and must be functional prior or in conjunction with upslope land disturbance.
   3. The berm shall be adequately compacted to prevent failure.
   4. Temporary or permanent seeding and mulch shall be applied to the berm immediately following its construction.

N. Temporary Slope Drains
   1. When temporary down drains are placed on fill slopes, a temporary earth berm or sandbag barrier shall be constructed as necessary to guide water into the drain.
   2. The inlet of a drain and berm system must be properly constructed to channel water into the temporary drain.
   3. All temporary drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing into the drain.
      a. If the drain consists of plastic pipe, it must be securely anchored to the ground.

O. Silt Curtain: Conform to WDNR Tech. Standard 1070.
   1. Floatation silt curtain shall be installed in locations shown on the Drawings and according to the manufacturer's specifications.
      a. Anchor" and secured to prevent any material from passing beneath, over, around, or through the barrier.
      b. Provide sufficient slack to permit the curtain to rise to the maximum expected high water level, including wave action, without being overtopped and still be in continuous contact with the bottom.
   2. Place floatation silt curtain as close to the shoreline or work area as possible. Flotation silt curtain shall not be placed across flowing rivers, streams, drainage ditches, or across culvert inlets or outlets.

3.03 MAINTENANCE

A. Conform to WisDOT Spec. 628.3, NPDES permit, and as follows:
   1. Inspect, maintain, and repair any washouts or accumulations of sediment that occur as a result of the grading or construction. Restoration consists of grade repair, turf re-establishment, and street sweeping of mud and debris tracked from the Site.
   2. Inspection of all erosion and sediment control items will take place immediately after each runoff event and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
   3. The Contractor shall maintain the temporary sediment control devices until they are no longer necessary and are removed:
      a. Maintenance consists of keeping the devices functioning properly.
      b. The Contractor shall repair or replace plugged, torn, displaced, damaged, or non-functioning devices.
   4. Upon final acceptance of the Project and establishment of permanent erosion control measures, the Contractor shall remove all temporary erosion control measures.
   5. Temporary mulching and temporary seeding/mulching are very effective at controlling erosion. However, these are considered temporary measures. These measures may need to be re-established several times throughout the duration of the Work.
   6. Floatation silt curtain shall remain in place until such time that water contained within is free from turbidity:
      a. The curtain shall be removed within 72 hours after this determination has been made.
      b. At the completion of the Project, the floatation silt curtain shall be removed in such a manner so as to minimize release of sediment adhering to the turbidity curtain.
   7. If an erosion control device has been reduced in capacity by 30-percent or more, the Contractor shall restore such features to their original condition.
   8. Control dust blowing and movement on Site and roads as directed by Engineer to prevent exposure of soil surfaces, to reduce on and off-site damage, to prevent health hazards, and to improve traffic safety.

B. Temporary Sediment Basin shall be maintained according to WDNR Technical Standard 1064.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Basic requirements for products used in the Work.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 SUBMITTALS

A. Submit the following items consistent with Instructions to Bidders:
   1. Written request for approval with supporting documentation.

B. Submit the following items consistent with Section 01 33 00 and General Specifications:
   1. Shop drawings for named products and "or-equal" products.
   2. Written application for substitute items, including supporting documentation.

1.04 PRODUCT SUBSTITUTIONS AND "OR-EQUAL" PROCEDURES

A. Procedures During Bidding
   1. Conform to the requirements of the Instructions to Bidders.

B. Procedures During Construction
   1. Scheduling of Submittals: Conform to the Contractor's Schedule of Submittals.
   2. Submittal Procedures: Conform to the requirements of Section 01 33 00.
   3. Items not approved as "or-equal" may be resubmitted as a Substitute Item.
   4. Engineer will review Substitute Item requests that conform to General Specifications and the following additional supporting documentation:
      a. Drawings and Specifications.
      b. Installation lists.
      c. Performance data, including equipment capacity, strengths, weights, and dimensions.
      d. Catalog cut-sheets.
      e. Lists of deviations from and exceptions to the Specifications.
      f. Detailed information for all buy-out items, including motors and drives.
      g. Lists of materials of construction.
      h. Maintenance schedules of equipment, including buy-out items.
      i. Other information deemed necessary at the discretion of Engineer.
   5. Incomplete submittals will be returned to Contractor without review.
   6. Contract times will not be modified due to substitute and "or-equal" review process.
   7. Engineer shall not have to prove that an item is not an "or-equal."
   8. Owner does not have to accept proposed Substitute Items.

1.05 SUBTITUTE ITEMS

A. Procedures During Bidding
   1. Conform to the requirements of the Instructions to Bidders.

B. Procedures During Construction
   1. Alternate material or equipment items accepted by the Owner and included in the award of Contract become named materials or equipment.
   2. Submit shop drawings and material certifications consistent with Section 01 33 00.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 DELIVERY

A. Transport and handle products in accordance with the manufacturer's instructions.

B. Handle and lift products only at designated lift points and by methods to avoid soiling, disfigurement, bending, over stressing, and damage.

C. Store products on shelves, in bins, or in neat groups of like items with seals and labels intact and legible, and in a manner to provide access for maintenance and inspection.

D. Store loose granular materials on clean, solid, flat surfaces, and prevent mixing with foreign matter. Store fabricated products supported above the ground on skids or blocking. Provide surface drainage to prevent erosion and ponding of water.

E. Cover products subject to discoloration or deterioration with impervious sheet covering and protect products from soiling and staining.

F. Store and protect products which are subject to damage by the elements in weathertight, climate-controlled enclosures, and according to the manufacturer's instructions. Maintain temperature, ventilation, and humidity within ranges stated in the manufacturer's instructions.

G. Attach applicable manufacturer's service instructions labeled "STORAGE SERVICE INSTRUCTIONS ENCLOSED" to exterior of each stored product.

H. Inspect, maintain, and service stored products on a regularly scheduled basis, consistent with the manufacturer's instructions.

I. Record inspection, maintenance, services performed, and keep log available for review.

J. Traffic control required for all deliveries to and from the Site shall be the responsibility of the Contractor. All flagmen, barricades, flares, and safety measures are the sole responsibility of the Contractor.

3.02 STORAGE AND HANDLING

A. Protect from damage all materials and equipment to be used in the completed facility.

B. Provide temporary Site security fencing around storage areas and as indicated on the Drawings.

C. The Contractor shall provide the Owner and Engineer with keys or combinations to any locks that may be used to secure fencing gates.

D. Storage areas and hazardous areas shall be protected by use of chain link fence around the perimeter of the area. This fencing is in addition to any other fencing required for Site containment.

3.03 OWNER SUPPLIED PRODUCTS

A. The Contractor shall be responsible for removal, protection, storage, delivery, and installation of all Owner furnished equipment or materials, unless otherwise specified.

B. The Contractor shall be required to make all modifications to structures, equipment, and power to provide a complete and working installation of the Owner furnished products.

C. The Contractor shall provide any materials or equipment required for the installation of the Owner supplied products, including but not limited to electric wire and conduit, pipes, anchors, and supports.

D. The Contractor shall be responsible for inspection of any existing Owner furnished products to verify characteristics prior to Bidding.

E. Install Owner furnished equipment in accordance with manufacturer's recommendations and as specified in other Sections.

F. All costs associated with the complete installation of Owner furnished equipment shall be considered incidental to the Project, unless otherwise specified.

END OF SECTION

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SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Requirements for overall execution of the Work and closeout of the Contract for Final Payment.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 SUBMITTALS

A. Submit the following items consistent with the Conditions of the Contract and Division 01 Sections:
   1. Record Documents.
   2. Written Notification of Substantial Completion.
   3. Executed Certificate of Substantial Completion.
   4. Written Notification of Final Completion.
   5. Spare Parts, Operation and Maintenance Manuals, instructions, schedules, warranties, guarantees, Bonds, certificates, certificates of inspection, and other documents.
   6. Final Application for Payment, including accompanying documentation.
   7. Federal W-2 from.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Acceptance of Conditions: By commencing Work, Contractor construes acceptance of the adjacent work as satisfactory to receive subsequent work.

B. Existing Conditions: Before commencing Work, inspect work completed by others that is adjacent to Work. If adjacent conditions prevent completion of Work, Contractor will not commence Work until the conditions are corrected.

C. Inspect each product immediately prior to installation. Remove damaged products from Site.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Comply with the manufacturer's instructions for installation of manufactured products to the extent that these instructions are applicable and more explicit or more stringent than requirements indicated in the Contract Documents.

B. Secure Work true to line and level, within recognized industry tolerances, with anchorage devices designed and sized to withstand stresses, vibration, and rocking. Allow for expansion and movement of building.

C. Install each element of work during weather conditions and Project status to ensure coordination of the Work. Isolate each element of work from incompatible work as necessary to prevent deterioration.

D. Coordinate space requirements and installation of mechanical and electrical work indicated on Drawings. Follow routing shown for pipes, ducts, and conduit; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs.

E. Mount individual units of work at industry recognized standard-mounting heights for the particular application indicated, where mounting heights are not indicated.

F. Conceal pipes, ducts, and wiring within the construction in finished areas, except as otherwise indicated. Coordinate locations of fixtures and outlets with finish elements.

G. Record installation details and prepare Record Documents consistent with the General Specifications.

3.03 EQUIPMENT VARIATIONS

A. Contractors are advised that because of manufacturer's variations in equipment design changes from Drawings in piping arrangement and layout, electrical and control from Drawings in piping arrangement and layout, electrical and control circuitry, and related dimensions of equipment foundation and anchorage details, may be required for equipment installations.

B. Equipment requiring minor deviations in the system layout, such as minor piping revisions, will be acceptable; however, the Contractor shall include all costs associated with the deviation in their Bid. Should the deviation require revisions in the design of the facility, the Contractor shall reimburse the Owner for the cost of any redesign.

C. Electrical and mechanical piping, conduits, and ducts are shown schematically and shall be located by the Contractor to avoid any conflicts. Contractor shall coordinate work of all subcontractors and make minor relocations as necessary at no change to the Contract Price.

3.04 SITE MAINTENANCE

A. Maintain stockpiles, excavations, access roads, and all other work areas free from dust. Employ dust abatement techniques whenever a dust nuisance or hazard occurs, or as directed by Engineer. Comply with local ordinances.

B. Protect hazardous work areas and hazardous material storage areas.

C. Protect trees, unless specifically indicated on Drawings.

D. Clean access roads and haul routes with mechanical street sweeper.

E. If Contractor fails to maintain Site, Engineer will provide Written Notice of Contractor's defective Work. Contractor will be given 12 hours from the Notice to clean Site. After the 12-hour period, Owner may correct the defective Work at the expense of the Contractor.

3.05 CLEANING AND PROTECTION

A. Clean and protect Work in progress and adjoining Work during handling and installation. Apply protective covering on installed Work where it is required to ensure freedom from damage or deterioration.

B. Clean and perform maintenance as frequently as necessary throughout construction period. Adjust and lubricate operable components to ensure operability without damage effects.

3.06 FINAL CLEANING

A. Wash and polish all glass surfaces.

B. Dust, vacuum, wash, and clean all spaces, duct work, light fixtures, equipment, electrical work, and all other components of the Work. Remove all stains, dust, and dirt.

C. Wash, clean, and sterilize plumbing fixtures.

D. Replace burned out lamps. Replace all HVAC filters.

3.07 CUTTING AND PATCHING

A. Complete all cutting, fitting, and patching as necessary to join the new Work to existing conditions.

B. Remove or cut existing work only as necessary to join the new work to the existing construction or as required by the Contract Documents.

C. Patch defective and incomplete surfaces caused or exposed by Work of the Project.

D. Repair any damage to existing conditions and patch to match.

E. Existing construction designated by the Contract Documents to remain that is loosened, cracked, or otherwise damaged or defaced beyond repair as a result of Work by the Contractor will be considered unsuitable for the use intended and shall be removed and replaced by the Contractor.

3.08 SPECIAL TOOLS

A. Provide any special tools, jigs, fixtures, and lifting tackle which are necessary for assembly, erection, operation, maintenance, and repair of equipment.

B. Special tools and devices are those the design, purpose, and use of which are peculiar to the equipment furnished and which are not available from normal wholesale or retail outlets. Standard general-purpose tools are not included in this requirement.

C. Provide neat and substantial metal toolbox with hinged cover and lifting handles or metal cabinet with hinged door.

3.09 SPARE PARTS

A. Required spare parts are listed under the individual Specification Sections.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. General procedures and requirements for Operation and Maintenance Manuals.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 SEQUENCING AND SCHEDULING

A. Schedule submittals consistent with Contractor's schedule of submittals.

B. Operation and Maintenance Manuals must be approved before placing equipment into operation.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Submit 1 preliminary set of Operation and Maintenance Manuals for review by the Engineer. Engineer will review and return to the Contractor this set marked "Reviewed," "Reviewed as Noted," or "Revise and Resubmit" consistent with Section 01 33 00. After the Operation and Maintenance Manuals have been corrected, submit 3 final sets.

B. Submit 3 approved and final sets of detailed equipment drawings and explicit instructions on the operation and maintenance of each piece of equipment furnished on the Project.

3.02 OPERATION AND MAINTENANCE MANUALS

A. Manuals are required for all equipment, accessories, devices, etc. that require adjustment, maintenance, operation, or repairs by the Owner's personnel, including driver, motors, controls, etc. All information shall be supplied by the appropriate equipment manufacturers, neatly bound in rigid cover ring type binders by the Contractor, and properly indexed. Manuals shall include record shop drawings and copies of factory certified tests. Each manual shall contain the following information where applicable:
   1. Operation and Maintenance Manuals shall be clearly identified as operation and maintenance submittal.
   2. All performance and design characteristics and unit identification, such as model and serial numbers.

3. All accessories or options furnished with unit.
4. Complete instruction on lubrication, testing, balancing, etc.
5. List of recommended lubricants.
6. Step-by-step instructions for repair or overhaul.
7. Parts list and parts diagram.
8. Wiring diagrams.
9. Copy of approved/revised shop drawings.
10. Listing of spare parts the Owner should keep on hand as recommended by the manufacturer.
11. Name and phone number of supplier where repair parts or additional information can be obtained.

B. Each manual shall be specifically for the items actually installed. Where manuals show a number of models or options, the manual shall be clearly marked to indicate what was furnished and which instructions apply to the furnished unit.

C. Superfluous information pertaining to other models, options, etc. not furnished shall be clearly crossed out or otherwise eliminated. Failure to meet this Section of the Specifications will result in payment reduction.

END OF SECTION

SECTION 01 78 36

WARRANTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Warranties for the Work of this Project.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measure and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 SUBMITTALS

A. Bind in commercial quality, 8.5 by 11-inches, 3-ring side binders with hardback, cleanable, plastic covers.

B. Table of Contents: Provide neatly typed, Table of Contents matching that of the Project Specifications with each item identified with the number and title of the Specification Section in which specified and the name of the product or work item.

C. Label cover of each binder with typed or printed title "WARRANTIES" with title of Project; name, address, and telephone number of Contractor and equipment supplier; and name of responsible principal.

D. Separate each warranty keyed to the Table of Contents listing. Provide full information using separate typed sheets as necessary. List subcontractor, supplier, and manufacturer with name, address, and telephone number of responsible principal.

1.04 PREPARATION OF WARRANTIES

A. Obtain warranties executed in duplicate by responsible subcontractors and suppliers within 10 days of completion of the application item or Work. Leave date of beginning of time of warranty blank until the Date of Substantial Completion is determined.

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

C. Co-execute submittals when required.

D. Retain warranties until delivery time indicated below.

1.05 DELIVERY

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

B. Within 10 days after Engineer's declared and written confirmation of the Date of Substantial Completion.

C. For items of Work when acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

1.06 LENGTH OF WARRANTY

A. Minimum length of all equipment warranties shall extend through the Correction Period.

B. Length of Warranties: Conform to the requirements of the Specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02 41 13

SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Complete or partial removal and disposal or salvage of at grade, above grade, and below grade structures and miscellaneous items.

B. Related Sections
1. Section 31 23 00 – Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Bid Items have been provided for demolition and removal items. Payment at the Bid Unit Price will be considered compensation in full for all Work necessary to complete the Bid Item in full, including removal, salvage, storage, and disposal.
2. Measurement will be based upon the units as listed below for items removed, abandoned, or salvaged complete as specified. No measurement will be made of any removals that are not required. The actual quantity removed multiplied by the appropriate Bid Unit Price will be compensation in full for all Work and costs of the following Bid Items:
   a. **Underwater Driveline Clearing**: Lineal Foot.
   b. **Remove Abandoned Petroleum Line, 8-inch**: Lineal Foot.
   c. **Remove Asphaltic Surface**: Per square yard without regard to thickness, including integral bituminous curb.
   d. **Remove Concrete Curb and Gutter**: Per lineal foot, no matter the type.
   e. **Remove Retaining Wall**: Per lineal foot, measured at ground level, not matter the height.
      1) Note: it shall be the responsibility of the Bidder to evaluate the existing retaining walls on site, prior to bidding.
   f. Removal of fencing will be incidental.
   g. Saw cutting will be incidental.
   h. Bulkheading and abandoning of existing pipe will be incidental.
   i. Salvage and reinstallation of signs and mailboxes will be incidental.
3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
1. 204 – Removing or Abandoning Miscellaneous Structures.

1.04 DEFINITIONS

A. Remove: To take away or eliminate from the Site by any method selected by the Contractor, including disposal of material.

B. Salvage: To dismantle, disassemble, or remove carefully without damage so the item can be re-assembled, replaced, or reused in a workable condition equal to that existing before removal.

C. Abandon: To fill, bulkhead, or close off pipes and structures so that no settlement or flow can occur.

1.05 REGULATORY REQUIREMENTS

A. Conform to WisDOT Spec. 204.3.1.3, with the following modifications:
   1. Dispose of all materials designated for removal outside the Site at locations selected by Contractor.
   2. Stockpile or temporarily store materials designated for salvage at locations provided by Contractor.

1.06 SCHEDULING

A. Prior to starting Work, submit for review by the Engineer and approval by the Owner, a schedule showing the commencement, order, and completion dates of the various parts of this Work.

B. Fill holes or depressions resulting from removal or salvage immediately.

C. Provide temporary surface restoration for traffic continuity where removal or salvage operations are completed within streets, driveways, or parking lots.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 GENERAL

A. Dispose of all items removed, except for those items identified to be salvaged or recycled. Said disposal shall be in accordance with all laws, regulations, statutes, etc.

B. Perform removal work without damage to adjacent retained work. Where such Work is damaged, the Contractor shall patch, repair, or otherwise restore same to its original condition at no expense to the Owner.

C. Remove debris from the work area as often as necessary, but not less than at least once at the end of each workday. Debris shall be placed in approved containers to prevent the spread of dust and dirt.

D. Execute the Work in a careful and orderly manner with the least possible disturbance to the public and occupants of buildings.

E. Fill holes resulting from removals consistent with Section 31 23 00.

3.02 EXAMINATION

A. Meet with owners of signs to determine requirements for salvage, storage, and replacement.

3.03 PROTECTION

A. Take all necessary precautions to adequately protect personnel and public and private property in the areas of Work. All Site fencing shall be in place prior to the start of any removal work.

B. All street signs, traffic control signs, guy wires, mailboxes, posts, wood fence, etc. which may interfere with construction shall be removed, stored safely, and replaced.

C. Approved barriers or warning signs shall be provided as necessary.

D. Provide and maintain temporary protection of existing structures designated to remain where removal work is being done, connections made, materials handled, or equipment moved.

E. Do not close or obstruct walkways or roadways. Do not store or place materials in passageways or other means of egress. Conduct operations with minimum traffic interference.

F. Take reasonable precautions to limit damage to existing turf.

G. Holes or depressions created by removals shall not be left open for more than 1 day. Any hole within 10 feet of sidewalks shall be filled, suitably marked, or covered immediately.

H. Avoid disturbance to any material beyond the limits required for new construction.

3.04 SAWING PAVEMENT

A. Concrete Pavement: Saw along the removal line to a depth of 1/3 of the thickness of the concrete prior to breaking off the pavement.

B. Bituminous Pavement: Saw along the removal line to a minimum depth of 3 inches prior to breaking off the pavement.

3.05 REMOVE CONCRETE PAVEMENT

A. Remove in accordance with WisDOT Spec. 204.3.2.2, except as modified below:
   1. Saw cut concrete pavement and concrete base prior to mechanical pavement removal equipment. Remove concrete in such a manner that the remaining pavement is not damaged.
   2. Prior to restoring trench areas, the edges of the trench shall be trimmed back to a vertical face on a straight line which is parallel with the centerline of the trench.

3.06 REMOVE BITUMINOUS PAVEMENT, PATH, DRIVEWAY

A. Remove in accordance with WisDOT Spec. 204.3.2.2, except as modified below:
   1. Saw cut bituminous pavement at the removal limits prior to that removal, unless otherwise approved by the Engineer.
   2. Prior to restoring trench areas, the edges of the trench shall be trimmed back to a vertical face on a straight line which is parallel with the centerline of the trench.

3.07 REMOVE CURB AND GUTTER

A. Saw cut at removal limits.

B. Concrete Curb and Concrete Curb and Gutter: Do not disturb any material beyond the limits required to form for new construction (assumed 12-inches maximum from the back of new work and 6-inches beyond the edge of new driveways).

3.08 REMOVE CONCRETE SURFACING

A. Work includes sidewalks, pedestrian ramps, medians, and driveways.

B. Saw cut concrete surfacing prior to removal.

C. Remove concrete in such a manner that the remaining surfacing is not damaged.

D. When removing existing sidewalks, the Contractor shall not disturb any material beyond the limits required for new construction (assumed as 6-inches maximum beyond and 8-inches maximum below existing grade).

E. When removing existing driveways, the Contractor shall not disturb any material beyond the limits required to form for new construction (assumed 12-inches maximum from the back of new Work and 6-inches beyond the edge of new driveways).

F. Prior to restoring trench areas, the edges of the trench shall be trimmed back to a vertical face on a straight line which is parallel with the centerline of the trench.

3.09 REMOVE BITUMINOUS SURFACING

A. Work includes pathways and driveways.

B. Saw cut bituminous surfacing to full depth at the limits of partial removal prior to that removal, unless otherwise approved by the Engineer.

C. Remove bituminous in such a manner that the remaining surfacing is not damaged.

D. Prior to restoring trench areas, the edges of the trench shall be trimmed back to a vertical face on a straight line which is parallel with the centerline of the trench.

E. When removing existing pathways and driveways, the Contractor shall not disturb any material beyond the limits required to form for new construction (assumed 12-inches maximum from the back of new work and 6 inches beyond the edge of new driveways).

3.10 REMOVE RETAINING WALL

A. Avoid damage to sections of wall to remain.

B. Dispose of materials off Site at a predetermined location.

C. Remove wall in its entirety, including footings and tiebacks.

3.11 UNDERWATER DRIVELINE CLEARING

A. The contractor shall complete a pre-construction sonar imaging survey of the proposed driveline to identify the nature and location of possible obstructions to installation of new sheet pile. Work includes all labor, materials, tools, equipment, and incidentals necessary for removal and disposal of obstructions discovered and documented as part of the pre-construction imaging survey.

3.12 REMOVE ABANDONED PETROLEUM LINE

A. Existing petroleum lines on property shall be removed from the oil/water separator according to Ch. ATCP 93560 WAC requirements and the Materials Management Plan requirements.

3.13 SALVAGE AND REINSTALL

A. Salvage operations conform to WisDOT Spec. 204.3.1.3.

B. Signs
   1. In no case shall a traffic sign or street sign be removed or disturbed by Contractor without prior notification being given to Engineer and then only after satisfactory arrangements have been made for a temporary installation or its disposition
      a. Street identification signage shall be maintained at all times due to its importance to the 911 Emergency Response System.
      b. Remove and salvage all posts, A-frame angle brackets, stringers, as well as the nuts, bolts, and washers.
      c. Exercise reasonable care against damage to in-place signs during storage and installation.
      d. Remove signs damaged during construction and replace with new signs.

C. Fences
   1. Salvage and store fence and post material where they are in conflict with the Work.
   2. After completion of Work, reinstall fence to the condition existing prior to removal.
   3. Install temporary snow fence or similar barrier at the end of the working day while the permanent fence is removed.

3.14 FIELD QUALITY CONTROL

A. Salvaged items to be reinstalled shall be of the same shape, dimension, location, and quality of the original item prior to construction.

B. Items damaged during removal or salvaging operations shall be replaced with new material of equal type and quality of the damaged item when it was new.

3.15 DISPOSING OF MATERIAL

A. Conform to WisDOT Spec. 204.3.1.3.

B. Dispose of all materials outside of the Site at disposal location selected by Contractor in compliance with state and local regulations. Burying of material and debris is not allowed within the Site.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install falsework and forms for cast-in-place concrete.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Unit Prices
      a. Payment for falsework and forms shall be incidental to the cost of cast-in-place concrete.

1.03 REFERENCES

A. American Concrete Institute (ACI)
   1. ACI 347 – Recommended Practice for Concrete Formwork.

1.04 SUBMITTALS

A. Submittals shall conform to Section 01 33 00.

B. Submit product data for form ties.

C. Submit shop drawings for deck falsework and forms, including all calculated weights.

1.05 QUALITY ASSURANCE

A. The design, engineering, and proper construction of all formwork shall be the responsibility of the Contractor.

B. Design formwork in accordance with ACI 347.

1.06 PRODUCT HANDLING

A. Protec form faces from damage and defects that may show on finished concrete surfaces.

PART 2 PRODUCTS

2.01 FORM MATERIAL

A. Form facing material shall be smooth faced, undamaged plywood or other panel type material approved by the Engineer.

B. The form facing material shall produce a smooth, hard, uniform texture on the concrete.

C. The arrangement of the facing material shall be orderly and symmetrical with the number of seams kept to a minimum.

D. Facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used.

2.02 FORM TIES

A. Form ties shall be factory fabricated, appropriate length, removable or snap-off metal form ties designed for single-side use, prevent form deflection and to prevent spalling concrete surfaces upon removal.

B. The portion of the tie remaining in the concrete after removal of the formwork shall be at least 1 inch from the surface of the concrete.

C. Provide water seals on all wall ties.

2.03 FORM COATINGS

A. Form coatings or release agents shall be commercially formulated chemical release agents containing no lubrication oil, conventional form oil, fuel oil, or kerosene.

B. The form coating shall not penetrate, stain, or leave a residual film on the concrete surface and shall not attract dirt or other deleterious material.

2.04 ACCESSORIES

A. Chamfer strips shall be 3/4 inch by 3/4 inch wood or plastic strips.

B. Provide all anchorages, braces, and special forms required to construct cast-in-place concrete components shown on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Establish a benchmark in an accessible location and use as a reference point for various construction levels.

B. Verify lines, levels, and centers of existing features used for reference before proceeding with formwork.

C. Verify that actual dimensions approximately agree with the Drawings. Report any discrepancies to the Engineer before proceeding with Work.

3.02 FORMWORK DESIGN

A. The design, engineering, and construction of the formwork shall be the responsibility of the Contractor.

B. Formwork shall be designed in accordance with ACI 347.

C. Formwork shall be designed, erected, supported, braced, and maintained to safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.

D. Formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete.

E. Positive means of adjustment of shores and struts shall be provided and all settlement shall be taken up during concrete placing operations. Forms shall be securely braced against lateral deflections.

3.03 FORMWORK CONSTRUCTION

A. Provide forms for all concrete work. Earth cuts shall not be used as forms for vertical surfaces.

B. Construct forms to conform to slopes, lines, and dimensions shown on the Drawings.

C. Forms shall be sufficiently tight to prevent loss of mortar from the concrete.

D. Place chamfer strips at all exposed corners.

E. Install all required openings, frames, pipe sleeves, cavities, slots, and other embedded items.

F. Cut all holes in forms required for installation or embedment of concrete reinforcement bars and ties.

G. Provide sharp clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts to maintain true, square corners.

H. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris before concrete is placed.

3.04 TOLERANCES

A. Construct formwork so that concrete surfaces will conform with the following tolerances:
   1. Variation from plumb
      In any 10 feet of length 1/4 inch.
      Maximum for entire length 1/2 inch.
   2. Variation from the level or specified grade
      In any 10 feet of length 1/4 inch.
      Maximum for entire length 1/2 inch.
   3. Variation of the linear structure lines from established position in plan and related position of walls or crest
      In any 20 feet of length 1/2 inch.
      Maximum for entire length 1 inch.
   4. Variation in cross-sectional dimensions of walls
      Minus 1/4 inch.
      Plus 1/2 inch.

3.05 FORM SURFACE PREPARATION

A. Clean surfaces of forms and embedded material of all accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

B. Before placing the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an acceptable coating material that will effectively prevent absorption of moisture, prevent bond with the concrete, and not stain the concrete surfaces.

C. Excess form coating material shall not stand in puddles in the forms.

D. Form coating material shall not come in contact with hardened concrete against which fresh concrete is to be placed.

E. Spray form coating on all concrete form surfaces, including wood forms for wall openings, keyway strips, and chamfer strips.

3.06 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used.

B. Do not use split, frayed, delaminated, or otherwise damaged form facing material.

3.07 FORM REMOVAL

A. Formwork for walls and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, but not less than 24 hours after completing concrete placement and finishing.

B. Forms and shoring used to support the weight of concrete in beams, slabs, and other structural members shall not be removed in less than 10 days and not until the concrete has attained
3,500 psi minimum compressive strength. Compressive strength shall be determined by field-cured specimens.

C. The Contractor shall be responsible for all damage resulting from removal of forms or premature overloading of structural members.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install concrete reinforcement, anchored dowels, supports, and accessories.

1.02 PRICE AND PAYMENT PROCEDURES

A. All work and costs of this Section shall be incidental to the Project and be included in the Total Base Bid.

1.03 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 - Specifications for Structural Concrete for Buildings.
   2. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials.
   3. ACI 315 - Details and Detailing of Concrete Reinforcement.

B. Concrete Reinforcing Steel Institute (CRSI)
   1. Manual of Standard Practice.

1.04 SUBMITTALS

A. Submittals shall conform to Section 01 33 00.

B. Submit complete shop drawings and bar lists of all material to be furnished and installed under this Section. Show bar sizes, spacings, locations, and quantities of reinforcing and bending details.

C. Make shop drawings in accordance with ACI 315 and the CRSI Manual of Standard Practice. Drawings shall show in detail the location, size, spacing, bends, and quantities of each and all reinforcing bars to be placed in the structure. Bars shall have unique identifying labels or marks for each size, length, bend configuration, etc.

D. Submit product data on threaded dowel inserts.

E. Submit mill certifications for concrete reinforcement at time of delivery.

1.05 QUALITY ASSURANCE

A. Comply with ACI 301, except as modified in this Section.

1.06 PRODUCT HANDLING

A. Deliver reinforcement to the Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement drawings.

B. Store reinforcement at the Site in a manner to prevent damage from drainage and accumulation of dirt and excessive rust.

C. Do not store reinforcement, supports, or equipment on finished slabs.

D. Store metal bar supports in a weather-proof shelter.

PART 2 PRODUCTS

2.01 MATERIAL

A. Reinforcing Bars: Deformed billet steel bars conforming to ASTM A615, Grade 60.

2.02 ACCESSORIES

A. Bar Supports for Walls: All bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be plastic protected, conforming to CRSI Class 1 protection for bar supports.

B. Ground Supported Reinforcing: All ground supported reinforcement shall be supported by precast concrete blocks. Precast concrete blocks shall have a minimum compressive strength of 4,000 psi.

C. Adhesive Anchor: Adhesive for anchoring steel reinforcement dowels and approved threaded rods in concrete shall be a 2 component injected epoxy structural adhesive. Approved products include Hilti RE-500 Adhesive as manufactured by Hilti Fastening Systems, Epoxy-Tie Adhesive as manufactured by Simpson Strong-Tie, or Epogel as manufactured by Sonneborn.

D. Tie Wire: Shall be black annealed wire, 16 gauge or heavier.

2.03 FABRICATION

A. Shop fabricate reinforcing steel to required shapes and dimensions.

B. Do not rebend or straighten reinforcing steel.

C. Fabricate bars in accordance with the fabricating tolerances given in ACI 315.

PART 3 EXECUTION

3.01 PLACING

A. Place reinforcing steel in accordance with ACI 117, the Drawings, approved shop drawings, and as specified herein. Notify Engineer of any discrepancies or conflicts as soon as they are discovered.

B. Reinforcing steel shall have the following concrete cover, unless specifically noted differently on the Drawings:

1. Concrete cast against earth	3 inches
2. Concrete surfaces exposed to flowing water	4 inches
3. All other concrete	2 inches

C. Properly position reinforcing steel and wire it together at intersections and supports to ensure against displacement during concrete placing. All reinforcing steel shall be tied to wall forms.

D. Reinforcing steel for slabs on grade shall be supported by placing precast concrete blocks at all locations where chairs are to be located. Chairs or standees shall be placed over concrete blocks.

E. Dowels shall be wired in place and anchored dowels cured before placing concrete.

F. All reinforcing steel must be placed and tied before concrete is placed.

G. Reinforcing steel embedded in hardened or partially hardened concrete shall not be bent after placing.

H. Wall chairs shall be placed at the top and bottom of all walls and not greater than 6 feet on center horizontally.

I. All reinforcement at the time concrete is placed shall be free of mud, oil, or other materials that may adversely affect or reduce the bond.

J. Chairs and bolsters shall support the reinforcing steel closest to the formed surface. Beam stirrups and column ties shall be supported by chairs.

3.02 SPLICES

A. Provide reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Provide lap splice lengths as shown on the Drawings.

B. Splices shall be made only as shown on the Drawings or as authorized by the Engineer.

C. Threaded or other approved mechanical bar splices shall be used where shown on the Drawings and may be used elsewhere for the convenience of the Contractor at no additional cost to the Owner if specifically requested of and approved by the Engineer.

3.03 TOLERANCES

A. Bars shall be placed to the tolerances indicated in ACI 117.

END OF SECTION

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SECTION 03 30 10

REINFORCED CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install all cast-in-place concrete, including formwork, reinforcement, supports, and accessories.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 REFERENCES

A. American Concrete Institute (ACI):
   1. 301 – Specifications for Structural Concrete for Buildings.
   2. 315 – Details and Detailing of Concrete Reinforcement.

B. American Society for Testing Materials (ASTM):
   1. C31 – Standard Practice for Making and Curing Concrete test Specimens in the Field.
   2. C33 – Standard Specification for Concrete Aggregates.
   3. C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. C143 – Standard Test Method for Slump of Hydraulic Cement Concrete.
   5. C150 – Standard Specification for Portland Cement.
   6. C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   7. C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
   8. C494 – Standard Specification for Chemical Admixtures for Concrete.
   9. C618 – Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

1.04 SUBMITTALS

A. Submittals shall conform to Section 01 33 00 – Submittal Procedures.

B. Submit complete shop drawings and bar lists of all reinforcement materials to be furnished and installed under this Section. Show bar sizes, spacings, locations, and quantities of reinforcing and bending details.

C. Make shop drawings in accordance with ACI 315.

D. Submit concrete mix designs at least 14 days prior to placement of concrete.

E. Submit manufacturer's data for concrete admixtures, curing materials, finishing compounds, expansion joint materials, and adhesive anchoring material.

F. Submit concrete test results.

1.05 QUALITY ASSURANCE

A. Comply with ACI 301, except as modified in this Section.

B. The design, engineering, and proper construction of all formwork shall be the responsibility of the Contractor.

C. The Contractor shall hire an independent testing laboratory, approved by the Engineer, to perform the work listed below. All costs for this testing shall be paid by the Contractor:
   1. Test proposed aggregate.
   2. Design concrete mixes.
   3. Cast and test concrete cylinders for all concrete in accordance with ASTM C31 and C39.
   4. Determine slump of concrete from each truck in accordance with ASTM C143.
   5. Determine air content of concrete from each truck in accordance with ASTM C231.

D. Refer to Section 01 41 00 for Special Inspection Requirements.

1.06 PRODUCT HANDLING

A. Store reinforcement supports and accessories at the project site in a manner to prevent damage from water, accumulation of dirt or construction activities.

B. Do not store forms, shores, reinforcing, equipment or other materials on finished slab surfaces.

PART 2 PRODUCTS

2.01 FORMWORK

A. Form facing materials shall produce a smooth, hard, uniform texture on the concrete.

B. Facing materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used.

C. Circular column forms shall consist of a continuous laminated fiber tube with exterior moisture protection and non-adhering interior surface, similar to “A-Coated Sonotube” as manufactured by Sonoco Products, or approved equal.

D. Form ties shall be factory fabricated, adjustable length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.

E. The portion of the tie remaining in the concrete after removal of the tie shall be at least 1 inch from the surface of the concrete. Provide water seals on all wall ties used in water containment structures and exterior walls.

F. Form coatings or release agents shall be commercially formulated chemical release agents containing no lubrication oil, conventional form oil, fuel oil, or kerosene.

G. The form coating shall not penetrate, stain, or leave a residual film on the concrete surface and shall not attract dirt or other deleterious material.

2.02 CONCRETE REINFORCEMENT

A. Reinforcing Bars: Deformed billet steel bars conforming to ASTM A615, Grade 60.

B. Welded Wire Fabric: Steel wire spot welded at intersections conforming to ASTM A185. Use flat sheets only.

2.03 CONCRETE MATERIALS

A. Concrete constituents shall conform to the following minimum requirements:

Cement	Conform to ASTM C150, Type I - from 1 source of supply
Aggregate	Conform to ASTM C33 - from 1 source of supply
Water	Clean potable and free from deleterious substances
Air Entraining Admixture	Conform to ASTM C260
Water Reducing Admixture	Conform to ASTM C494, Type A
Fly Ash	Conform to ASTM C618, Class C or F

B. Concrete mixture shall conform to the following minimum requirements:

Coarse aggregate size	ASTM C33 Size No. 67
Minimum compressive strength at 28 days	4000 psi
Maximum water-cement + pozzolan ratio	.45
Minimum cement and pozzolan content	564 lb/cu. yd.
Slump	3 inches ± 1 inch
Entrained air content	6 percent ± 1-1/2 percent

2.04 CONCRETE ACCESSORIES

A. Chamfer strips shall be 3/4 inch by 3/4 inch wood or plastic strips.

B. Burlap-Polyethylene Sheets: Burlap polyethylene sheets for curing shall consist of burlap weighing not less than 10 oz./lin. yd., 40 inches wide impregnated on 1 side with white opaque reinforced polyethylene 0.006 inch thick.

C. Curing Compound: Conform to ASTM C309, Type 1-D, Class B, clear or translucent with fugitive dye. Not to be applied to slabs receiving sealer.

D. Expansion Joint Materials:
   1. Closed cell expanded polyethylene sheet, 1/4 inch thick.
   2. Closed cell neoprene sheet, 3/4 inch thick.

PART 3 EXECUTION

3.01 FORMWORK

A. Formwork shall be designed and constructed in accordance with ACI 347.

B. Formwork shall be designed, erected, supported, braced, and maintained to safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.

C. Construct forms to conform to slopes, lines, and dimensions shown on the Drawings. Earth cuts shall not be used as forms for vertical surfaces.

D. Place chamfer strips at all exposed corners. Install and secure all required openings, bolts, pipes, sleeves, plates, and other embedded items prior to placing concrete.

3.02 REINFORCEMENT

A. Place reinforcing steel in accordance with the Structural Drawings, approved shop drawings, and as specified herein.

B. Reinforcing steel shall have the following concrete cover, unless specifically noted differently on the Drawings:
   1. Concrete cast against earth 3 inches.
   2. All other concrete 2 inches.

C. Properly position reinforcing steel and wire it together at intersections and supports to ensure against displacement during concrete placing. All reinforcing steel shall be tied to wall forms.

D. All reinforcing steel, including dowels and embedded items, must be placed and tied securely with wire before concrete is placed.

E. All reinforcement at the time concrete is placed shall be free of mud, oil or other materials that may adversely affect or reduce the bond.

F. Provide reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Provide lap splice lengths as shown on the Drawings.

G. Bars shall be placed to the following tolerances:
   1. Clear distance to formed surface ± 1/4 inch.
   2. Spacing dimensions ± 1/2 inch.

3.03 CONCRETE PRODUCTION

A. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.

B. Discharge concrete from truck within 60 minutes after cement is added to the mix.

C. Do not add water at the Site without the permission of the Engineer.

3.04 CONCRETE PLACEMENT

A. Formwork shall be completed, and all reinforcement and embedded items shall be secured in place. Accessories, such as expansion joint materials and waterstop, shall be in place and secured.

B. All snow, ice, and mud shall be removed prior to placing concrete. Do not place concrete on frozen ground or ground with either standing water or when upper 2 inches of ground is saturated.

C. Do not place concrete during rain, sleet, or snow.

D. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

E. Concrete which has partially hardened or has been contaminated by hardened materials shall not be deposited.

F. Remove rejected concrete from the Site.

G. Deposit concrete as nearly as practicable in its final position to avoid segregation due to handling or flowing.

3.05 PLACING CONCRETE SLABS

A. Deposit and consolidate concrete slabs in a continuous operation.

B. Consolidate concrete placed in slabs by mechanical vibration or other methods acceptable to the Engineer. Bring slab surfaces to the correct level with a straight edge and then strike off. Use bullfloats or darbies to smooth the surface, leaving it free from bumps and hollows.

C. Screed surface to lines and grades shown. Slope to drains. Do not leave screed stakes in concrete.

D. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to start of finishing operations.

3.06 COLD WEATHER PLACING

A. Do not place concrete when the air temperature is less than 40 degrees F without the specific approval of the Engineer.

B. Cold weather concrete work shall conform to all requirements of ACI 306.1, except as modified by the requirements of these Contract Documents.

C. Concrete shall not be placed against any frozen substrate, including subgrade soils and surfaces of formwork.

D. Concrete shall not be placed around any embedment, including reinforcing steel that is at a temperature below freezing.

E. The temperature of the concrete delivered at the site shall conform to the following limitations:

	Minimum Concrete Temperature	
Air Temperature	< 12 Inches Thick	12 – 36 Inches Thick
Above 30 degrees F	60 degrees F	55 degrees F
0 to 30 degrees F	65 degrees F	60 degrees F
Below 0 degrees F	70 degrees F	65 degrees F

F. If water or aggregate is heated above 100 degrees F, the water shall be combined with the aggregate in the mixer before cement is added. Cement shall not be mixed with

water or with mixtures of water and aggregate having a temperature greater than 100 degrees F.

G. When the mean daily temperature is less than 40 degrees F, the temperature of the concrete shall be maintained between 50 degree and 70 degrees F for the required curing period.

H. Arrangements for heating, covering, insulation, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of cold or heat. Protection shall remain in place for a minimum of 3 days.

I. Combustion heaters shall not be used during the first 24 hours, unless precautions are taken to prevent exposure of the concrete to exhaust gases.

J. Once the cold weather concrete protection is removed, concrete curing must be continued for the remainder of the 10-day curing period.

3.07 HOT WEATHER PLACING

A. Comply with ACI 305 when hot weather conditions exist.

B. Maintain concrete temperature at time of placement below 90 degrees F.

C. When the temperature of the steel is greater than 120 degrees F, steel forms and reinforcement shall be sprayed with water prior to placing concrete.

D. Keep all surfaces protected from rapid drying. Provide windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering in advance of placement.

3.08 CONCRETE SLAB FINISHING

A. Float Finish:
   1. Apply float finish to all slab surfaces. Consolidate the surface by handfloating.
   2. Check and level the surface plane to a tolerance not exceeding l/4 inch in 10 feet when tested with a 10-foot straight-edge placed on the surface at not less than 2 different angles.
   3. Immediately after leveling refloat the surfaces to a smooth, uniform, granular texture.

B. Trowel Finish:
   1. Apply steel trowel finish to all interior floor slabs.
   2. Apply float finish to slabs as described above in Paragraph 3.08.A.
   3. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
   4. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10-foot straight-edge.

C. Broom Finish:
   1. Apply non-slip broom finish to all exterior sidewalks and aprons.
   2. Apply float to slabs as described above in Paragraph 3.08.A.

3. Immediately after floating, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber-bristle broom for light texturing.

3.09 CONCRETE CURING

A. Immediately after finishing operations are complete, all slabs shall be covered with burlap-polyethylene sheets, wetted and kept in place for at least 7 days.

B. Formed surfaces shall be covered with burlap-polyethylene sheets or sprayed with curing compound immediately after form removal. Do not allow compound to contact steel reinforcement.

3.10 PATCHING AND CLEANING

A. Repair honeycomb and other defective areas, fill surface voids and fill form tie holes and similar defects in accordance with Section 5 of ACI 301. Fill any and all voids in and under footings with concrete of equal strength to that specified for footings.

B. Upon completion, all exposed concrete surfaces shall be thoroughly cleaned of all concrete spatters, form oil, or other foreign material detrimental to appearance.

C. All excess concrete debris remaining after completion of placement and form removal shall be removed from the Site and disposed of in a proper and legal manner.

END OF SECTION

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SECTION 03 35 00

CONCRETE FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative concrete floor finish system as specified or scheduled.
   1. Polymer stain for interior and exterior horizontal and vertical surfaces as specified or scheduled.
   2. Wax for interior concrete floor surfaces as specified or scheduled.
   3. Acrylic polymer wax for interior concrete floor surfaces as specified or scheduled.
   4. Concrete floor sealer as specified or scheduled.
   5. Clear topcoats for concrete finishes as specified or scheduled.
   6. Clear penetrant for concrete finishes as specified or scheduled.
   7. UV cured floor coating finish for interior concrete floors.
   8. Cleaners and strippers for surface preparation as required.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 09 96 00 - High Performance Coatings.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Surface preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

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

D. Verification Samples: For each finish product specified, 2 samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

E. Installer's Project References: Submit list of successfully completed projects, including project name and location, name of architect, and type and quantity of decorative concrete floor finish systems applied.

F. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.

1.05 ASSURANCE

A. Installer Qualifications:
   1. Successful experience in application of similar decorative concrete floor finish systems.
   2. Employ persons trained for application of decorative concrete floor finish systems.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

C. Single Source Responsibility: Concrete floor finish materials shall be products of a single manufacturer.

D. Pre-installation Meeting: Convene a meeting before the start of the application of concrete floor finish system. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and applicator. Review surface preparation, application, protection, and coordination with other work.

1.06 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Concrete Floor Wax and Concrete Floor Sealer: Keep away from ignition sources. Do not allow to freeze.

D. Handling: Protect materials during handling and application to prevent damage or contamination.

1.07 PROJECT CONDITIONS

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

B. Exterior Surfaces: Do not apply materials in wet weather.

C. Concrete Floor Wax: Do not apply when air or surface temperature is below 55 degrees F (13 degrees C).

D. Concrete Floor Stain: Do not apply when air or surface temperature is below 40 degrees F (4 degrees C).

E. Concrete Floor Sealer: Do not apply when air or surface temperature is below 55 degrees F (13 degrees C).

1.08 SEQUENCING

A. Prepare surface and apply concrete floor stain after other interior finish work is completed and before baseboards and trim are installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: EPMAR Corporation, which is located at: 13240 Barton Circle ; Whittier, CA 90605-3254; Tel: 562-236-1175; Email: request info (villaw@quakerchem.com); Web: www.epmar.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 CONCRETE FLOOR STAIN

A. Product: Kemiko Stone Tone Stain as manufactured by Epmar Corporation.
   1. Type: Combination of acid solution, wetting agents, and metallic ions. When mixed with water, chemically combines with Portland cement to form permanent colors.
   2. Color: Malay Tan.
   3. Color: Green Lawn.
   4. Color: Black.
   5. Color: Cola.
   6. Color: English Red.
   7. Color: Aqua Blue.
   8. Color: Golden Wheat.
   9. Color: Vintage Umber.

2.03 POLYMER STAIN

A. Polymer Stain: Rembrandt Polymer Stain as manufactured by Epmar Corporation.
   1. Product: Water-extended, acrylic urethane polymer solution with added pigments.
   2. Volume Solids: 20 percent.
   3. VOC: Less than 30 g/L. Meets final SCAQMD Rule 13 (2008).
   4. Base Color: Adobe.
   5. Base Color: Black.
   6. Base Color: Oyster.
   7. Base Color: Sand.
   8. Base Color: Tweed.
   9. Base Color: White.
   10. Color: Phthalo Blue.
   11. Color: Medium Yellow.
   12. Color: Yellow Oxide.
   13. Color: Monoazo Red.
   14. Color: Red Oxide.
   15. Color: Orange.
   16. Color: Phthalo Green.
   17. Color: Raw Umber.

18. Color: Raw Sienna.
19. Color: Burnt Umber.
20. Color: Burnt Sienna.
21. Color: Violet.

2.04 CONCRETE FLOOR FINISH

A. Floor Wax: Kemiko Stone Tone Buff On Wax II as manufactured by Epmar Corporation.
   1. Type: Aliphatic petroleum wax.
   2. Non-yellowing.
   3. Fast drying.
   4. Satin finish.

B. Acrylic Polymer Wax: Kemiko Easy Shine Mop On as manufactured by Epmar Corporation.
   1. Type: A low-VOC single component waterborne acrylic polymer wax. Designed to repel water, reduce scuffing and marring, allows substrate to breath, is low odor, and produces a deep rich shine.
   2. Clear gloss.

C. Floor Sealer: Kemiko Stone Tone Sealer II as manufactured by Epmar Corporation.
   1. Type: Acrylic water-based urethane clear sealer.
   2. Solids Content: 30 percent.
   3. Non-yellowing.
   4. Resistant to blush.
   5. Clear gloss.
   6. VOC compliant.
   7. Quick drying.

D. Clear Topcoat: Clear Polyurethane.
   1. Product: Kemiko SS2700.
   2. Type: 2 component, waterborne, high-solids, aliphatic polyurethane coating.
   3. Color: Clear.
   4. Color: White.
   5. Color: Gloss.
   6. Primer: Self-priming.
   7. Primer: Kemiko SS1600.
   8. Primer: Kemiko SS3700.
   9. Primer: Kemiko SS3800.

E. Clear Topcoat: High Gloss Clear Epoxy.
   1. Product: Kemiko SS3700 WB.
   2. Type: High-gloss, quick-dry, amine-cured, water-extended, epoxy coating.
   3. Color: Clear.
   4. Color: White.
   5. Color: Gray.
   6. Color: Tan.
   7. Color: Spanish Red.
   8. Color: Light Gray.
   9. Color: Beige.
   10. Color: Diego Blue.
   11. Color: Yellow.
   12. Color: Navajo White.

F. Clear Penetrant: Kemiko Sta-Natural as manufactured by Epmar Corporation.
   1. Type: A water viscosity, single component zero VOC waterborne silane/siloxane emulsion designed to repel water, reduces efflorescence and frost damage, allows substrate to breathe, with very little or no odor. Does not contain solvents, and preserves stained concrete color. Resistant to UV and high alkalinity exposure.

G. UV Cured Floor Finish: Field applied high-performance polyester UV-curable floor coating system for new or existing concrete floor. The one-component formulation shall be applied by roller or squeegee. A mobile UV Floor Curing Lamp shall be used to cure the system.
   1. Product: RapidShield as manufactured by Quaker Chemical.
   2. Color: Refer to drawing for schedule of floor and marking locations and colors.
   3. Color: QV 0007 - Clear (Seal coat and primer).
   4. Color: Clear (Seal coat) with glossy finish.
   5. Color: Clear (Seal coat) with matt finish.
   6. Color: QV 0604 - Safety Yellow.
   7. Color: QV 0008 - High Build Sealer.
   8. Color: QV 0202 - White.
   9. Color: QV 0404 - Quaker Blue.
   10. Color: QV 0304 - Light Grey.
   11. Color: QV 0501 - Safety Green.
   12. Color: QV 0305 - Pewter Grey.
   13. Color: QV 0902 - Safety Red.
   14. Technical Data:
      a. Gloss: 80+.
      b. Theoretical VOC: 0 lb/gallon.
      c. Pencil Hardness: 2H+.
      d. Chemical Resistance: 100 MEK double rubs; no failure.
      e. Application: 4-8 mils (0.1 mm to 0.2 mm) DFT.
      f. Viscosity (#3 Zahn Cup at 77 degrees F (25 degrees C).
         QRS0007 Clear: 18-22 second. QRS0008 Sealer: 60-80 second. Colors: 45-55 second.

2.05 CLEANER/ STRIPPER

A. Heavy Duty Water Base Stripper: Kemiko Easy Strip as manufactured by Epmar Corporation.
   1. Type: High performance Ammonia/Alkaline concentrate in water base wax stripper designed specifically for removing Kemiko Stone Tone and Kemiko Easy Shine waxes.
   2. Biodegradable with low ammonia odor.

B. Water Base Cleaner (alkaline concentrate in water): Kemiko Neutra Clean as manufactured by Epmar Corporation.
   1. Type: Industrial strength, low VOC, high performance water base sodium metasilicate cleaner for the preparation of bare concrete and coated substrates.
   2. Biodegradable with low odor.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Protection:
   1. Protect walls and surrounding surfaces not to receive decorative concrete floor finish.
   2. Do not allow products to come in contact with wood or metal surfaces.

D. Concrete shall be as specified in Section 03 30 00. Verify concrete is a minimum of 28 days old.

E. Confirm that concrete surface is clean, dry, structurally sound, and free from dirt, dust, oil, grease, solvents, paint, wax, asphalt, concrete curing compounds, sealing compounds, surface hardeners, bond breakers, adhesive residue, and other surface contaminants.

F. Do not acid wash or use heavy alkali cleaners.

3.03 STRIPPING

A. Bare Concrete: Apply water base stripper to substrate and let stand for 2 to 3 minutes. Work into surface with brooms, brushes or floor scrubbing machines. Do not allow stripper to dry on floor. Rinse with clean water and repeat stripping operation until surface is free of wax contaminants. Substrate shall be allowed to dry thoroughly prior to re-coating application.

B. Existing Coatings/Sealers: Apply water base stripper to substrate and let stand for 2 to 3 minutes. Do not allow cleaner to dry on floor. Rinse with clean water and repeat cleaning operation until substrate is free of contaminants. Substrate shall be allowed to dry thoroughly prior to coating application. Stripping of acrylic sealers may result from stripping operation. Test compatibility with existing sealers if scheduled to remain.

C. Reduction:
   1. Light Duty: 1 part Kemiko East Strip to 2 part water.
   2. Medium Duty: 1 part Kemiko East Strip to 1 part water.
   3. Heavy Duty: Applied without dilution.

3.04 CLEANING

A. Bare Concrete: Apply water base cleaner to substrate and let stand for 2 to 3 minutes. Work into surface with brooms, brushes or floor scrubbing machines. Do not allow cleaner to dry on floor. Rinse with clean water and repeat cleaning operation until substrate is free of contaminants. Substrate shall be allowed to dry thoroughly prior to coating application.

B. Existing Coatings/Sealers: Apply water base cleaner to substrate and let stand for 5 to 10 minutes. Do not allow cleaner to dry on floor. Rinse with clean water and repeat cleaning operation until substrate is free of contaminants. Substrate shall be allowed to dry thoroughly prior to coating application. Stripping of acrylic sealers may result from cleaning operation. Test compatibility with existing sealers if scheduled to remain.

C. Reduction:
   1. Light Duty: 1 part Kemiko Neutra Clean to 10 part water.
   2. Medium Duty: 1 part Kemiko Neutra Clean to 5 part water.
   3. Heavy Duty: 1 part Kemiko Neutra Clean to 2 part water.

3.05 STAIN APPLICATION

A. Apply concrete floor stain in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Control depth of color by adjusting volume of stain applied to floor.

C. Apply 2 applications of concrete floor stain. Allow floor to completely dry after each application. Do not scrub clean between applications.

D. After floor has completely dried, scrub off stain residue in accordance with manufacturer's instructions. Allow floor to completely dry.

E. Keep material containers closed when not in use to avoid contamination.

3.06 POLYMER STAIN APPLICATION

A. Apply polymer stain in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Concrete, Plaster, and Polymer Cement Substrate:
   1. Remove dirt, dust, oil, grease, and other surface contaminants before abrasive surface preparation, acid etching, and water washing.
   2. Confirm surfaces are cured, dry, and free from alkali stain and laitance.
   3. Verify concrete is a minimum of 28 days old.

C. Wood Substrate: Ensure surfaces are clean, dry, and free from mildew, organic matter, and surface contaminants.

D. Apply polymer stain as a stain finish.

E. Apply polymer stain as a wash finish.

F. Apply polymer stain as a faux finish.

G. Do not add thinners or dilute polymer stain.

H. Keep material containers closed when not in use to avoid contamination.

I. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

J. Apply polymer stain to be free of film characteristics and defects that would adversely affect performance or appearance.

K. Apply clear topcoat over polymer stain in accordance with manufacturer's instructions.

3.07 FLOOR SEALER APPLICATION

A. Apply sealer in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Do not dilute sealer.

C. Apply sealer in a thin uniform film.

D. Apply second coat of sealer if required by manufacturer's instructions. Apply second coat after first coat is dry.

E. Keep sealer film build-up to a minimum.

F. Keep material containers closed when not in use to avoid contamination.

3.08 CLEAR PENETRANT APPLICATION

A. Surface Preparation - Concrete: All visible oil, grease, sludge, stain residue and any other contaminants shall be removed prior to any Kemiko Sta-Natural application. Surface shall be cured, dry and free from alkali stain and laitance. Mask all glass and metal surfaces - these surfaces shall be protected from contact with this product.

B. Apply between 50 degrees F and 100 degrees F (10 degrees C and 38 degrees C) with temperature 5 degrees above dew point. Do not store in direct sunlight. Protect from freezing. Do not apply if rain is forecast within 24-hours of application. Do not apply to asphalt, glazed brick or glazed tile. Do not apply to wet or frosted surfaces.

3.09 FLOOR WAX APPLICATION

A. Apply and buff wax in accordance with manufacturer's instructions at locations indicated on the drawings.

B. Keep material containers closed when not in use to avoid contamination.

3.10 UV CURED FLOOR FINISH

A. Preparation: Completely remove any existing coating.

B. Environment: The minimum floor application temperature color shall be 23 degrees F (-5 degrees C) and 3 degrees above dew point. Optimum application temperature is 68 degrees F (20 degrees C). Maximum relative humidity is 85 percent.

C. Concrete Substrates: Prepare according to ASTM F-710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F-1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sf (.015 kg/sm) in 24 hours.
      b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

D. Application: With the floor ground and shot blasted apply the product to required thickness by either roller or squeegee. The product shall be cured using a driven UV Floor Curing Lamp that cures the coating instantly.

E. Color Coat: Colors shall only be applied directly to a clear coat of the product (applied as a primer/sealer) or to the high build sealer for purposes such as demarcation lines, designation of safety areas, truck traffic ways and walkways.
   1. Application Rate: 2.5 mils to 3.5 mils (.06 mm to .09 mm) per coat.
   2. Multiple coats shall be applied to obtain the required opacity.
   3. A clear topcoat shall be applied over the color coats to provide optimum cleaning and durability.

3.11 PROTECTION

A. Protect decorative concrete floor finishes from damage during construction.

B. Protect concrete surfaces from foot traffic for a minimum of 24 hours.

C. Avoid washing concrete surfaces for a minimum of 48 hours.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 03 40 00

HOLLOW CORE PRECAST CONCRETE PLANK

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install structural precast concrete components and accessories.

1.02 REFERENCES

A. American Concrete Institute (ACI)
   1. 318 - Building Code Requirements for Reinforced Concrete.

B. American Welding Society (AWS)
   1. D1.1 - American Welding Code - Steel.

C. Prestressed Concrete Institute "PCI Design Handbook, Precast and Prestressed Concrete" (PCI).

1.03 SUBMITTALS

A. Submittals shall conform to Section 01 33 00.

B. Shop drawings shall indicate complete information for fabrication and installation of units. Include the following:
   1. Plans and elevations locating and defining all material furnished by manufacturers.
   2. Sections and details showing connections, cast-in items, field installed lifting hooks, capacities, all openings greater than 10 inches in diameter, and their relation to the structure.
   3. All dead, live, and other applicable loads used in the design.

C. Submit design calculations for all members and connections provided.

D. Submit certification report for precast concrete plank fabrication and erection.

1.04 QUALITY ASSURANCE

A. Design, fabrication, delivery, and erection of precast units shall be by an organization specializing in providing precast concrete products similar to units required for this Project.

B. Design, fabrication, delivery, and erection shall conform to ACI 318.

C. Perform all welding in accordance with AWS D1.1.

D. Provide report certifying that the quality assurance requirements were completed as required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: ASTM C150, Type 1 or Type III.

B. Aggregate For Concrete: ASTM C33.

C. Water Used In Mixing Concrete: Clean, potable, and free from deleterious amounts of oils, acids, alkalies, or organic materials.

D. Deformed Reinforcing Bars: ASTM A615, Grade 60.

E. Prestressing Tendons: Uncoated, low relaxation, 7-wire strands, ASTM A416, Grade 270.

F. Admixtures
   1. Air Entraining Admixture: ASTM C260.
   2. Water Reducing Admixture: ASTM C494.

G. Joint Grout: 1-part Portland cement and 3-parts clean fine sand by volume. Use minimum water for placement and hydration.

2.02 FABRICATION AND MANUFACTURE

A. Fabricate precast members in plastic lined or metal forms which are true to line and plane. Form openings 10 inches or larger in diameter.

B. Accurately place prestressing strands, reinforcing steel, sleeves, inserts, weld plates, anchor plates, and embedded items before concrete is placed.

C. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface which will not show in finished structure.

D. Provide Finishes for Precast Concrete Planks as Follows:
   1. Standard Formed Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.
   2. Standard Top Finish: Normal finish as a result of vibrating screed and additional hand finishing at projections. In areas with composite topping, provide a rough broom finish. Normal color variations, minor indentations, minor chips, and spalls shall be permitted. No major imperfections, honeycomb, or defects shall be permitted.

2.03 FABRICATION TOLERANCES

A. Fabricate precast concrete plank to conform to PCI Design Handbook tolerances, and as follows:
   1. Variation in plank length: ± 1/2 inch.
   2. Variation in plank width: ± 1/4 inch.
   3. Variation in plank depth: + 1/4 inch, - 1/8 inch.

2.04 DESIGN

A. Design calculations shall be prepared by a professional Engineer registered in the State of Wisconsin and experienced in precast concrete design.

B. Design shall be in accordance with ACI 318.

C. Design members and connections for all applicable loads, including the following:
   1. Initial handling and erection stresses.
   2. All applied dead loads (including concrete block walls), live loads, and wind loads as specified on the Structural Drawings.
   3. Applied equipment loads, such as overhead hoists and lifting hooks.

D. Steel hangers shall be installed to support plank wherever holes of more than 1/2 the width of the plank are cut. Hangers shall be shop painted in accordance with Section 09 91 00.

E. Live load deflections shall not exceed 1/360th of the span.

2.05 FIRE RATING

A. All precast members and connections shall have a 1-hour fire rating, unless otherwise specified.

PART 3 EXECUTION

3.01 TRANSPORTATION

A. Transport precast units by rail or truck in a manner to avoid excessive stress or strain on units.

B. Support units during hauling and stockpiling with sufficient hardwood shores to prevent cracking and spalling. Secure units in place to prevent shifting or undesired movements. Location of temporary supports shall be as directed by precast manufacturer.

3.02 ERECTION

A. Provide proper bearing surfaces to receive the precast units.

B. Handle precast units with inserts or other devices which permit units to be lifted without incurring cracking or spalling.

C. Remove lifting hooks and handling inserts after placement.

D. Grout joints between planks as follows:
   1. Seal underside of plank joints to prevent grout leakage.
   2. Fill grout keys full and strike flush with top surface.
   3. Remove grout that seeps through to ceiling below before grout hardens.
   4. Strike back grout 1/2 inch on the underside of the plank for caulking.

E. Paint all exposed weld plates and welds with zinc chromate type rust inhibitive primer.

3.03 ERECTION TOLERANCES

A. Erect precast concrete plank to conform to PCI Design Handbook tolerances, except as follows:
   1. Variation in joint width ± 1/4 inch.
   2. Maximum difference between bottom surfaces of adjacent plank 1/4 inch.

END OF SECTION

SECTION 04 05 13

MORTAR

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Work under this section includes mortar for unit masonry.

B. Related Sections
   1. 04 22 00 – Concrete Unit Masonry.

1.02 REFERENCES

A. The following specifications and standards are incorporated by reference:
   1. American Society for Testing Materials (ASTM)
      a. C144 Standard Specification for Aggregate for Masonry Mortar.
      b. C150 Standard Specification for Portland Cement.
      c. C207 Standard Specification for Hydrated Lime for Masonry Purposes.
      d. C270 Standard Specification for Mortar for Unit Masonry.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 TESTING AGENCY

A. Employ the service of an independent testing laboratory approved by the Architect or Engineer for testing of mortar specified herein.

1.05 SUBMITTALS

A. Test Reports: Submit information copies in duplicate of all test reports to the Architect, OWNER, Local Building Official, and SER.

PART 2 PRODUCTS

2.01 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type 1 or Type 2. Provide natural color or white cement as required to produce required mortar color.

B. Masonry Cement: Not allowed.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregates: ASTM C144.

E. Water shall be clean, potable, and free of deleterious amounts of acids, alkalis, or organic materials.

F. Colored Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes.
   1. Use only pigments with record of satisfactory performance in masonry mortars.
   2. Colors:
      a. At Architectural Precast Concrete: As approved by the Architect.
      b. At Concrete Unit Masonry: As approved by the Architect.
   3. Acceptable Manufacturers and Products:
      a. Centurion: Centurion Pigments.
      b. Rockwood Industries, Davis Colors: True Tone Mortar Colors.
      c. Solomon Grind-Chem Services, Inc.: SGS Mortar Colors.
      d. Prism Pigments: Mortar Colors.
      e. Or approved equal.

2.02 MEASURING AND MIXING

A. The method of measuring materials for the mortar used shall be by their volume or weight, and such that the specified proportions of the mortar can be controlled and accurately maintained. Measurement of sand by shovel shall not be permitted.

B. Cementitious material and aggregate shall be mixed for at least 3 minutes and not more than 5 minutes in a mechanical batch mixer with the maximum amount of water to produce a workable consistency.

C. Mix mortar as required for immediate use only. Discard any mixed for a period exceeding 2-1/2 hours. Non-colored mortar only may be re-tempered as required to restore proper consistency.

D. Mortar Proportions by Volume

Type	Parts by Volume of Portland Cement	Parts by Volume of Hydrated Lime	Aggregate Measured in a Damp, Loose Condition
M	1	1/4	Not less than 2-1/4 times and not more than 3 times the sum of the volumes of cement and lime used
S	1	Over 1/4 to 1/2	
N	1	Over 1/2 to 1-1/4	

E. Putty made from 92-percent hydrated lime may be used immediately after mixing.

2.03 MORTAR PROPERTIES

A. Mortar shall conform to the property specifications of ASTM C270 and the following:
   1. Compressive Strength: The average compressive strength of three 2-inch cubes of mortar shall not be less than the strength given in the following table for the mortar type specified:

Mortar Type	Average Compressive Strength at 28 Days (psi)
M	2,500
S	1,800
N	750

PART 3 EXECUTION

3.01 REFERENCE MASONRY

A. Reference Unit Masonry Sections for mortar types, color, installation, and protection requirements.

END OF SECTION

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SECTION 04 05 19

MASONRY ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Accessories related to masonry work as specified herein.

B. Related Sections
   1. 03 20 00 – Concrete Reinforcement.
   2. 04 22 00 – Concrete Unit Masonry.

1.02 REFERENCES

A. American Society for Testing Materials (ASTM)
   1. A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. C476 Standard Specification for Grout for Masonry.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Product Data: Shall be manufacturers' printed data sheets on each product and application.

B. Shop Drawings: Provide graphic details of layout and installation.

C. Samples: Provide samples upon request.

D. Manufacturers' installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturers' original sealed packaging.

B. Store products away from direct sunlight, heat sources, and open flame. Replace damaged material before start of installation.

1.06 WARRANTY

A. Warranty in accordance with Section 01 78 36.

PART 2 PRODUCTS

2.01 REINFORCEMENT, ANCHORS AND TIES

A. Acceptable Manufacturers for Reinforcement, Anchors, and Ties:
   1. Dur-O-Wal, a Hohmann & Barnard Company.
   2. Heckmann Building Products, Inc.
   3. Masonry Reinforcing Corporation of America (Wire-Bond).
   4. Or approved equal.

B. Deformed Reinforcing Bars for Wall Reinforcing: Provide under this Section to comply with requirements specified under Section 03 20 00.

C. Horizontal Reinforcement for Single Wythe Concrete Masonry Unit Walls: Ladder-type reinforcing with perpendicular cross rods spaced not more than 16 inches on center, complete with prefabricated corners and tees.
   1. Wire Type and Gauge
      a. Side Rods: Smooth No. 9 cross wires.
      b. Cross Rods: Smooth No. 9 cross wires.
   2. Size: Width to position side wires over masonry unit face shells.
   3. Finish
      a. At interior walls use hot-dipped galvanized, ASTM A153, Class B-2, 1.50 ounce per square foot zinc coating.
   4. Acceptable Manufacturers and Product
      a. Dur-O-Wal, a Hohmann & Barnard Company: DA3200 Single Wythe Ladur.
      b. Comparable product of other specified manufacturers.

D. Horizontal Reinforcing for Cavity Walls with Stud Wall Back-Up: Veneer anchor spaced not more than 16 inches on center.
   1. Wire type and gauge:
      a. Anchor Thickness: 12 gauge.
      b. Vee-Byna-Tie: 3/16 inch.
   2. Vee-Byna-Tie Length: Length to position ties properly over brick masonry units.
   3. Finish: Hot-dipped galvanized, ASTM A153, Class B-2, 1.50 ounce per square foot zinc coating.
   4. Acceptable manufacturers and product:
      a. Dur-O-Wal, a Hohmann & Barnard Company: DW-10.
      b. Comparable product from other specified manufacturers.

E. Wire Mesh Ties: 1/2-inch square mesh of 16-gauge steel wire, 3-inch wide strip by length as indicated or required to provide not less than 2 inches of embedment in mortar joint.
   1. Finish: Hot-dipped galvanized, ASTM A153, Class B-2, 1.50 ounce per square foot zinc coating.
   2. Acceptable Manufacturers and Product:
      a. Dur-O-Wal, a Hohmann & Barnard Company: DA960 – Wire Mesh Ties and Rolls.
      b. Comparable product of other specified manufacturers.

F. Expansion Ties at Concrete, Concrete Block, or Steel: Adjustable tie.
   1. Finish: Hot-dipped galvanized, ASTM A153, Class B-2, 1.50 ounce per square foot zinc coating.
   2. Acceptable manufacturer and product:
      a. Dur-O-Wal, a Hohmann & Barnard Company: DA2200 Joint Stabilizing Anchor.

b. Comparable product of other specified manufacturers.

2.02 ACCESSORIES

A. Backer Rods and Sealants: Provided.

B. Control Joint: As per detail.

C. Horizontal Joint Grout Barrier:
1. Corrosion proof and biologically inert grout barrier which maintains positive bond in mortar joint.
2. Acceptable manufacturer and product:
a. Dur-O-Wal, a Hohmann & Barnard Company: DA1018 Dur-O-Stop.
b. Comparable product of other specified manufacturer.

2.03 GROUTS AND CONCRETE FILL

A. Grout: ASTM C476, except masonry cement not permitted for vertically reinforced masonry. Compressive strength 3,000 pounds per square inch in 28 days, unless otherwise indicated. Not less than 9-inch slump at mixing and not more than 10-inch slump at placement.

PART 3 EXECUTION

3.01 INSTALLATION OF ACCESSORIES IN MASONRY

A. Wall Reinforcing: Insert wall reinforcing at courses specified in Section 04 22 00. Overlap reinforcing 6 inches, install prefabricated corner reinforcing, and extend into intersecting walls. Bend and overlap wires at wall ends, vertical control joints, or jambs.

3.02 CONTROL JOINTS

A. Control Joints: Provide constant width joint as detailed.

B. Interrupt wall reinforcing at control joints.

3.03 ANCHORAGE OF INTERSECTING WALLS OR PARTITIONS

A. Partitions Intersecting Bearing Walls and Exterior Walls: Use expansion ties every second course as detailed.

B. Partition intersection, other than that noted in Paragraph A, use prefabricated corners or tees.

END OF SECTION

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SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Work under this Section includes providing labor, materials, and equipment necessary for the complete erection of the concrete block and related materials in accordance with the Drawings and Specifications.
2. Complete masonry Work as shown and detailed on the Drawings and otherwise as required, including but not limited to the following:
   a. Mortar materials.
   b. Block and other masonry unit materials.
   c. Masonry reinforcing materials.
   d. Miscellaneous bond beams and lintels.
   e. Grout for reinforced masonry walls.

B. Related Sections
1. 04 05 13 – Mortar.
2. 04 05 19 – Masonry Accessories.
3. 08 11 00 – Metal Doors and Frames.
4. 09 91 00 – Painting.

1.02 REFERENCE STANDARDS

A. The following specifications and standards are incorporated by reference:
1. American Society for Testing Materials (ASTM):
   a. C33 Standard Specification for Concrete Aggregates.
   b. C90 Standard Specification for Load-bearing Concrete Masonry Units.
   c. C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   d. C476 Standard Specification for Grout for Masonry.
   e. C1314 Standard Test Method for Compressive Strength of Masonry Prisms.
2. The Masonry Society
   a. 402 Building Code Requirements and Specifications for Masonry Structures.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 QUALITY ASSURANCE

A. Compressive Strength Verification by the Unit Strength Method:
1. Unless noted otherwise, compressive strength of masonry shall be determined by the Unit Strength Method per ASTM C140.

1.05 SUBMITTALS

A. Test Reports: Submit test reports in duplicate indicating compliance with applicable Specifications for compressive strength, absorption, weight, moisture content, and dimensions for each type of masonry unit.

B. Water Proofers and Highlighting Sealers: Furnished and installed as specified in Section 09 91 00.

C. Block Certificates: Submit manufacturer's Block Certificates as required for each type and size of block used on the Project.

1.06 HANDLING, DELIVERY, AND STORAGE

A. Handle, transport, and store at the Site in a manner that will avoid damage.

B. Concrete masonry units shall be protected from wetting prior to use. The units shall be cubed on pallets at the time of manufacture and shall be delivered to the Site with waterproof coverings. It shall be the Contractor's responsibility to see that the units remain covered on the Project.

PART 2 PRODUCTS

2.01 MASONRY UNITS

A. Concrete masonry units shall be of modular dimensions; shall conform to the ASTM Specifications, and the modifying and additional requirements as indicated below:
   1. Hollow Load Bearing Units: ASTM C90.
   2. Minimum compressive strength of 2,000 psi.
   3. Unless otherwise noted, all units shall be normal weight aggregate (ASTM C33).
   4. Bullnose block units shall be furnished and installed at jambs and where indicated on the Drawings.
   5. **All CMU shall be Open Core ("H" block) style units.**

B. Reinforcement
   1. Joint reinforcement shall be steel wire ladder type, 3/16-inch diameter manufactured in accordance with ASTM A-82, hot dipped galvanized in accordance with ASTM A153, Class B2.
   2. Reinforcing steel shall be ASTM A615 Grade 60 deformed billet bars.

C. Grout
   1. Grout 28-day strength compressive strength f_g shall be 2,500 psi

D. Special Units:
   1. Standard Concrete Block (CMU): Shall be 8 inches high, normal weight, and conforming to the requirements specified above. Provide bullnose edges at all outside corners.
      a. Acceptable Manufacturers:
         1) Amcon Block and Precast, Inc.
         2) Anchor Block Company.
         3) County Materials Corporation.
         4) Or approved equal.

PART 3 EXECUTION

3.01 MORTAR

A. Mortar proportioning and mixing is specified in Section 04 05 13.

B. Tempering: The consistency of mortar may be adjusted to the satisfaction of the mason
   1. Use mortar within 2-1/2 hours after mixing.

C. Lay masonry in mortar of the type specified below, unless otherwise noted:

Kind of Masonry	Masonry Type
Load-bearing masonry in contact with the ground	M
Load-bearing construction and exterior single-wythe masonry	S
Exterior veneer masonry (Brick, stone, etc.)	N
Masonry other than above	N

D. Mortar Color: As selected by the Architect.

3.02 LAYING UNIT MASONRY

A. Lay masonry in straight, uniform courses, plumb and true to line and plane, unless otherwise specified or indicated on the Drawings:
   1. Use face shell bedding with full coverage of face shells of hollow units, full bed for solid units.

B. Build in property anchors, ties, plates, beams, lintels, flashings, inserts, etc. which come in contact with masonry work:
   1. Consult other trades in advance and make provisions for installation of their work in order to build in Work specified under other Sections of these Specifications as the Work progresses.
   2. No cutting or drilling shall be done without the permission and instruction of the General Contractor.

C. Reinforce concrete block masonry work with wall reinforcing, starting at every second course in bearing walls and every second course in non-bearing walls:
   1. Bond facing units to backing with reinforcing and metal ties as specified.
   2. Corners and ends shall be formed by cutting and bending to fit by use of prefabricated corner units. Place reinforcing in the first and second bed joints above and below opening or recesses where possible.
   3. Terminate reinforcing on each side of control joints.

D. Fill Solid with Concrete or Grout:
   1. The entire core under bearing plates.
   2. Top course of bearing walls and around openings as shown on Drawings.

E. Masonry units shall be cut with saws and shall be free from broken or chipped corners. Shells and cross webs of hollow masonry units shall be loaded with mortar. Units shall be

shoved in place so that joints are completely filled without pointing. Facing material shall be free from mortar smears.

F. Wetting of concrete units before laying is not permitted.

G. Construct bond beams as detailed.

H. Pattern: CMU courses shall be laid in running bond, unless otherwise noted on the Drawings.

I. Control and Expansion Joint:
   1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
      a. Exterior Walls: 20 feet on center and within 24 inches on 1 side of each interior and exterior corner.
      b. Interior Walls: 30 feet on center.
      c. At changes in wall height.
   2. Do not continue horizontal joint reinforcement through control and expansion joints.

3.03 JOINTS

A. Where new mortar joints join masonry that is partially set or totally set, the exposed surface of the set masonry shall be cleaned so as to obtain the best possible bond with the new work.

B. If it becomes necessary to stop a continuous horizontal run of masonry, step back a minimum of 1/2 unit length in each course. Toothing will not be permitted, except upon written approval of the Architect or Engineer.

C. Where cutting of exposed units is necessary, the cuts shall be made with a motor-driven masonry saw.

D. Exposed mortar head and bed joints in block walls shall have a thickness equal to the difference between the actual dimension and nominal dimensions of the unit, either in height or in width.

3.04 TOOLING, CLEANING, POINTING

A. Tool all unit masonry joints, including block covered by finishes and block below grade.

B. Tool joints in exposed interior and exterior concrete block.
   1. Unless shown on the Drawings, joints shall be tooled concave and smooth with a 5/8-inch round bar tool for weather tightness and appearance.

C. After mortar has cured thoroughly, clean exposed masonry. If stiff brushes and water are not adequate, clean masonry with cleaning materials and methods approved by the masonry manufacturer. Cleaning shall not result in discoloration of masonry.

D. At completion of Work, point holes or defective mortar joints and where necessary cut out and re-point defective joints.

3.05 PROTECTION OF WORK

A. Protect Facing Material, Sills, and Ledges Against Staining:
   1. Keep top of wall covered with non-staining waterproof coverings at end of day and when Work is not in progress at the wall.
   2. Anchor coverings securely, overhang at least 2 feet on each side of wall.
   3. When Work is resumed, clean off all loose mortar from top surface.

B. Lay no masonry when the temperature of the outside air is below 40 degrees F or is anticipated to fall below 40 degrees F, unless suitable means are provided to heat the masonry materials and maintain the completed work at a temperature of 40 degrees F.
   1. Mortar ingredients should be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Every effort should be made to produce consecutive batches of mortar with the same temperatures falling within this range. The mortar temperature after mixing and before use should be above 40 degrees F, maintainable either by auxiliary heaters under the mortar board or by more frequent mixing of mortar batches. Heated mortar should not become excessively hot (greater than 120 degrees F).
   2. Cold Weather Requirements While Work is Progressing:
      a. Use dry masonry units with a surface temperature of not less than 40 degrees F. wet or frozen masonry units shall not be laid.
      b. Air Temperature 40 Degrees F to 32 Degrees F: Sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F.
      c. Air Temperature 32 Degrees F to 25 Degrees F: Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Maintain temperatures of mortar on boards above freezing.
      d. Air Temperature 25 Degrees F to 20 Degrees F: Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Maintain temperatures of mortar on boards above freezing. Salamanders or other sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
      e. Air Temperature 20 Degrees F and Below: Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain temperature above 32 degrees F. Temperature of units when laid shall be not less than 20 degrees F.
   3. Concrete block walls indicated to receive vertical reinforcing shall be maintained at a temperature of not less than 40 degrees F for a period of not less than 48 hours after the vertical reinforcing has been grouted. Contractor shall verify and document surface temperatures of the concrete block units prior to placement of grout at vertical reinforcing locations.
   4. In order to avoid "thermal shock" in concrete block walls, the heat (either temporary or permanent) shall be turned on or off at a rate not to exceed 20 degrees per hour or approximately 50 degrees F per 24 hours.

3.06 GROUTING MASONRY

A. Grouting shall be placed by pouring in lifts not exceeding 5 feet in height. It shall be consolidated by vibrating during placement and reconsolidated after excess moisture has been absorbed but before plasticity is lost.

B. Special care shall be given to holding reinforcing steel in the proper position during the grouting operation. Utilize rebar positioners when necessary.

C. Install a horizontal joint grout barrier when flow-thru bond beam blocks are utilized. Do not use roofing felt or other materials that will inhibit bonding between the bond beam and the masonry below.

D. Stop grout placement 1-1/2 inches below bed joints to create a shear key between successive grout pours. Stop grout placement 1/2 inch below the top of masonry at bond beams.

3.07 TESTING

A. Prism tests on all widths and types of CMU shall be provided in accordance with Division 01. Copies of tests shall be distributed to the Architect/Engineer, the Owner, and the Local Building Inspector.

END OF SECTION

SECTION 05 12 00A

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install all structural steel columns, beams, purlins, bracing, and connections.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)
   1. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

B. American Welding Society (AWS)
   1. Structural Welding Code D1.1.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Submittals shall conform to Section 01 33 00.

B. Shop Drawings: Submit shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Indicate welded connections using standard AWS welding symbols.

1.05 PRODUCT HANDLING

A. Store materials to permit easy access for inspection and identification. Materials shall all be properly marked to identify the structure for which it is intended. Markings shall correspond to markings indicated on the shop drawings.

B. Keep steel members off the ground using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL

A. Structural Steel Wide Flange Shapes: ASTM A992, unless otherwise indicated on the Drawings.

B. Structural Steel Channels, Angles, Plate, Bars, S- and M- Shapes: ASTM A36.

C. Hollow Structural Sections: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53, Grade B, Schedule 40, unless otherwise indicated on the Drawings.

E. Anchor Bolts, Nuts, and Washers: Where bolts are anchored into concrete ASTM A307, hot dipped galvanized.

F. Bolts, Nuts, and Washers Connecting Steel to Steel: ASTM A325, 3/4 inch diameter, unless noted otherwise. Washers shall conform to ASTM F436.

G. Welding Electrodes and Fluxes: Conform to AWS D1.1.

H. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finish carbon steel with dimensions complying with AISC specifications.

I. Shop Paint: Conform to Steel Structures Painting Council Paint Specification No. 13.

2.02 HIGH STRENGTH BOLTS

A. High strength bolts, nuts, and washers shall conform to ASTM A325.

B. All high strength bolts shall have a twist-off tension indicator device.

C. Zinc coated bolts and nuts shall be shipped in the same container.

2.03 ANCHOR BOLTS

A. Anchor bolts shall be threaded rod conforming to ASTM A36.

B. Nuts shall conform to ASTM A563, Grade A, heavy hex.

C. Washers shall be fabricated from steel plate conforming to ASTM A36.

D. All anchor bolts, nuts, and washers shall be galvanized.

2.04 WELDING ELECTRODES

A. Welding electrodes shall conform to AWS D1.1.

2.05 NON-SHRINK GROUT

A. Non-shrink grout for base plates shall conform to Section 03 60 00.

2.06 FABRICATION

A. Fabricate steel members in accordance with AISC - Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

2.07 SHOP PAINTING

A. Shop paint all steel fabrications.

B. Surface Preparation: After inspection and before shipping, clean steel to be painted. Remove loose rust, loose mill scale and spatter, slag or flux deposits. Clean steel in

accordance with Steel Structures Painting Council Surface Preparation Specification No. 2 - Hand Tool Cleaning.

C. Shop Paint: Immediately after surface preparation apply 1 coat of alkyd metal primer accordance with manufacturer's instructions at a rate to provide a uniform dry film thickness of 2.0 mils minimum.

2.08 GALVANIZING

A. Galvanize structural shapes, plates, and bars in accordance with ASTM A123.

B. Galvanize hardware and miscellaneous items in accordance with ASTM A153.

C. All anchor bolts shall be galvanized, unless noted.

PART 3 EXECUTION

3.01 ERECTION

A. Erect steel members in accordance with AISC - Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

B. All field welding shall be performed by certified welders in accordance with AWS D1.1.

C. Tighten high strength bolts and provide washers in accordance with AISC - Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

D. Grout base plates.

END OF SECTION

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SECTION 05 31 00

STEEL DECKING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install steel roof deck, opening reinforcements, fasteners, and accessories.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Submittals shall conform to Section 01 33 00.

B. Submit complete shop drawings. Drawings shall include the following:
   1. Deck drawing.
   2. Deck profile dimensions.
   3. Details for anchorages, supports, projections, openings, and reinforcements.
   4. Finishes.

C. Submit manufacturer's specification for installation, storage, and handling of decking.

D. Submit manufacturer's specifications, published diaphragm shear force values, and fastener layout drawings for fasteners.

1.04 QUALITY ASSURANCE

A. Design, manufacture, and install metal deck in accordance with the "Steel Deck Design Manual," latest edition by the Steel Deck Institute.

B. Perform welding by personnel qualified according to Section 5 of the A.W.S. D1-1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, unload, store, and erect decking in a manner to completely protect the deck from damage, including the paint surface. Cover deck and accessories in storage with a waterproof covering and keep off ground.

B. Do not place or store metal deck on steel joists or beams until they are permanently anchored and bridged. Avoid excessive concentrated loads during construction by distributing piles of deck to ensure that the load carrying capacity of the joists is not exceeded.

PART 2 PRODUCTS

2.01 STEEL DECK

A. Roof Deck Shall Conform to the Following:
   1. ASTM A611, Grade C.
   2. ASTM A653, Galvanized, Minimum of 0.9 ounces/sq. ft. Zinc Coating.
   3. Deck Configuration: 1-1/2 inches deep, wide rib configuration, 22-gauge minimum thickness.

B. Sheet metal accessories shall comply with ASTM A526.

2.02 FASTENERS

A. Fasteners for fastening steel deck to steel supports 1/8 inch to 3/8 inch thick shall be Hilti ENP2K powder actuated pin fasteners manufactured by Hilti Fastening Systems, or approved equal.

B. Fasteners for fastening steel deck to steel supports greater than 1/4 inch thick shall be Hilti ENP2 powder actuated pin fasteners manufactured by Hilti Fastening Systems, or approved equal.

C. Values of acceptable fastener shear forces shall be published by the Steel Deck Institute.

D. Welding of the steel deck will not be permitted.

E. Fasteners for fastening steel deck side laps shall be No. 10 screws.

2.03 FABRICATION

A. Form deck units in lengths to span 3 or more supports with nested 2 inch minimum laps at the ends and interlocking or nested side laps, unless otherwise indicated.

B. Provide deck configurations complying with SDI "Basic Design Specifications," of the gauge, depth, and width shown on the Drawings and specified herein.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Place steel deck units on supporting members and adjust to final position with proper bearing dimensions, end and side laps in accordance with approved shop drawings and the manufacturer's specifications and erection layouts. Deck shall be continuous over 3 spans. Do not stretch or contract side lap interlocks.

B. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

C. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection. Extend each deck section of minimum of 3 supports members, unless otherwise indicated.

D. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

E. Do not use floor or roof deck units for storage or working platforms until permanently secured.

F. When decks rest on masonry walls or steel beams over a partition or at an exterior wall, the hollow space between the webs of the deck shall be closed off with rubber closures secured in place with screws or adhesive or shall be grouted solid.

G. All areas of metal decking shall be bounded by steel edge angles, 2 by 2 by 3/16 minimum, securely fastened to roof or wall framing by bolting or welding.

3.02 FASTENING DECK UNITS

A. Fasten decking to steel supports using proper mechanical fasteners for base material thickness as listed in the Hilti Product Technical Guide.

B. Fastener pattern shall be as shown on the approved shop drawings.

C. Fasteners shall be driven into the base material so that the two metal washers are tight together, pressing the deck sheet firmly against the base material, but are not cutting into the deck material. Ensure that all fasteners penetrate steel decking as well as steel base materials, providing secure anchorage.

D. Prior to beginning deck fastening, verify that fastener tool settings are correct and that test fasteners are installed within driving depth tolerances. Installation depths shall be measured with a Hilti Standoff Gauge.

E. Notify Hilti representative and Engineer of any problems encountered achieving proper fastening depths.

F. Fastener installation may proceed when any 20 fasteners, selected at random within a 10-foot by 10-foot area of deck, are measured to be within nail head standoff tolerances.

G. Any and every fastener determined to be outside allowable nail head standoff tolerances shall be left in place and have an additional adjacent fastener properly installed within 2 to 6 inches.

H. Sidelap fastener screw spacing shall be as shown on the Drawings, but shall not exceed 36 inches.

3.03 CUTTING, REINFORCEMENTS, AND ACCESSORIES

A. Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking as shown.

B. Provide additional metal reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work shown. If not otherwise indicated provide the following:
   1. Openings 6 to 18 Inches: 2 inch by 2 inch by 1/4 inch steel angles.
   2. Place angles perpendicular to flutes, extend minimum 2 flutes each side of opening and weld to deck.

C. Weld to top surface of roof decking and secure to wood nailers with galvanized nails and to steel framing with welds or galvanized self-tapping screws. Space fasteners or welds at 12 inches o.c. Lap end joints not less than 3 inches and secure with galvanized sheet metal screws.

3.04 CLEAN-UP AND PAINTING

A. After decking installation, clean and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members
   1. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
   2. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

B. Upon completion of erection, promptly remove all tools, equipment, and rubbish caused by or resulting from the roof deck erection work and perform such final cleaning service as may be necessary to leave Site in acceptable condition.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install all metal fabrications.

1.02 REFERENCES

A. Aluminum Association (AA)
   1. Specification for Aluminum Structures.

B. American Institute of Steel Construction (AISC)
   1. Specification for the Design, Fabrication, and Erection of Structural Steel for Building.

C. American Welding Society (AWS)
   1. Structural Welding Code D1.1.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Submittals shall conform to Section 01 33 00.

B. Product Data: Submit product data or manufacturer's specifications indicating compliance with requirements specified herein.

C. Shop Drawings: Submit shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Indicate welded connections using standard AWS welding symbols.

1.05 PRODUCT HANDLING

A. Store materials to permit easy access for inspection and identification. Materials shall all be properly marked to identify the structure for which it is intended. Markings shall correspond to markings indicated on the shop drawings.

B. Keep steel members off the ground using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

PART 2 PRODUCTS

2.01 STEEL MATERIALS

A. Structural Steel Wide Flange Shapes: ASTM A992, unless otherwise indicated on the Drawings.

B. Structural Steel Channels, Angles, Plate, Bars, S- and M- Shapes: ASTM A36.

C. Hollow Structural Sections: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53, Grade B, Schedule 40, unless otherwise indicated on the Drawings.

E. Anchor Bolts, Nuts, and Washers: Where bolts are anchored into concrete ASTM A307, hot dipped galvanized.

F. Bolts, Nuts, and Washers Connecting Steel to Steel: ASTM A325, 3/4 inch diameter, unless noted otherwise. Washers shall conform to ASTM F436.

G. Welding Electrodes and Fluxes: Conform to AWS D1.1.

H. Headed Stud-Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finish carbon steel with dimensions complying with AISC specifications.

I. Shop Paint: Conform to Steel Structures Painting Council Paint Specification No. 13.

2.02 STAINLESS STEEL

A. Shapes, Bars, and Rods: ASTM A276, Type 316 or 316L.

B. Sheets, Strips, and Plates: ASTM A167, Type 316 or 316L.

C. Type 316L stainless steel shall be used for welded construction.

2.03 ALUMINUM MATERIAL

A. Aluminum Shapes: ASTM B308, Alloy 6061-T6.

B. Aluminum Sheet and Plates: ASTM B209, Alloy 6061-T6.

C. Bolts, Nuts, and Washers: 300 Series stainless steel.

D. Welding: Conform to AA-Specification for Aluminum Structures.

2.04 CAST IRON MATERIALS

A. Cast iron shall comply with the requirements of the latest Standard Specification for Cast Iron Pipe and Special Castings of the American Society of Testing Materials.

2.05 NON-SHRINK GROUT

A. Non-shrink grout shall be a ready to use, non-shrink, non-metallic aggregate product requiring only the addition of water at the Site.

B. Non-shrink grout shall meet the requirements of Corps of Engineers Specification CRD-C-621.

2.06 ANCHORS

A. Expansion anchors for fastening to cast-in-place concrete shall be Hilti Type 316 Stainless Steel Kwik Bolts, or approved equal. Size as shown on Drawings.

B. Sleeve anchors for fastening to cast-in-place concrete and solid grouted masonry shall be Hilti Sleeve Anchors, or approved equal. Size as shown on Drawings.

C. Adhesive anchors for fastening to masonry shall be Hilti Standard HIT Anchor, or approved equal. Size as shown on Drawings.

2.07 FABRICATION

A. Verify dimensions on Site prior to shop fabrication.

B. Fabricate items with joints neatly fitting and properly secured. All tolerances for built-up and rolled shapes shall meet or exceed ASTM A6.

C. Use only materials which are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled grade names, and roughness. Remove blemishes by grinding, or by welding and grinding prior to cleaning, treating, and application of surface finishes.

D. Shop fabricate and assemble in shop to greatest extent possible. Sections shall be full length pieces between connections or splices.

E. Grind exposed welds smooth and flush with adjacent finished surfaces.

F. Supply components required for proper anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, unless otherwise specified in schedule herein.

2.08 SHOP PAINTING

A. Shop paint all steel fabrications.

B. Surface Preparation: After inspection and before shipping, clean steel to be painted. Remove loose rust, loose mill scale and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council Surface Preparation Specification No. 2 - Hand Tool Cleaning.

C. Shop Paint: Immediately after surface preparation, apply shop paint in accordance with manufacturer's instructions at a rate to provide a uniform dry film thickness of 1.5 mils minimum. Maintain minimum coverage at joints, corners, edges, and exposed surfaces.

D. In special areas indicated in Section 09 90 00, use primer compatible with painting systems used.

2.09 GALVANIZING

A. Galvanize structural shapes, plates, and bars in accordance with ASTM A123.

B. Galvanize hardware and miscellaneous items in accordance with ASTM A153.

C. All anchor bolts shall be galvanized, unless noted.

2.10 GALVANIZING COATING PAINT

A. Wash Primer: Vinyl butyral acid.

B. Primer: Converted epoxy, epoxy phenolic, or urethane type, minimum 14-pounds metallic zinc content per gallon.

C. Apply in strict accordance with manufacturer's specifications.

PART 3 EXECUTION

3.01 ERECTION

A. Install items square and level, accurately fitting, and free from distortion or defects. Shim and grout as necessary.

B. Make provision for erection stresses by temporary bracing. Keep work in alignment.

C. Replace items damaged in course of installation.

D. Perform field welding in accordance with AWS D1.1.

E. A325 Bolts: Tighten bolts and provide washers in accordance with "Specifications for Structural Joints" for ASTM A325 bolts.

F. Aluminum surfaces in contact with or embedded in concrete shall be coated with 2 coats of bituminous paint.

3.02 TOUCH-UP PAINTING AND CLEAN-UP

A. After installation, clean and touch up field welds, bolt connections, and scratched and damaged prime painted surfaces. Use a primer consistent with shop coat.

B. Repair damaged or scratched galvanized coatings. Solvent clean damaged area with a wash primer, 1 coat, 4-mil dry film thickness. Clean by hand tool, power tool, or brush off blast. Apply 3 coats of organic zinc paint with a minimum dry film thickness of 3 mils per coat.

3.03 SCHEDULE OF ITEMS

A. Supply and install metals indicated on the Drawings and listed herein complete with anchorage and attachments necessary for installation.

B. Framing, Supports, and Lintels
   1. Provide framing members, supports, lintels, and required connections as shown on the Drawings.
   2. Fabricate steel to sizes, shapes, and profiles shown. Unless otherwise indicated, fabricate steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware and similar items.
   3. Loose angle lintels and lintel beams shall be detailed for a minimum bearing of 8 inches, unless otherwise indicated.

C. Steel Stairs
   1. Furnish and install steel stairs as shown on the Drawings.
   2. Steel stair stringers shall be C12 by 20.7, unless noted otherwise.
   3. Provide closures at ends of channels.
   4. Provide continuous welds, ground smooth where exposed.

D. Steel Ladders
   1. Furnish and install steel ladders as shown on the Drawings.
   2. Galvanize ladders and connections in accordance with ASTM A123.
   3. All ladders shall conform to OSHA Section 1910.27.

E. Aluminum Ladders
   1. Furnish and install aluminum ladders as shown on the Drawings.
   2. Fabricate ladders from aluminum alloy 6061-T6 as detailed on the Drawings.
   3. Provide prefabricated ladder rungs with serrated, non-slip surface.
   4. All ladders shall conform to OSHA Section 1910.27.

F. Aluminum Grab Bars
   1. Furnish and install aluminum grab bars as shown on the Drawings.
   2. Fabricate grab bars from aluminum alloy 6061-T6 as detailed on the Drawings.

G. Steel Railing
   1. Furnish and install steel pipe railings as shown on the Drawings.
   2. Pipe rails and posts shall be welded 1-1/2 inch (1.9-inch o.d.) extra-strong steel pipe.
   3. Pipe rail heights, spacing, and mounting details shall be as shown on the Drawings.
   4. Fabricate railing in largest sections possible to minimize field connections.
   5. Field splices shall not be more than 6 inches from a post or bracket.
   6. Field connections shall be tightly fitting sleeve type connections with sleeve projecting a minimum of 3 inches into each rail. Provide a minimum of 2 flush set rivets on each side of connection.
   7. All ends of railings shall terminate at posts or shall be provided with a return section. Railings against walls shall be supported with wall brackets to underside of rails. The exposed ends of all railings and posts shall be capped.

H. Aluminum Railing
   1. Furnish and install aluminum pipe railings as shown on the Drawings.
   2. Pipe rails and posts shall be welded 1-1/2 inch (1.9-inch O.D.), Schedule 80, aluminum alloy 6061-T6 pipe.
   3. Pipe rail heights, spacing, and mounting details shall be as shown on the Drawings.
   4. Fabricate railing in largest sections possible to minimize field connections.
   5. Field splices shall be not more than 6 inches from a support post or bracket.

6. Field connections shall be tightly fitting sleeve type connections with sleeve projecting a minimum of 3 inches into each rail. Provide a minimum of 2 flush set rivets on each side of connection.
7. All ends of railings shall terminate at posts or shall be provided with a return section. Railings against walls shall be supported with wall brackets to underside of rails. The exposed ends of all railings and posts shall be capped.
8. All aluminum, including rails, posts, and brackets, shall be provided with a clear anodized finish.
9. Aluminum surfaces in contact with or embedded in concrete shall be coated with 2 coats of bituminous paint.

I. Steel Grating
1. Steel grating shall be standard welded grating with 3/16 inch bearing bars at 1-3/16 inch on center and twisted square cross bars at 4 inches on center. Material shall be ASTM A569 steel.
2. All grating shall be shop galvanized in accordance with ASTM A123.
3. Grating shall be designed for a uniform loading of at least 200 pounds per square foot. Maximum deflection under design loading shall not exceed 1/4 inch.
4. Grating shall be banded around all edges.
5. Recesses for grating shall be 1/4-inch steel angle frames embedded in concrete. Frames shall have mitered and welded corners.
6. Furnish and install stainless steel hold-down clips on all grating sections. All bolts and clips shall be stainless steel.

J. Aluminum Grating
1. Aluminum grating shall be aluminum I-bar type grating with 1/4 inch wide, slip resistant aluminum I-bars at 1-3/16 inches on center and swage locked crossbars at 4 inches on center.
2. Grating shall be designed for a uniform loading of at least 200 pounds per square foot. Maximum deflection under design loading shall not exceed 1/4 inch.
3. Furnish and install recessed angle frames as shown on the Drawings. All frames shall have mitered and welded corners.

K. Steel Floor Plate
1. Steel floor plate shall be ASTM A36 steel plate with raised diamond pattern.
2. All steel floor plate shall be shop galvanized in accordance with ASTM A123.
3. Furnish and install recessed angle frames as shown on the Drawings. All frames shall have mitered and welded corners.

L. Aluminum Floor Plate
1. Aluminum floor plate shall be aluminum alloy 6061-T6 with raised diamond pattern.
2. Furnish and install recessed aluminum angle frames as shown on the Drawings. All frames shall have mitered and welded corners.

M. Floor Drain Grates and Frames
1. Furnish and install floor drain grates and frames as shown on the Drawings.
2. Grates and frames shall be R-4990-XC, Type C as manufactured by Neenah Foundry Co.

N. Sidewalk Trench Covers and Frames
1. Furnish and install sidewalk trench cover and frame as shown on the Drawings.

2. Covers and frames shall be R-4991-CS, Type D as manufactured by Neenah Foundry Co.

O. Concrete Stair Tread Nosing
   1. Furnish and install metal safety nosings on all interior concrete stair treads.
   2. The nosings shall be aluminum replaceable and 3 inches wide.
   3. The nosings shall be Safe-T Metal Style AXPF, American Abrasive Metals Style A, or approved equal.

P. Equipment Lifting Hooks
   1. Furnish and install equipment lifting hooks as shown on the Drawings.
   2. Shop galvanized lifting hook assemblies after fabrication in accordance with ASTM A123.

Q. Trolley Beam Support Assemblies
   1. Furnish and install trolley beam support assemblies as shown on the Drawings.
   2. Shop galvanized trolley beam support assemblies after fabrication in accordance with ASTM A123.

R. Vents
   1. Furnish and install air vents as shown on the Drawings.
   2. Vents shall be Schedule 40 steel pipe with a 180-degree gooseneck, including #24 bronze mesh insect screen.

S. Fabricated Aluminum Hatches
   1. Furnish and install aluminum hatches as shown on the Drawings.
   2. Fabricate hatch with 1/4-inch raised diamond aluminum floor plate, aluminum reinforcement and frame, stainless steel hinges, stainless steel compression spring operators, and aluminum hold-open arm.
   3. Fabricate hatch covers with hasps welded to the aluminum hatch and keyed padlocks for locking. All padlocks shall be keyed to the same lock. Provide 2 keys with each lock.

T. Roof Screen Support Posts
   1. Furnish and install roof screen support post assemblies as shown on the Drawings.

U. Steel Pipe Guard Posts (Bollards)
   1. Furnish and install steel pipe guard posts as shown on the Drawings.

V. Pipe Anchorage Assemblies
   1. Furnish and install the pipe anchorage assemblies for anchoring large pipes as shown on the Drawings.

W. Pipe Hanger Inserts
   1. Furnish and install all large pipe hanger inserts as shown on the Drawings.
   2. Shop galvanized assemblies after fabrication in accordance with ASTM A123.

X. Automatic Switch-Over Frame
   1. Furnish and install a steel frame for mounting the automatic chlorine switch-over devices as shown on the Drawings.

Y. Spray Wash Pipe Support
   1. Furnish and install the steel pipe supports for securing the spray wash pipe as shown on the Drawings.
   2. Shop galvanized assemblies after fabrication in accordance with ASTM A123.

Z. Backwash Baffle
   1. Furnish and install stainless steel baffles over the filter backwash pipes as shown on the Drawings.
   2. Fabricate baffles from type 316 stainless steel.

END OF SECTION

SECTION 05 51 13

ALUMINUM STAIRS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Aluminum stairs engineered and detailed by fabricator.
   2. Contractor has option to provide either shop fabricated or factory fabricated systems complying with profiles and configurations indicated.

B. Related Sections
   1. 03 30 00 – Cast-In-Place Concrete.
   2. 04 22 00 – Concrete Unit Masonry.

1.02 SYSTEM DESCRIPTION

A. Design Requirements: Fabricator's engineer shall provide engineering design and certification for entire stair system, including components, connections, and embedded materials. Comply with profiles and size limitations indicated.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Product Data: Manufacturer's specification and technical data, including detailed specification of construction, fabrication, and recommended installation instructions.

B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, including specific requirements indicated:
   1. Construction details, sizes of metal sections, thicknesses of metals, profiles, attachments, dimensions and field joints, method of support from structure, finishes, and work to be built-in or provided by other Sections.
   2. Welding: Indicate welded connections, both shop and field, using standard AWS welding symbols. Indicate net weld lengths.
   3. **Shop Drawings shall be signed by a Professional Engineer registered in the state in which the Project is located**:
      a. Do not submit design calculations.

C. Quality Control Submittals
   1. Statement of qualification for manufacturers and installers.
   2. Professional certifications.

1.05 QUALITY ASSURANCE

A. Installer's Qualifications: Firm experienced in installation of systems similar in complexity to those required for this Project.

B. Certifications: Perform design work of this Section under the direct supervision of a Professional Engineer registered in the state in which the Project is located.

1.06 PRODUCT HANDLING

A. Store materials to permit easy access for inspection and identification. Materials shall all be properly marked to identify the structure for which it is intended. Markings shall correspond to markings indicated on the shop drawings.

B. Keep aluminum members off the ground using pallets, platforms, or other means of support. Protect aluminum members and packaged materials from corrosion and deterioration.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Shapes: ASTM B308, Alloy 6061-T6.

B. Aluminum Sheet and Plates: ASTM B209, Alloy 6061-T6.

C. Bolts, Nuts, and Washers: 300 Series stainless steel.

2.02 COMPONENTS

A. Design and fabricate aluminum stairs to comply with recommendations of NAAMM Metal Stair Manual.

B. Aluminum Stair/Ships Ladder Fabrication: Fabricate to dimension requirements and configurations indicated:
   1. NAAMM Classification: Industrial class (Ships Ladder).
   2. NAAMM Classification: Service class.
   3. NAAMM Classification: Commercial class.
   4. Design Loading
      a. Design and fabricate stairs, landings, and component connections to support live loads of not less than 100 pounds per square foot creating a deflection not to exceed the lesser of 1/360 of span or 0.25 in.
      b. Design and fabricate treads to support a concentrated load of 300 pounds on a 4-inch square area centered on tread length.
      c. Design and fabricate integral guardrails, railings and component connections to be capable of resisting a load of 200 pounds applied in any direction at any point on the top rail and a vertical and horizontal thrust of 50 pounds per lineal foot applied to the top railing without permanent set or damage. The 2 loads are not cumulative. Stair guardrail and handrail components shall not be less than those shown in Paragraph 2.02.B.
   5. Stringers: Profile and sizing by fabricator using channel, unless otherwise indicated.

6. Treads: Grating Type:
   a. Layout and design by fabricator.
7. Landings (Platform): Grating Type:
   a. Layout and design by fabricator.

C. Aluminum Guardrail and Handrails
1. Furnish and install aluminum pipe guardrails and handrails as shown on the Drawings.
2. Stair guardrail pipe rails and posts shall be welded 1-1/2 inches (1.9 inches O.D.), Schedule 80, aluminum alloy 6061-T6 pipe.
3. Stair handrail pipes and returns shall be welded 1-1/4 inches (1.66 inches O.D.), Schedule 40, aluminum alloy 6061-T6 pipe. Provide clear anodized finish.
4. Stair guardrail and handrail pipe rail heights, spacing, and mounting details shall be as shown on the Drawings.
5. Fabricate stair railings in largest sections possible to minimize field connections.
6. Field splices shall be not more than 6-inches from a support post or bracket.
7. Field connections shall be tightly fitting sleeve type connections with sleeve projecting a minimum of 3 inches into each rail. Provide a minimum of 2 flush set rivets on each side of connection.
8. All ends of stair railings shall terminate at posts or shall be provided with a return section. Railings against walls shall be supported with wall brackets to underside of rails. The exposed ends of all railings and posts shall be capped.
9. All aluminum, including rails, posts, and brackets, shall be provided with a mill finish, unless otherwise indicated.
10. Aluminum surfaces in contact with or embedded in concrete shall be coated with 2 coats of bituminous paint.

D. Handrail Wall Brackets: Aluminum, 2-inch by 2 1/2-inch wall plate, center of rail located to maintain 1 1/2-inch clearance between rail and face of wall:
1. Acceptable Manufacturers and Product:
   a. Julius Blum and Company, Inc.: No. 477.
   b. R and B Wagner, Inc.: No. SA515.
   c. Or approved equal.

2.03 ACCESSORIES

A. Fasteners: Determined by fabricator for specific application, unless specific fastener is indicated:
1. Bolts, Nuts, Washers, and Other Fasteners: As recommended by the manufacturer/fabricator:
   a. Expansion anchors for fastening to cast-in-place concrete shall be Hilti Stainless Steel Kwik Bolts, or approved equal. Size as shown on Drawings.
   b. Adhesive anchors for fastening to masonry shall be Hilti HIT HY 150 or approved equal. Size as shown on Drawings.

B. Non-Metallic Shrinkage Resistant Grout: in accordance with Section 03 60 00.

2.04 GENERAL FABRICATION OF ALUMINUM STAIRS/SHIPS LADDER

A. When cutting, shearing, and forming, leave clean, true uniform lines and surfaces, free from buckles and twists. Remove burrs from cut edges.

B. Welding: Comply with AWS D1.2:
   1. On connections exposed in finished work, grind welds smooth and flush with adjacent surfaces. Welds shall be finished to match adjacent mill aluminum surfaces.

C. Mechanical Fastening (Bolts and Screws): Except where welded connections or other connections are indicated, provide mechanical fasteners for field connections. Connections shall be designed by the fabricator, unless detailed on Drawings:
   1. Conceal mechanical fasteners whenever possible. Where not possible to conceal, use flush countersunk type, unless indicated otherwise.

D. Make exposed mechanically fastened joints flush butt type hairline joints.

E. Supply components required for proper anchorage of aluminum fabrications. Fabricate anchorage and related components of same material and finish as aluminum fabrication, unless otherwise indicated.

F. Shop assembles in largest practical sizes that can be easily handled through building openings and accessibility routes.

G. Coordinate ships ladder fabrication with odor control tank vendor.

2.05 FINISHING

A. Aluminum surfaces in contact with or embedded in concrete shall be coated with 2 coats of bituminous paint.

B. Exposed aluminum stair member surfaces shall be mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper and timely completion.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install stairs square, level, plumb, and free from distortion or defects detrimental to appearance and performance.

B. Align stairs with adjacent construction.

C. Install nosings at stair/ships ladder tread and landing edges to comply with manufacturer's recommendations.

D. Perform cutting and altering work to provide for installation of work of other Sections that does not affect stair appearance or structural integrity.
   1. Do not perform cutting and altering that will affect appearance or structural integrity without Architect's review.

E. Field Welding: Perform same as specified for welding under Fabrication in Part 2 – Products:
   1. Touch up welds to match adjacent mill finish.

F. Field Mechanical Fastening: Perform same as specified for mechanical fastening under Fabrication in Part 2 - Products.

3.03 CLEANING

A. Clean field welds, bolt connections, and scratched or damaged surfaces to match adjacent mill finish.

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Dimension/framing lumber.
2. Bracing, blocking, sills, nailers and miscellaneous components.
3. Rough framing connection and anchorage hardware.
4. Related accessories and miscellaneous materials.

1.02 REFERENCES

A. American Society of Testing Materials (ASTM)
1. A307 – Specification for Carbon Steel Bolts and Studs.
2. D226 – Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

B. Forest Stewardship Council: FSC Guidelines - Forest Stewardship Council Guidelines.

C. American Wood Council
1. 2018 National Design Specification for Wood Construction.

D. Uniform Building Code (UBC) Standard No. 42-1

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data, including the following:
1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.

B. Materials Resources Certificates
1. Certify source for regional materials and distance from Project site.
2. Certify lumber is harvested from Forest Stewardship Council Certified well managed forest.

C. Shop Drawings: Show dimensioned layout, materials provided, connection details, etc.

D. Samples: Submit as requested by the Architect/Engineer.

1.05 QUALITY ASSURANCE

A. Lumber Standards: Conforming to Voluntary Product Standard PS20. Mark material with official grade mark of specified agency. Grading rules of the following agencies apply:
   1. West Coast Lumber Inspection Bureau (WCLIB).
   2. Western Wood Products Association (WWPA).
   3. Southern Pine Inspection Bureau (SPIB).
   4. Redwood Inspection Service (RIS).

B. Plywood Standards: Conforming to Voluntary Product Standard PS1 and identified with appropriate grade and trademark of American Plywood Association (APA). Mark material with official grade mark of specified agency.

C. Lumber Certification: Identified with grade stamp of an agency certified by National Forest Product Association (NFPA).
   1. Dimensional Work: Conform to NFPA "National Design Specifications for Stress-Grade Lumber and Its Fastenings".

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Comply with manufacturer's recommendations.
   1. Store lumber and plywood not less than 6-inches above ground on framework of blocking, and cover with protective waterproof covering providing for adequate air circulation or ventilation.
   2. Protect corners of sheet materials from damage while handling.
   3. Fire Retardant Materials: Comply with treatment manufacturer's requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Framing Lumber: Nominal and actual dimensions conforming to PS20, not more than 19-percent moisture content, surfaced 4 sides (S4S), unless otherwise indicated.
   1. Douglas Fir, Larch, Hem-Fir: Grade WCLIB or WWPA No. 2, or better.
   2. Southern Pine: Grade SPIB No. 2, or better.
   3. Southern Yellow Pine: Grade SPIB No. 2, or better.
   4. Mixed white woods (S-P-F): No. 2, or better.

B. Exposed Blocking and Other Miscellaneous Wood Framing:
   1. Construction Grade No. 1, or better, Douglas Fir-Larch, Hem-Fir, and Western Hemlock, or mixed white woods (S-P-F).
   2. Where Exposed Material: Sound, straight, clean, and smooth (sand if required).

C. Concealed Blocking: Standard Grade No. 2, or better, Douglas Fir-Larch, Hem-Fir, Western Hemlock, Southern Pine, or mixed white woods (S-P-F).

2.02 FIRE RETARDANT TREATMENT

A. Pressure Impregnated Fire Treatment: Bearing Underwriters Laboratories, Inc. label with Fire Hazard Classification of 25 or less, or FRS Classification (Guide BPVV).
   1. Flame Spread: Not more than 25, with no increase in fire hazard classification when test is extended to 30 minutes in compliance with Uniform Building Code (UBC) Standard No. 42-1.
   2. Identification: Mark each piece with performance identification label or mark of UL. Provide identification mark at intervals required by inspection officials having jurisdiction.
   3. Acceptable manufacturers and processes for typical applications:
      a. Hickson Corp.: Dricon.
      b. Hoover Treated Wood Products, Inc.: Pyro-Guard.

B. Moisture Content for Lumber and Plywood
   1. Materials Exposed to View in Finished Work: Kiln dry to not more than 12-percent moisture content after treatment.
   2. Concealed Plywood: Dry to not more than 15-percent moisture content after treatment.
   3. Concealed Lumber: Dry to not more than 19-percent moisture content after treatment.

C. Schedule of Fire-Retardant Treatment
   1. Concealed blocking in walls and/or attic space (dimensional and plywood).
   2. Exposed materials.

2.03 ACCESSORIES

A. Rough Hardware – General: Furnish rough hardware required, including nails, screws, anchor bolts, J-bolts, lag screws, cinch anchors, strap anchors, toggle bolts, shot anchors, and similar items.
   1. Select rough hardware of proper size and type for use intended and for materials to be fastened. Furnish sufficient hardware to ensure substantial and positive anchorage.
   2. Use hot dip galvanized or aluminum at exterior work.

B. Nailing into wood plugs is not acceptable for any Work. Where shot anchors are used, they shall be of type and size recommended by manufacturer for conditions of use.

C. Bolts: Course thread, not plated with washers and nuts.

D. Anchor Bolts with Nuts and Washers: ASTM A307, 1/2-inch diameter, unless otherwise indicated, threaded 1 end with 1 1/2-inch right angle bend opposite end. Determine bolt length by the following embedment requirements:
   1. Not less than 7-inch embedment into concrete or horizontal masonry joints.
   2. Not less than 15-inch embedment into vertical masonry joints.

E. Expansion Bolts: Hilti Stainless Steel Kwik Bolts, or approved equal. Size as shown on Drawings.

F. Adhesive Anchors: Heavy-duty vinylester resin adhesive anchors sized by manufacturer for specific application and substrate.
   1. Acceptable manufacturers and products.
      a. Hilti Corp.: HIT Anchor Series.
      b. Comparable products by The Rawlplug Company, Inc.

G. Nails: Bright finish steel for interior and galvanized steel for exterior.

H. Construction Adhesive: Conform to APA Specification AFG-01.

PART 3 EXECUTION

3.01 ERECTION

A. Install all Work plumb, level, true, and square.

B. Use appropriate nails and glue for materials to be installed.

C. Do not notch, bore, or cut members for pipes, ducts, conduits, or other reasons, except as shown on the Drawings or as approved by the Engineer.

D. Provide full bearing for members. Where framing members slope, cut or notch ends to give uniform bearing surface.

E. Make all studs single length and unspliced.

F. Frame all corners and intersecting walls with 3 or more studs.

G. Apply preservative treatment at all field cuts, drilled holes, or other areas where pre-treatment has been damaged.

3.02 FASTENING

A. Use common wire nails of the size and quantity specified in the Building Code, unless shown otherwise.

B. Remove and replace all split wood.

C. Drill bolt holes 1/16-inch larger in diameter than the bolts being used.

D. Use washers under head and nut of all bolts.

E. Pre-bore holes for lag screws the same diameter as the root of the thread.

F. Screw all lag screws and wood screws into position. Do not drive.

END OF SECTION

SECTION 07 21 00

INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Perimeter Insulation.
2. Cavity Wall Insulation.
3. Unfaced Fiberglass Batt Insulation.

B. Related Sections
1. 03 40 00 – Hollow Core Precast Concrete Plank.
2. 04 22 00 – Concrete Unit Masonry.
3. 06 10 00 – Rough Carpentry.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Certification: Insulation manufacturers approved if any adhesives to be used and their application procedure.

B. Literature: Manufacturer's data on all materials to be used.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver to Site in manufacturer's wrapping or individual sheets that clearly identify the manufacturer, contents, brand name, and R-value.

B. Storage: Store off the ground and protect against weather, condition, and damage.

C. Handling: Remove damaged materials from Site and protect board insulation from prolonged sunlight.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Surfaces shall be dry.

B. Temperatures shall meet adhesive recommendations.

PART 2 PRODUCTS

2.01 INSULATION

A. Perimeter insulation (**INSUL-1**)
   1. Approved Manufacturers
      a. Dow Building Solutions Styrofoam™ Square Edge.
      b. Owens Corning Foamular® 400.
      c. DiversiFoam™ Products CertiFoam 40.
      d. Pactiv Building Products, GreenGuard Insulation Board (Type VI 40 PSI).
      e. Or Approved Equal.
   2. Characteristics:
      a. ASTM C578-87, Type VI.
      b. Size: 48-inches by 9- inches.
      c. Thickness: 2-inches, unless otherwise indicated on the Drawings.
      d. Edges: Square.
      e. Rigid extruded polystyrene: 1.8 pcf typical (ASTM C303), 1.6 pcf minimum.
      f. Compressive Strength: 40 psi typical (ASTM D1621).
      g. Comply with ASTM C578, Type VI.

B. Cavity Wall Insulation (**INSUL-2**)
   1. Approved Manufacturers:
      a. Dow Building Solutions Styrofoam™ Cavitymate™.
      b. Owens Corning Foamular® CW25.
      c. DiversiFoam™ Products CertiFoam 25 SE.
      d. Pactiv Building Products, GreenGuard Insulation Board (Type IV 25 PSI).
      e. Or approved equal.
   2. Characteristics
      a. ASTM C578-87, Type 4.
      b. Size: 16-inches by 96-inches.
      c. Thickness: 2-inches, unless otherwise indicated on the Drawings.
      d. Edges: Square.
      e. Rigid extruded polystyrene: 1.8 pcf typical (ASTM C303), 1.6 pcf minimum.
      f. Compressive Strength: 40 psi typical (ASTM D1621), 25 psi minimum.
      g. 5-Year Aged R-Value at 40 Degrees F: 5.4 per inch (ASTM C518).
      h. Water Vapor Transmission Rate: 0.8 perms (ASTM E96).
   3. Joint Sealing Tape: Manufacturer's standard.

C. Unfaced Fiber Glass Batt Insulation (**INSUL-3**)
   1. Approved Manufacturers
      a. Certainteed – Fiber Glass Building Insulation.
      b. Owens Corning – Fiber Glass Thermal Batts.
      c. Johns Manville – Formaldehyde-free™ Fiber Glass Insulation.
      d. Or Approved Equal.
   2. Characteristics:
      a. ASTM C665, Type 1, and ASTM E136 (unfaced fiberglass batts).
      b. Obtain the R-Value shown on the Drawings or an R-38 if none is shown.
      c. Width: To fit framing spacing, 24-inch maximum.

2.02 VAPOR BARRIER (**VB**)

A. FS L-P-375 translucent polyethylene film, Type 1, Class 1, 6 mils thick.

2.03 ATTACHMENTS

A. Adhesive
   1. H.B. Fuller - Max Bond or manufacturer approved materials for conditions encountered.

B. Mechanical Fasteners
   1. Galvanized roofing nails with 3/8-inch diameter heads.
   2. Crown Staples: 16-gauge galvanized 3/8-inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Rigid Board Insulation
   1. Verify that substrate is flat, dry, and free of honeycombs, fins, or foreign materials that will impede adhesive bond or damage.

B. Fibrous Insulation
   1. Examine areas scheduled to receive insulation to insure protection against inclement weather and other hazards, and work of preceding trades is complete.

C. Beginning installation means installer accepts conditions.

3.02 RIGID BOARD INSULATION INSTALLATION

A. General
   1. Tightly fit each board together and stagger joints.
   2. Adhesive Application:
      a. Apply adhesive to insulation in 1 1/2-inch diameter spheres on 12-inch centers.
      b. Press insulation in place using rocking action.
   3. Mechanical Anchors
      a. Use with wood framing.
      b. Fasteners shall be placed not less than 16-inches on center with a 1/2-inch penetration into substrate.
   4. Fit insulation tightly around penetrations.

B. Furred out walls shall be adhesive applied insulation.

C. Perimeter Insulation
   1. Adhesive applied.
   2. Remove insulation exposed above grade.

3.03 FIBROUS INSULATION

A. General
   1. Fit insulation snugly between framing.
   2. Maintain integrity of insulation over entire area to be insulated.
   3. Insulate small areas between closely spaced framing members.
   4. Carefully cut and fit insulation around pipes, conduits, and other obstructions.
   5. Where pipes or conduit are located in stud spaces, place insulation between exterior wall and pipe, compress insulation where necessary.
   6. Fit insulation in spaces between rough openings and door frames.
   7. Mechanically fasten insulation when friction fitting can not be accomplished.

3.04 VAPOR BARRIER

A. General
   1. Secure vapor barrier to the substrate with tape or a minimal number of staples.
   2. Place on the warm side of all exterior wall and roof fibrous insulation and as otherwise required by the Drawings.
   3. Patch and seal punctures, tears, or voids in the vapor barrier.
   4. All splices shall have a 6-inch minimum lap joint.

3.05 CLEAN UP

A. Remove and dispose of excess materials, litter, and debris.

B. Leave work areas in a clean condition.

END OF SECTION

SECTION 07 26 16

UNDERSLAB VAPOR RETARDER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Surface preparation.
   2. Application of an underslab vapor retarder.

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

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 REFERENCES

A. ASTM D1709 - 09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

B. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

C. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.

D. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

E. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

F. ASTM F1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.04 SUBMITTALS

A. Submit manufacturer's product data and application instructions.

1.05 QUALITY ASSURANCE

A. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the vapor retarder.

B. Obtain vapor retarder materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage or contamination.

D. Ensure membrane is stamped with manufacturer’s name, product name, and membrane thickness at intervals of no more than 85 inches (220 cm).

1.07 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not apply on frozen ground.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

2.02 MATERIALS

A. Plastic Vapor Retarder
   1. Performance-Based Specification: Vapor retarder membrane shall be manufactured from virgin polyolefin resins and shall meet or exceed all requirements of ASTM E1745, Class A.
      a. Maximum Water Vapor Permeance (ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249)
         1) As received: 0.0183 perms.
         2) After Wetting and Drying: 0.0219 perms.
         3) Resistance to Plastic Flow and Temperature: 0.0197 perms.
         4) Effect Low Temperature and Flexibility: 0.0212 perms
         5) Resistance to Deterioration from Organisms and Substances in Contacting Soil: 0.0198 perms.
      b. Puncture Resistance (ASTM D1709): >3,500 grams.
      c. Tensile Strength ASTM E154, Section 9: 52 Lb. Force/Inch
   2. Proprietary-Based Specification:
      a. PERMINATOR 10 mil by W. R. MEADOWS.

2.03 ACCESSORIES

A. Seam Tape
   1. High Density Polyethylene Tape with pressure sensitive adhesive. Minimum width 4 inches (100 mm).
      a. Perminator Tape by W.R. Meadows.

B. Pipe Collars
   1. Construct pipe collars from vapor retarder material and pressure sensitive tape per manufacturer's instructions.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Level, tamp, or roll earth or granular material beneath the slab base.

3.02 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.03 APPLICATION

A. Install the vapor retarder membrane in accordance with manufacturer's instructions and ASTM E 1643–98.

B. Unroll vapor retarder with the longest dimension parallel with the direction of the pour.

C. Lap vapor retarder over footings and seal to foundation walls.

D. Overlap joints 6 inch (152 mm) and seal with manufacturer's tape.

E. Seal all penetrations (including pipes) with manufacturer's pipe boot.

F. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.

G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches (152 mm) and taping all four sides with tape.

END OF SECTION

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SECTION 07 84 00

FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Firestopping not specified elsewhere.

B. Related Sections
   1. 07 92 00 – Joint Sealants.
   2. 22 07 00 – Plumbing Insulation.
   3. 23 07 00 – HVAC Insulation.
   4. 26 05 05 – Basic Electrical Materials and Methods.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 DEFINITIONS

A. Firestopping: A material or combination of materials to retain the integrity of time-rated construction by maintaining an effective barrier against the spread of flame, smoke, and gases. It shall be used in specific locations as follows:
   1. Duct, cables, conduit, and piping penetrations through floor slab and through time-rated partitions or fire walls.
   2. Penetrations of vertical service shafts.
   3. Openings and penetrations in time-rated partitions or fire walls containing fire doors.
   4. Locations where shown on the Drawings or specified in other Sections of the Specifications.

1.04 QUALITY ASSURANCE

A. Submit manufacturer's product data, letter of certification or certified laboratory test that the material or combination of materials meet the requirements specified in ASTM E814 and are so classified in UL's Building Materials Directory.

B. Materials shall meet and be acceptable for use by the state building code.

C. Materials shall meet the requirements of NFPA 101-Life Safety Code and NFPA 70 - National Electrical Code.

1.05 SUBMITTALS

A. Submit shop drawings, product data, certifications for each condition requiring firestopping, and manufacturer's installation instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original unopened containers or packaging bearing manufacturer's names, brand designations, and product descriptions.

B. Store materials under cover and protected from damage.

C. Do not use damaged materials.

D. Provide proper ventilation if using solvents.

E. Keep flammable materials away from sparks and flames.

F. Use safety glasses and protective clothing.

G. Comply with manufacturer's temperature requirements.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. 3M - Electrical Products Division.

B. DOW Corning Fire Stop System.

C. Standard Oil - Fyre Putty.

D. Or Approved Equal.

2.02 FIRESTOPPING MATERIALS

A. Firestopping materials/constructions shall constitute 1 or more of the following by 3M Brand, or approved equal:
   1. Caulk: CP-25.
   2. Putty: 303.
   3. Wrap/Strip: FS-195.
   4. Composite Sheet: CS-195.
   5. Penetrating Sealing System: 7900 Series.
   6. Compatible materials with those above as certified by the manufacturer.

B. Firestopping materials shall be asbestos-free and capable of maintaining an effective barrier against flame, smoke, and gases in compliance with the requirements of ASTM E814 and UL 1479.

C. Materials shall be compatible with surrounding materials.

D. On insulated pipe, the fire-rating classification must not require removal of the insulation.

E. The rating of the firestops shall be at least 1 hour, but in no case less than the rating of the time-rated floor or wall assembly.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to be in contact with firestopping materials free of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting or the required fire resistance.

3.02 INSTALLATION

A. Install firestopping materials indicated in accordance with manufacturer's instructions.

B. Seal all holes or voids made by penetrations to ensure an effective smoke barrier.

C. Unless protected from possible loading or traffic, install firestopping materials in floors having void openings of 4 inches or more to support the same floor load requirements.

D. Fill all holes, penetrations, and sleeves in all fire-rated assemblies, unless included in other Sections of the Specifications.

3.03 FIELD QUALITY CONTROL

A. Examine firestopping areas to ensure proper installation prior to concealing or enclosing fire stopped areas.

B. Areas of work shall remain accessible until inspection by the applicable code authorities.

3.04 ADJUSTING AND CLEANING

A. Clean up spilled products.

B. Cut and trim cured foam with sharp knife.

C. Remove equipment, materials, and debris leaving area in undamaged, clean condition.

END OF SECTION

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SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Exterior and interior sealants.

B. Related Sections
1. 04 22 00 – Concrete Unit Masonry.
2. 04 71 16 – Manufactured Masonry Units.
3. 07 46 13 – Fiber Cement Siding.
4. 08 11 00 – Metal Doors and Frames.
5. 08 11 16 – Aluminum Doors and Frames.
6. 08 16 13 – FRP Doors and Frames.
7. 08 45 13 – Translucent Wall Panels.
8. 08 51 13 – Aluminum Windows.
9. 08 91 19 – Metal Wall Louvers.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Shop Drawings Consistent with Section 01 33 00 and Including:
1. Two 6-inch long bead of each color of caulking to be used.
2. Two 6-inch pieces of each size of backing material to be used.
3. Copies of manufacturer's specifications, recommendations, and installation instructions for caulking, backer rod, and accessory materials.
4. Manufacturer's published data, letter of certification, or certified test laboratory report that each material complies with requirements and is intended for application shown.

1.05 QUALITY ASSURANCE

A. Applicator Qualification: Minimum 2 years of experience in applying sealants and approved by sealant manufacturer.

B. Mock-Up
1. Prepare sample application in location directed by Architect.
2. Approval of the mock-up must be obtained from Architect.
3. Accepted mock-up shall constitute standard of acceptance for remaining Work.

1.06 PRODUCT HANDLING

A. Deliver materials in original, tightly sealed containers or unopened packages with manufacturer's name, labels, product identification, and lot numbers where appropriate.

B. Store materials out of weather in original containers or unopened packages as recommended by manufacturer.

1.07 JOB CONDITIONS

A. The compounds shall be applied within an air temperature range of 40 degrees F to 80 degrees F to clean and dry substrate, unless manufacturer's literature and procedure allows for an exception.

1.08 WARRANTY

A. Provide caulking manufacturers standard 10-year material guarantee.

B. Guarantee workmanship against leakage for 2 years.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Tremco, Dymeric, Sikaflex-2C NS/SL, or approved equal - General Applications.

B. Mameco Vulkem 116 One-Part High Performance Elastomer - Submersion Service.

C. Fire Barrier Caulk: 3M Brand.

D. Or Approved Equal.

E. Colors: To be selected by Architect from manufacturer's standard colors. Colors may be different for every type of material receiving caulk.

2.02 MATERIAL

A. Sealant Materials
   1. Vertical Surfaces
      a. For Interior Joints Up to 2 Inches Wide: 1-part acrylic terpolymer base type "Mono" conforming to ASTM C834.
      b. For Exterior Joints and Joints Larger Than 2 Inches Wide: 2-parts polytremdyne base type "Dymeric" conforming to ASTM C920.
      c. Caulking Compound for All Interior Joints Not Subject to Movement: Acrylic type which does not contain ingredients that will stain masonry or corrode metals conforming to ASTM C834.

2.03 BACKER ROD

A. Material: Closed cell polyethylene ethafoam, or approved equal, compatible with sealant. Sof-rod by applied extrusion technology will be accepted for horizontal locations.

B. Sized and shaped to control depth of sealant and to provide 20-percent to 50-percent compression upon insertion.

2.04 MISCELLANEOUS MATERIALS

A. Joint Cleaner: Caulking manufacturer's recommended cleaner for condition encountered.

B. Primer: Manufacturer's recommended primer for various substation substrates encountered.

C. Bond Breaker: Pressure sensitive adhesive polyethylene tape.

D. Masking Tape: Pressure sensitive adhesive paper tape.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine joints to be caulked for construction defects which would adversely affect execution of Work.

B. Do not start Work until conditions are satisfactory and construction defects have been corrected.

3.02 PREPARATION

A. Wire brush, grind, sandblast, solvent wash, or prime per manufacturer's recommendations any surface containing release agents, water proofing, dust, loose mortar or laitance, paint or finishes.

B. Cleaning: Clean joint surfaces using joint cleaner as necessary to be free of dust, dirt, oil, grease, rust, lacquers, laitance, release agents, moisture, or other matter which might adversely affect adhesion of caulking.

C. Masking: Mask areas adjacent to joints.

D. Priming: Apply primer following manufacturer's instructions.

3.03 APPLICATION

A. Install backer rod material in new and existing joints using blunt instrument to avoid puncturing. Do not twist backer rod while installing. Install backer rod so that joint depth is 50 percent of joint width, but a minimum of 1/4 inch deep.

B. Apply caulking in new joints using pressure gun with nozzle cut to fit joint width. Make sure caulking is deposited in uniform, continuous beads without gaps or air pockets.

C. Tool joints to required configuration within 10 minutes of caulking application. If masking materials are used, remove immediately after tooling.

D. Verify sealant type as required in other Sections.

E. Apply sealant as shown on the Drawings and on new or modified areas as follows:
   1. Perimeter of new sound attenuated partitions.
   2. Around the bottom of all interior door frames where metal abuts or contacts concrete.
   3. Around openings in walls, ceilings, and floors at conduits, pipes, ducts, and similar items (both sides of walls, ceiling, and floors). Apply Fire Barrier caulk at all such penetrations through rated walls.
   4. All areas where dissimilar wall materials abut or adjoin.
   5. Any other places shown on the Drawings.

F. Caulking is not to be painted.

3.04 CLEANING

A. Remove excess materials adjacent to joints by mechanical means or with xylol (xylene) or mineral spirits as work progresses to eliminate evidence of spillage or damage to adjacent surfaces. Note: When using flammable solvents, avoid heat, sparks, and open flames. Always provide adequate ventilation and follow all precautions listed on solvent container label.

B. Leave finished work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Hollow metal doors and frames.

B. Related Sections
   1. 04 22 00 – Concrete Unit Masonry.
   2. 07 46 13 – Fiber Cement Siding,
   3. 07 92 00 – Joint Sealants.
   4. 08 71 00 – Door Hardware.
   5. 09 91 00 – Painting.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Conform to Section 01 33 00.

B. Manufacturer's descriptive literature and installation instructions.

C. Shop Drawings: Illustrations and schedule of door and frame sizes, types, materials, construction, finishing, anchoring, accessories, and preparation for installing hardware.

1.04 QUALITY ASSURANCE

A. Erector shall have minimum of 2 years' experience installing stock hollow metal work.

B. Regulatory Agency Requirements
   1. Must comply with applicable Minnesota State Building Code requirements.

C. Manufacturer shall be a NAAMM member and shall comply with Standard Steel Door and Frame ANSI/SDI 100 (latest edition) Specifications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver all products in cartons and palletized.

B. Inspect products upon delivery for damage.

C. Store products under cover and on wood blocks.

D. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

E. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

F. Provide 1/4-inch space between stacked doors.

PART 2 PRODUCTS

2.01 HOLLOW METAL FRAMES

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) metallic coating.
   1. Door Frames: 14 gauge.

B. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.
   1. Closer Reinforcements: Fabricate according to ANSI/SDI A250.6 with half sleeve closer reinforcement plates welded to frame minimum 14 gauge.
   2. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at top hinge locations.
   3. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

C. Wall Anchors
   1. Masonry: "T" Strap Type to suit frame size, formed from A60 metallic coated material, not less than 0.042-inch-thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long Provide minimum 5 anchors per jamb. [Hinge Jamb: 1 anchor just below top hinge, anchors just above and below each hinge. Strike Jamb: Just above and below strike location, other space evenly above and below strike location.
   2. Stud Wall Type: At Steel stud applications, Spot weld 16-gauge provide minimum 5 anchors per jamb. [Hinge Jamb: 1 anchor just below top hinge, anchors just above and below each hinge. Strike Jamb: Just above and below strike location, other space evenly above and below strike location. Spot welding shall not be visible through frame.

D. Floor Anchors
   1. Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

E. Accessories
   1. Silencers: 3 required on stop jamb of single swing frames, 2 required on head of frame for pair of swing doors.

F. Bituminous Coating
   1. Factory or shop apply inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils.

G. Fabrication
   1. General: Fabricate frames with mitered or coped corners and continuously arc-welded for full depth and width of frame. Contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush. Finished work shall be strong and rigid, neat in appearance, and free from defects.

2.02 HOLLOW METAL DOORS

A. Material: Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) metallic coating.
   1. Doors: Minimum 16-gauge steel with manufacturer's standard polyurethane. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value 2.17 or better.

B. Hardware Reinforcement
   1. General: Door shall be mortised, reinforced, and mortise hardware reinforcements drilled and tapped at factory for templated hardware, all in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface mounted hardware is to be applied, door shall have welded on reinforcing plates only; all drilling and tapping for surface-mounted hardware shall be a field operation by installation personnel.
   2. Reinforcement Gauges: Hinges - 3/16 inch by 1-1/4 inches by 9 inches. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
   3. Closer Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates minimum 14 gauge.

C. Fire Rated Doors
   1. Materials and construction of fire rated doors shall be as required to meet Underwriters Laboratories, Inc., label classification for opening. Fire rated doors shall bear U/L label for class and rating required.

D. Fabrication
   1. General: Hollow metal doors shall be fully welded of types and sizes shown on Drawings, seamless construction with no visible seams or joints on faces or vertical edges. All doors shall be strong, rigid, and neat in appearance, free from warpage or buckle. All doors shall maintain a flatness tolerance of plus or minus 0.03 inch in a diagonal direction.
   2. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
   3. Construction: Construct doors and panels of cold-rolled steel face sheets. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot-welded to both faces. Doors shall have an additional flush filler channel at top edges welded full width of door on both edges, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable. Seal joints in top edges of door against water penetration.
   4. Openings shall be provided in bottom closure of exterior doors to permit escape of entrapped moisture.

5. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Coordinate with Section 08-8000 for glass types. Install glass as recommended by manufacturer and in compliance with ITS-Warnock Hersey or UL approved glazing system.
6. Astragals: Provide "Z" style overlapping astragals as required by hardware application in Section 08 71 00 – Door Hardware on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted. Flat bar astragals are not allowed.

2.03 SHOP PAINTING

A. Doors and frames to be cleaned, and chemically treated to ensure maximum finish paint adhesion. Surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting shop primer.

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

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

D. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

2.04 SEALANTS

A. Joint sealants shall be 1-part acrylic terpolymer based type "Mono" conforming to ASTM C834.

B. Color as selected by Architect from manufacturer's standard colors.

PART 3 EXECUTION

3.01 INSPECTION

A. Frame Installer and Contractor are responsible to examine door frames two times after original installation for the following purposes:
   1. First after their initial installation of frames by Contractor and installation of walls boards or masonry units.
   2. Prior to installation of doors and hardware.

B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
   1. Verify that frames are installed plumb, square and true and will maintain maximum and minimum gap requirements listed in NFPA 80-2010, NFPA 101-2012 before installation of doors and hardware as follows:
   2. Head, Jambs, and meeting edge of pairs gap requirements: 1/8 inch Maximum.
   3. 3/4 inch at sill Maximum.
   4. Any installed door frames that exceed the minimum or maximum gap requirements, such opening shall be removed and replaced without delay including all necessary products and processes to achieve the specified opening at no additional cost to the Owner.
   5. Examine floor and opening conditions to assure suitability for installation.

C. Provide Architect with written report listing conditions detrimental to compliance with requirements of this Section. Accepted installation constitutes acceptance of responsibility for performance.

D. Do not proceed with installation until dimensions and conditions of openings are satisfactory.

3.02 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 ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
   1. Set frames accurately in position at finished floor level, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
   4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim, as necessary.
   1. Frames shall not deviate from the horizontal and vertical construction by any amount greater than:
      a. Top to Bottom: 1/4 inch over entire frame height.
      b. Jamb to Jamb: 1/8 inch over entire width of single leaf door frames.
      c. 1/4 inch over entire width of double leaf door frames.
   2. Doors shall not deviate from the horizontal and vertical planes of the frames in which they are installed by any amount greater than:
      a. Top to Bottom: 1/8 inch over entire door height.
      b. Jamb to Jamb (Back edge to front edge): 1/16 inch over width of door leaf.

D. Install all hardware as noted on the door schedule or listed in this Specification.

E. Any doors that are installed in door frames that exceed the minimum or maximum gap requirements, such opening shall be removed and replaced without delay including all necessary products and processes to achieve the specified opening at no additional cost to the Owner.

F. Sealant shall be applied where frames abut walls, apply neat even line.

3.03 ANCHORS

A. Use anchors as recommended by the manufacturer for the conditions encountered.

B. Anchors that pierce the frames shall be countersunk.

C. After the frame is properly positioned and tightly anchored, the countersunk anchors shall be covered with auto-body filling compound and sanded smooth.

D. When the filling compound has fully cured, the jambs shall be sanded smooth and immediately coated with primer to prevent absorption of moisture into the filling compound.

3.04 ADJUSTMENTS

A. 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. Adjust all door closers to shut doors tight against jambs.

3.05 CLEANING

A. Remove dirt and excess sealants or glazing compound from exposed surfaces.

B. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer and/or finish paint.

C. Remove debris from Site.

END OF SECTION

SECTION 08 36 13

UPWARD ACTING SECTIONAL DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Upward Acting Sectional Doors.
2. Operators and controls.

B. Related Sections
1. 06 10 00 – Rough Carpentry.
2. Division 26.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Shop drawings required, including details of door, door track, and operator.

B. Manufacturers' descriptive literature and installation instructions.

C. Manufacturers' maintenance and operating instructions for the door and operator.

1.04 WARRANTY

A. 1-year limited warranty for all materials and installation.

B. Exterior and interior skins shall be warranted for 5-years against delamination from the insulation.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. The listed manufacturers shall meet or exceed the specification listed.
1. Raynor Manufacturing Co.: TriCore™ Optima.
2. Overhead Door Corporation: Thermacore Door, 596 Series.
3. Wayne-Dalton Corporation: Thermospan Door, Model 200-20.
4. Midland Garage Door: 3-inch energy saver door with 20-gauge flush panels and full vision section.
5. Dor Craft Quality Sectional Garage Doors distributed by Industrial Door Co, Inc.: Thermo Craft Model 2400 with full-view sections.

2.02 EXTERIOR DOORS

A. Sections: 2-inch minimum thick with a roll-formed 20-gauge galvanized steel embossed with a textured pattern exterior and interior skin, and a thermal break. All sections reinforced with backup plates and pre-punched for attachment of hardware.

B. Full Glazed Aluminum Sash Panels
   1. 1/2 inch (12.5 mm) Double Strength Insulating Glass

C. End Stiles: 16-gauge minimum.

D. Insulation: CFC and HCFC Free insulation either polyurethane or polystyrene with a minimum overall R-value of 14.5.

E. Hinges and Fixtures: Heavy-duty commercial double ended and long stem roller galvanized steel hinges. 3-inch rollers with steel rims and case-hardened raceways and ball bearings.

F. Weather seals: Rubber tube seals fitted inside section joints. PVC bull type strip at bottom.

G. Wind Load: ANSI/ASMA 102 standards and as required by code.

H. Finish and Color:
   1. 2-coat baked-on polyester finish.
      a. Exterior and interior color to be selected from manufacturer's standard colors.

2.03 TRACK AND ACCESSORIES

A. 3-inch wide galvanized steel standard or lift clearance track, provide 2 braced supports per track.

B. All required hardware.

C. Weatherstrip: Manufacturers standard jamb and head.

D. Spring: 100,000 cycle life.

2.04 ELECTRIC DOOR OPERATORS

A. Electric Operator: Center mounted draw bar assembly, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware. Provide means to disengage motor to allow manual operation in event of power failure.

B. Motor shall be minimum 3/4 horsepower, 120volt, continuous duty with instant reverse and automatic reset thermal overload. Motor shall be UL listed.

C. Disconnect Switch: Factory mount disconnect switch on equipment.

D. Motor Type: NEMA MG1.

E. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

F. Control Station: Standard three button (open-close-stop) momentary pressure type, control for each electric operator; 24 volt circuit, surface mounted.

G. Remote door controls: Provide 2 remote control devices per door.

H. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to reverse door upon striking object; hollow neoprene covered to provide weatherstrip seal.

I. Photoelectric Sensor: Furnish system which detects obstruction and reverses door without requiring door to contact obstruction.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect substrate openings and structures for compliance and do not commence Work until everything is satisfactory.

3.02 INSTALLATION

A. Install per manufacturer's instructions and recommendations.

B. Install door straight, plumb, and level and in a weather tight manner.

C. Coordinate Work with other trades.

D. Operator's push button stations, leading edge shall be installed by the electrical contractor.

E. Electrical contractor to provide electricity to a box next to operator.

3.03 CLEANUP

A. Make final adjustments so doors are in good operating condition.

B. Touch up paint on any areas scratched or chipped during the installation.

C. Remove all debris at conclusion of installation.

END OF SECTION

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SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Aluminum windows including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of window units.
2. Types of aluminum windows
a. Fixed Windows: 2-piece low rise framing system with non-metallic thermal isolator designed to accept 1-inch glazing material.
1) Profiles: 1-3/4 inch wide by 6 inches deep.

B. Related Sections
1. 06 10 00 – Rough Carpentry.
2. 06 61 16 – Solid Surface Fabrications.
3. 07 46 13 – Fiber Cement Siding.
4. 07 92 00 – Joint Sealants.
5. 08 81 00 – Glazing.
6. 09 29 00 – Gypsum Drywall.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Product Data

B. Manufacturer's specifications and technical data, including the following:
1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Certified test reports clearly indicating compliance with performance requirements specified herein.
4. Glass warranty, including manufacturer's written certification of compatibility between glazing material and hermetic seal.
5. Sealant manufacturer's data on surface preparation and application for each type of sealant proposed.

C. Shop Drawings
1. Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware and installation procedures, plus the following specific requirements:
a. Elevate entire openings of framing system.
b. Indicate jamb, head, and sill conditions and specific anchorage details and spacing for each situation.
c. Large scale details of sills, weep system, meeting rail interlock, sash glazing.

d. Custom extrusions.
e. Glazing details.

D. Color Samples
1. 2 sets of samples for color selection of verification for the following:
a. Frame color and finish.

E. Quality Control Submittals
1. Statement of qualifications.
2. Test Reports and Design Data: Laboratory test reports and redlined design charts attached to letter from manufacturer indicating compliance with requirements specified herein.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications
1. Acceptable to or licensed by manufacturer.

B. Product Qualifications
1. Fixed Units: Performance requirements as outlined in ANSI/AMA GA-001, except for special specified herein:
a. Air infiltration Tested at 6.24 PSF
1) Laboratory test data not to exceed 0.06 CFM/square foot.
2) Actual field tests not to exceed 0.09 CFM/square foot.
b. Water resistance tested at 8.0 PSF = No leakage.
c. Uniform Load Structural Rest
1) Maximum L/175 deflection at design load (30 PSF positive and negative).
2) No permanent set at 150 percent of design load (45 PSF positive and negative).

1.05 WARRANTY

A. Contractor/Manufacturer/Installer shall stand behind installed system for a period of 5 years from date of Substantial Completion against all the conditions indicated below and when notified in writing from the Owner, Contractor/Manufacturer/ Installer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
1. Failure of hermetic seal.
2. Stress breakage resulting from improper framing design.
3. Breakage resulting from chipped or damaged edge conditions from original installation or thermal stresses.
4. Faulty material and workmanship.
5. Water and air infiltration in excess of performance requirements specified herein.
6. Sealant failure, both around perimeter and within window frame.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Acceptable Manufacturers and Products for the Exterior Window System:
1. Kawneer, an Alcoa Company
a. Fixed Windows: EnCORE®.
b. Arch Aluminum and Glass Co., Inc.: Amarlite NRG Framing System.
c. CMI Architectural Products, Inc.: CTS.
d. Tubelite, Inc.: VersaTherm™ Framing.

e. Or Approved Equal.

B. Clarification Note: Drawings and Installation Specifications are based on manufacturer's proprietary literature from Kawneer Company, Inc. Other specified manufacturers shall comply with the minimum levels of material and detailing indicated on the Drawings and specified herein.

2.02 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090 inch (2.3 mm) wall thickness at any location for the main frame and sash members.
   1. Recycled Content: Shall have a minimum of 50 percent mixed pre- and post-consumer recycled content.

B. Thermal Barrier: High density, non-conductive material separating inside and outside portions of both frames and sash sections.
   1. Design to provide minimum Condensation Resistance Factor (CRF) specified herein.

C. Fasteners: Nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

D. Anchors: Nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.03 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum windows, and sized to accommodate sash weight and dimensions.

2.04 CONSTRUCTION AND MATERIALS

A. Frames: Extrude members in single lengths with pour-in-place thermal barrier and wall thickness as determined by manufacturer to resist loads:
   1. Join corners using stainless steel fasteners and small joint epoxy adhesive/sealant to form a watertight hairline joint. Reinforce corner construction with aluminum gusset blocks and chemically weld in place.
   2. Field assembled corner units and field applied sealants within frame construction is not permitted.
   3. Design frames to allow for thermal expansion and contraction within frame construction. Provisions to allow for expansion within glazing material is not acceptable.

2.05 ACCESSORIES

A. Fasteners Within Frame Assembly: Series 300 stainless steel.

B. Perimeter Anchors: Aluminum, stainless steel, or other materials recommended by manufacturer and compatible with frame members, trim, hardware, and anchors.

C. Fasteners: Aluminum, stainless steel, or zinc plated steel complying with ASTM A164.

D. Glazing Gaskets: EPDM elastomeric extrusions specially designed for application.

E. Sealant Within Frame System: As recommended by manufacturer and specially designed for use in framing/window wall applications.

F. Sealant for Installation Around Frames: Provide under this Section in compliance with requirements specified under Section 07 92 00:
   1. Provide low-modulus silicone unless otherwise indicated.
   2. Verify compatibility with sealants used in adjacent construction.

G. Bituminous Coating: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness per coat.

H. Glass Types: Provide under this Section in compliance with requirements specified under Section 08 81 00.

I. Glazing Gaskets: Resilient closed-cell sponge neoprene.

J. Weatherstrip Material: Extruded sponge neoprene complying with ASTM C509.

K. Weep Hole Filter Material: 6 inches long, 30 to 40 ppi open cell, reticulated, polyurethane foam block with PVC coating, sized to install at 30-percent to 50-percent compression.

L. Foam Insulation: Provide under this Section.

M. Anchors: Steel or aluminum size and configuration as determined by manufacturer for design loading and attachment requirements.

N. Slip Shim Pads: As recommended by frame manufacturer.

O. Fabric Flashing: 30-mil neoprene or EPDM.

2.06 FABRICATION

A. Fabricate frames allowing for minimum clearances and shim spacing around perimeter of assembly yet enabling installation.

B. Rigidly fit and weld joints and corners. Accurately fit and secure corners tight. Make corner joints flush, hairline, and weatherproof. Seal corner joints with sealant.

C. Develop drainage holes with moisture pattern to exterior.

D. Prepare components to receive anchor devices. Do not bridge thermal barrier with anchoring devices.

E. Provide internal reinforcement in mullions with galvanized steel members to maintain rigidity.

2.07 FACTORY FINISH

A. Anodic Coating: Clean exposed surfaces with caustic etch and anodize to an Architectural Class 1 coating:
   1. Color Anodic Coating: Clean exposed surfaces with medium matte caustic etch and anodize to an Architectural Class 1 coating (thickness not less than 0.7 mil).
      a. Color: As selected by Architect from full range of available anodic coating colors.

B. Furnish manufacturer's matching touch-up anodic coating for touch-up of fasteners and abrasions.

C. Thoroughly clean, etch, and give metal surfaces a chromate conversion pretreatment before application of the primer coat.

D. Apply a heavy coating of bituminous paint where aluminum contacts masonry, concrete, mortar, plaster, or a dissimilar metal.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

A. Comply with manufacturer's recommendations.

B. Erect frames plumb, true, and square in a substantial manner with concealed fasteners. Anchor securely without distortion of the frames.

C. Install sills and related aluminum trim. Set in bed of mastic.

D. Use anchorage devices to securely attach frame to structure.

E. Apply 1 coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar metal.

F. Align frame plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

G. Coordinate attachment and seal of air and vapor barrier materials. Install flashings.

H. Fill perimeter voids in window frame channel with polyethylene backer material or foam insulation.

I. Inject sprayed foam insulation in shim spaces at perimeter to maintain continuity of thermal barrier.

J. Install Related Trim and Closure Panels
   1. Perimeter Sealants: Clean and prime joints as recommended by the sealant manufacturer.
   2. Install sealant and related backing material around perimeter of windows in compliance with window and sealant manufacturer's instructions and the requirements of Section 07 92 00.
   3. Apply sealant completely filling the joint and tool smooth to insure full contact with adjacent surfaces.
   4. Strike off excess material.
   5. Finished bead shall be flush with the adjoining surfaces.

K. Completed installation shall be water and weathertight.

3.03 FIELD QUALITY CONTROL

A. Tests: Provide the Following Field Quality Control Testing to Verify Compliance:
   1. 2 areas of testing will be selected by the Architect when window system is approximately 40 percent completed and will be tested for both air and water infiltration.
   2. Upon completion of remaining portions, 1 additional area of testing will be selected by the Architect and tested for both air and water infiltration.
   3. Areas not meeting specified requirements and other areas of similar deficiencies shall be corrected at no additional cost to the Owner.
   4. Costs for Successful Tests: Unsuccessful tests and retests shall be the responsibility of this Section:
      a. For each area that fails, retest that area plus 1 additional area selected by the Architect.
   5. Air Infiltration: Comply with ASTM E783 at 6.24 PSF.
      a. Allowable Limit: 0.09 CFM per square foot.
   6. Water Infiltration: Comply with AAMA 501.3 at 8.0 PSF.
      a. Allowable Limit: No water on interior surface.

3.04 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt form corners. Wipe surface clean.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

D. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Touch up factory finish.

E. Clean glass of preglazed units promptly after installation of windows; comply with requirements of Section 08 81 00 for cleaning and maintenance.

3.05 PROTECTION

A. Initiate and maintain protection and other precautions required to ensure system will be without damage or deterioration (other than normal weathering) at time of acceptance.

END OF SECTION

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SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Finish hardware for Metal doors and FRP doors.

B. Related Sections
   1. 06 10 00 – Rough Carpentry.
   2. 08 11 00 – Metal Doors and Frames.
   3. Division 26 – Conduit and power connections.

1.02 REFERENCES

A. National Fire Protection Agency (NFPA)
   1. NFPA 80.
   2. NFPA 101.

B. Underwriters Laboratories, Inc. (UL)
   1. Building Materials Directory.

C. Warnock Hersey (WH)
   1. Building Materials Directory.

D. ADA
   1. Americans With Disabilities Act.

E. Wisconsin State Building Code

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Product Data: Manufacturer's product data sheets.

B. Door Hardware Schedule: The finish hardware supplier shall, prior to ordering and/or delivering, prepare and submit to Architect within ten days after award of contract an electronic PDF detailed and engineered, vertical type hardware schedule conforming to DHI publication, "Sequence and Format of the Hardware Schedule" engineering and detailing door hardware specified ensuring all components work together, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. Hardware schedules submitted without the AHC's signature will be rejected without review.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. The Architect will check the Hardware Schedule submitted for quality and types only, but Hardware Supplier shall be solely responsible for quantities, errors, omissions and full conformance with the specifications and the drawings including all addenda and bulletins.

1.05 QUALITY ASSURANCE

A. Where items of hardware are not definitely or correctly specified and is required for the intended operation, such omission, error, or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise, furnish such items in the type, quality and quantity established by this specification for the appropriate service intended. Should any material be ordered without proper coordination, it shall be replaced at no additional cost to the Owner.

B. Installation shall be in compliance with Federal ADA Guidelines, Installation of all hardware (except that noted by storefront supplier) is to be by General Contractor.

C. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
   1. Upon completion of installation, all door assemblies shall be inspected in accordance with NFPA 80 - 4.9 and 5.2.4. Any opening that does not comply with NFPA standards shall be removed and replaced at no additional cost to the Owner.

D. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, arrange for hardware supplier and manufacturers' representatives to hold a project specific training meeting to instruct the installing Contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware for aluminum, hollow metal and FRP doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

E. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.

C. Compare delivered hardware to Approved Hardware Schedule. Report any shortages or damaged materials to Architect and Supplier within 24 hours of delivery. Shortages not reported will be the Contractor's responsibility.

1.07 WARRANTY

A. General Warranty: Reference Section 01 78 36. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

1.08 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Groups and each referenced section that products are to be supplied under.
   1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Groups at the end of Part 3.

2.02 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinge with number of hinge knuckles as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
      a. Three Hinges: For doors with heights 61 to 90 inches.
      b. One (1) additional hinge for doors 3'-4" wide to 4'-0" wide up to 90 inches high.
      c. One (1) additional hinge for exterior and vestibule doors through 40 inches wide and 90 inches high.
   2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required.

3. Hinge Sizes: Provide the following hinges in widths sufficient to minimally clear trim.

Thickness	Size
1-3/4 inch Doors	4-1/2 inch by 4-1/2 inch

4. Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, stainless steel, ball bearing or oil impregnated bearing hinges.
   b. Interior Doors 40 inches or less: Standard weight, stainless steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
   c. Interior Doors 40 inches or more: Heavy weight, stainless steel, ball bearing or oil impregnated bearing hinges.
5. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings.
   a. Tips: Flat button unless otherwise indicated in hardware groups.
   b. Non-removable Pins: Lockable doors opening outward.
   c. Other Doors: Non-Rising pins.
6. Approved Manufacturers
   a. Bommer Industries, Inc. (BO).
   b. Hager Companies (HA).
   c. Ives Hardware; a division of Allegion plc. (IV).
   d. McKinney Products Company; an ASSA ABLOY Group company (MK).
   e. Stanley Hardware; a division of DormaKaba (ST).

B. Continuous geared hinges
   1. ANSI/BHMA A156.26 certified continuous geared Hinges are non-handed, reversible, and fabricated to template screw locations. Provide models as specified in the Hardware Sets. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.
   2. Approved Manufacturers
      a. Bommer Industries, Inc. (BO).
      b. Hager Companies (HA).
      c. Ives Hardware; a division of Allegion plc. (IV).
      d. Pemko Manufacturing Co.; an ASSA ABLOY Group company (PE).
      e. Select Hinges (SL).
      f. Stanley Hardware; a division of DormaKaba (ST).

2.03 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3, Grade 1, certified.
   1. Provide top and bottom flushbolts for inactive leaf of door pair, unless otherwise specified. Whenever top and bottom bolts are utilized, provide dustproof strike as required for sill conditions. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
   2. Approved Manufacturers
      a. Burns Manufacturing (BU).
      b. Door Controls International (DC).
      c. Hager Companies (HA).
      d. Ives (IV).
      e. Rockwood Products (RO).
      f. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever, and inactive-leaf release trigger. Coordinators fabricated from steel with nylon-coated strike plates and built-in adjustable safety release. Provide coordinators complete with necessary closer.

C. Provide proper size coordinators for size of door, plus filler piece to complete total length of frame stop.
   1. Approved Manufacturers
      a. Burns Manufacturing (BU).
      b. Door Controls International (DC).
      c. Hager Companies (HA).
      d. Ives (IV).
      e. Rockwood Products (RO).
      f. Trimco (TC).

D. Vandal Resistant Pulls: Provide stainless steel anti-ligature design minimizing the opportunity for tampering with a soft black touch coating. Provide with through bolts at non-integrated mounting. Provide with mounting points that mate with exit device or mortise lock. Like Rockwood VRT24
   1. Approved Manufacturers and Products
      a. Burns, Hager, Hiawatha, and Trimco.

2.04 CYLINDERS AND KEYING

A. Provide temporary keyed construction cores and keys for all doors during the construction period. Construction control and operating keys and cores shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system.
   1. At end of project and just prior to substantial completion and under direction of Owner or his representative, construction cores shall be removed and returned to the contract hardware distributor and permanent cores installed by Owner/Contractor.
   2. Upon completion of project, and after permanent cores have been installed, the key cabinet, the keying and bitting schedules shall be turned over to the Owner's lock shop.

B. Provide permanent cores for all locks and cylinders keyed into Owner's existing Best master key system. All locks and cylinders shall be master-keyed or grand-master keyed as directed by Owner. Owner will supply system expansion requirements.

C. Key Quantity: Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Three (3).
   2. Master Keys (per Master Key Group): Three (3).
   3. Construction Control Keys: Two (2).
   4. Permanent Control Keys (where required): Two (2).
   5. Construction Keys: Ten (10).

D. Visual Key Control:
   1. Stamp "DO NOT DUPLICATE"

E. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150 percent of the number of locks required for the project.
   1. Approved Manufacturers
      a. Lund Equipment (LU).
      b. MMF Industries (MM).
      c. Telkee (TK).

2.05 MECHANICAL LOCKS AND LATCHING DEVICES

A. Provide wrought boxes and curved lip strikes with lip length sufficient to minimally clear trim.

B. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be field-reversible for handing without disassembly of the lock body. Furnish with standard 2 3/4 inch backset, 3/4 inch throw anti-friction stainless steel latchbolt, and a full 1 inch throw stainless steel bolt for deadbolt functions.
   1. Approved Manufacturers
      a. Corbin Russwin Hardware (RU) – ML2000 Series.
      b. Sargent Manufacturing (SA) – 8200 Series.
      c. Schlage (SC) – L9000 Series.
      d. Stanley Best (BE) – 45H Series.

C. Lock Trim Design: As specified in Hardware Sets.

2.06 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
   1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305.
   2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware".
   3. Except on fire rated doors, provide exit devices with keyed cylinder dogging device to hold the pushbar and latch in a retracted position.
   4. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets.
   5. Narrow Stile Applications: At doors constructed with narrow stiles, regardless of specified in Hardware Sets, provide devices designed for maximum 2 inch wide stiles.
   6. Provide device where noted with a photo-luminescent coating which will produce visible EXIT signage in darkness or low-lit areas.
   7. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

B. Conventional Push Rail Exit Devices: ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.
   1. Approved Manufacturers
      a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
      b. Sargent Manufacturing (SA) - 80 Series.
      c. Von Duprin (VD) - 35A/98XP Series.

2.07 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   2. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide closers meeting requirements to physically handicapped, provide units complying with ANSI/ICC A117.1 provision for door opening and closing force.
   3. Closers shall not be installed on exterior or corridor side of doors, where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
   4. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt as required.

B. Door Closers, Surface Mounted: ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one-piece aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
   1. Approved Manufacturers
      a. LCN Closers (LC) - 4050 Series.
      b. Sargent Manufacturing (SA) - 351 Series.
      c. Norton Door Controls (NO) - 7500 Series.

2.08 ARCHITECTURAL TRIM

A. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
   1. Stainless Steel: 050-inch thick.

B. Door Protective Trim
   1. Size: Fabricate protection plates (kick, armor, or mop) not more than 2 inches less than door width (LDW) on stop side of single doors, and not more than 1 inch less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates.
      a. Kick Plates: 0.050 inch thickness, beveled edges (B4E) and countersunk screw attachment.
      b. Widths: 2 inches less than door width.
      c. Height: 12 inches or 1/2 inch less than height of bottom rail, whichever is less.

C. Approved Manufacturers
   1. Burns Manufacturing (BU).
   2. Hiawatha, Inc. (HI).
   3. Ives (IV).
   4. Rockwood Manufacturing (RO).
   5. Trimco (TC).

D. Trim Protectors: 3/8" x 1-1/2" solid stainless-steel bar.

	Rockwood
Locksets	R115LBP

1. Approved Manufacturers: Burns, Hager, Hiawatha, Ives., Rockwood, Trimco.

2.09 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as required by wall condition. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

C. Approved Manufacturers
1. Burns Manufacturing (BU).
2. Hiawatha, Inc. (HI).
3. Ives (IV).
4. Rockwood Manufacturing (RO).
5. Trimco (TC).
6. Hager.

D. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Provide non-handed design with mounting brackets as required for proper operation and function. Provide Rixson 9-Series overhead stop for doors that are capable of swinging more than 145-degrees before striking wall and where door strikes fixed object such as sink, cabinet, and similar obstructions.

	ABH	Glynn-Johnson	Rixson
Heavy Duty Concealed	1020SL	GJ-100	1-Series
Heavy Duty Surface	9000	GJ-90	9-Series

2.10 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Thresholds: Provide full-saddle type threshold unless floor conditions dictate or detailed otherwise. Provide thresholds with slip resistant" surface like Pemko "PemKote™"
   1. Hardware supplier responsible to verify all finish floor conditions and coordinate proper threshold as required ensuring a smooth transition between threshold and interior floor finishes.

E. Weatherstrip: Install weather strip prior to other surface hardware such as door closers, exit devices ect. to provide full perimeter seal without interruption. Supplier to ensure proper templating of surface hardware allowing for the thickness of the weatherstrip.

F. Automatic Door Bottoms: Provide units with a light-spring action which reduces the operating force to 3-5 pounds required for actuation.
   1. Provide Pemko "RL" Sponge neoprene for units sealing against hard surfaces. Semi-mortised on non-rated openings.
   2. Provide Pemko 420PKL Sponge neoprene for units installed in hollow metal or aluminum doors.
   3. Hardware supplier responsible to verify all finish floor conditions and coordinate proper automatic door bottom as required to prevent snagging between door bottom and interior floor finishes.

G. Astragal Seal: Provide Single Fin with self-adhesive (PCA) backing. UL approved for all labeled and smoke doors like Pemko S771 S772.

H. Approved Manufacturers
   1. National Guard.
   2. Pemko.
   3. Reese.
   4. Zero.

I. Weatherstrip for aluminum doors and frames specified in Section 08 41 13.

2.11 CLOTHES HOOKS

A. Approved products of the following manufacturers:
   1. Don-Jo 302.
   2. Ives 582.
   3. Rockwood 796.

2.12 FABRICATION

A. Fasteners
   1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Exposed Metal Finishes
   1. BHMA 626 / US26D = Satin Chromium plated over nickel, over brass or bronze base metal.
   2. BHMA 652 / US26D = Satin Chromium plated over nickel, over Steel base metal.
   3. BHMA 630 / US32D = Satin Stainless Steel, over stainless-steel base material.
   4. Closers: Waterborne acrylic and powder coat to withstand 100 hours of salt spray.

PART 3 EXECUTION

3.01 INSPECTION

A. Hardware installer and Contractor are responsible to examine all door frames two times after original installation for the following purposes:
   1. First after their initial installation of frames by Contractor and installation of walls boards or masonry units.
   2. Prior to installation of doors and hardware.

B. To verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.
   1. Verify that all frames are installed plumb, square and true and will maintain maximum and minimum gap requirements listed in NFPA 80-2010, NFPA 101-2012 before installation of doors and hardware as follows:
      a. Head, Jambs, and meeting edge of pairs gap requirements: 1/8 inch Maximum.
      b. 3/4 inch at sill Maximum.
      c. Any installed door frame that exceed the minimum or maximum gap requirements, such opening shall be removed and replaced without delay including all necessary products and processes to achieve the specified opening at no additional cost to the Owner.
   2. Examine floor and opening conditions to assure suitability for installation.

C. Provide architect with written report listing conditions detrimental to compliance with requirements of this Section. Accepted installation constitutes acceptance of responsibility for performance.

3.02 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.03 PREPARATION

A. Hollow Metal and FRP Doors and Frames: Comply with ANSI/DHI A115 series.

3.04 INSTALLATION

A. Upon completion of installation, all fire door assemblies shall be inspected in accordance with NFPA 80 - 4.9 and 5.2.4.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
   3. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including hanging devices; locking devices; closing devices; and seals.
   4. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
      a. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   5. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   6. Provide blocking in drywall partitions where wall stops, or other wall mounted hardware is located.

C. Locks
   1. Mount so key enters cylinder with smooth edge down.

D. Door Closers
   1. Install closers on room side of corridor doors, and stair side of stairways.
   2. Lobby doors: Mount on vestibule side.
   3. Exterior doors: Parallel rigid arm installation.
   4. Install closers using only manufacturer-furnished template machine screws for metal doors and manufacturer -furnished wood screws for wood doors.
      a. Coordinate with door supplier to provide proper blocking for surface mounting.

E. Kick plates and armor plates: Bottom within 1/8 inch of door bottom; attach with Phillips head screws.

F. Door Stops: Coordinate blocking requirement with Section 06 10 00.
   1. Position wall stops to catch lever handle or pull.
   2. Wall Stop/ Holder- 6'-6" up from finish concrete floor.

G. Clothes hooks: 48 inches from finish floor on door centerline.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period. At end of project and just prior to substantial completion and under direction of

Owner or his representative, construction cores shall be removed and returned to the contract hardware distributor and permanent cores installed.
1. Furnish permanent cores to Owner for installation.

I. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

J. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Section 07 92 00 - Joint Sealants. Anchor to substrate with stainless steel countersunk screws in stainless steel expansion shields not more than 4 inches from each end and not more than 12 inches on center.

K. Install weather strip prior to other surface hardware such as door closers, exit devices, etc. to provide full perimeter seal without interruption. Supplier to ensure proper templating of surface hardware allowing for the thickness of the weatherstrip.

L. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Owner occupancy.

3.07 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the Owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware, and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Coordinate materials listed in this section with other related sections prior to ordering materials. Should any materials be supplied as previously stated, they shall be required to be replaced at no additional cost to the Owner.

GROUP 11.1 PASSAGE FUNCTION - CLOSER

	Hinges	as specified	US32D	
1	Passage Latchset	45HON 14H	626	BE
1	Surface Overhead Stop (Hvy Dty)	9020	630	ABH
1	Closer	PR7500	689	NO
1	Kick Plate	K1050 - 12" x 2" LDW 4BE CSK	US32D	RO
1	Gasket	S88 D		PE

Functions: Door normally closed and latched. Both levers always active allowing free passage in either direction.

GROUP 12.0 PRIVACY FUNCTION WITH INDICATOR - CLOSER

	Hinges	as specified	US32D	
1	Privacy Lockset w/ Indicator	45HOLT 14H x VIN	626	BE
1	Closer	7500	689	NO
1	Kick Plate	K1050 - 12" x 2" LDW 4BE CSK	US32D	RO
1	Stop	as required		
1	Coat Hook	796	US26D	RO
1	Gasket	S88 D		PE

Functions:

- Door normally closed and latched.
- Outside lever active unless locked by turning inside turn lever.
- Turning inside turn lever secures outside lever; and changes occupancy indicator to "RED Padlock Icon", identifying room is occupied.
- In case of emergency, the outside lever is unlocked by emergency tool outside.
- Rotating inside lever always retracts latchbolt allowing free egress and changes occupancy indicator to "Padlock Icon Un-Locked", identifying the room is vacant.

GROUP 14.0 STOREROOM FUNCTION - CLOSER

	Hinges	as specified	US26D	
1	Storeroom Lockset	ALX80PD RHO	626	SC
1	Closer	1461 REG / 1461 EDA	689	LC
1	Kickplate	8400 - 12" x 2" LDWB-CS	US32D	IV
1	Stop	as required		
1	Gasket	188S		ZE

Functions: Door normally closed, latched, and outside lever is locked. Outside lever always locked. Key in outside cylinder retracts latchbolt allowing entry. Key can only be removed in locked position. Rotating inside lever always allows free egress.

GROUP 20 HARDWARE BY OTHERS

All hardware to be furnished by the door manufacturer or specified elsewhere.

GROUP 164.4 EXTERIOR - RIM EXIT DEVICE - NIGHTLATCH FUNCTION – CLOSER/STOP

	Heavy Weight Hinges	as specified	US32D	
1	Rim Exit Device (nightlatch)	ED5200S K157 M49 M52 M110 VTL957ET	630	RU
1	IC Cylinder	as required (for exit device trim)	626	
1	IC Cylinder	as required (for exit device dogging)	626	
2	Permanent Core	as specified	626	
1	Closer (spring stop arm)	CPS7500	689	NO
1	Door Status Switch	3287		
1	Kick Plate	K1050 - 12" x 2" LDW 4BE CSK	US32D	RO
1	Threshold	273x3AFG-K		PE

1	Set Weatherstrip	2891 APK	PE

Note: Install weather strip prior to other surface hardware such as door closers, exit devices etc. to provide full perimeter seal without interruption. Supplier to ensure proper templating of surface hardware allowing for the thickness of the weatherstrip.

1	Sweep	345APK	PE
1	Rain Drip	346 C	PE

Functions: Door normally closed, latched, and outside is secured. Key in outside retracts latchbolt so the door can be pulled open. Key can only be removed in locked position. Depressing touchpad from inside always allows free egress.

(M49) Photoluminescent coating which will produce increased visibility to exit locations in darkness, low lit areas, or smoke-filled passages.

END OF SECTION

SECTION 08 81 00

GLAZING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Glass for doors and windows.

B. Related Sections
   1. 08 11 00 – Metal Doors and Frames.
   2. 08 11 16 – Aluminum Doors and Frames.
   3. 08 51 13 – Aluminum Windows.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Manufacturer's descriptive data of glass and glazing methods.

B. Recommended installation instructions.

C. Shop drawings showing details of glass installation at framing members, such as head, mullions, jambs, and sills.

D. One 12-inch by 12-inch pieces of each type of glass specified.

1.04 QUALITY ASSURANCE

A. Manufacturer/Fabricator's Qualifications: Not less than 5 years' experience in the actual production of the specified products.

B. Installer Qualifications: Firm with 3 years of experience in installation of systems similar in complexity to those required for this Project, plus other specified requirements:
   1. Acceptable to or licensed by manufacturer.
   2. Successfully completed a minimum of 5 comparable scale projects using this system.

C. Regulatory Requirements: Glass fabricator is responsible for determining specific glass strengths and thicknesses. Strengths and thicknesses indicated on Drawings and specified in this Section are minimum only. Manufacturer's glass sizing and thickness charts shall take precedence over Drawings only where charts indicate thicker or stronger glass:
   1. Tempering: Comply with requirements of CPSC 16, CPR 1201, C11 applicable to this Project. Locations indicated on Drawings are minimum only.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass with manufacturer's labels intact.

B. Do not remove labels until glass has been installed, inspected, and approved by Architect.

C. Keep glass free from contamination by materials capable of staining glass.

D. Deliver glazing compounds and sealants in manufacturer's unopened, labeled containers.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Perform glazing when ambient temperature is above 10 degrees F.

B. Perform glazing on dry surfaces only.

1.07 WARRANTY

A. Contractor/manufacturer/installer shall warrant insulated glass for a period of 5 years from Date of Substantial Completion against conditions indicated below. When notified in writing by Owner they shall promptly and without inconvenience and cost to Owner correct said deficiencies in compliance with requirements of A201, 12.2.
   1. Failure of the Hermetic Seal (10 years on Glass):
      a. Condensation, dust collection, or film formation on glass surfaces within the air space.
   2. Breakage resulting from chipped or damaged edge conditions from original installation or thermal stresses.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Acceptable Manufacturers for Glass Substrate
   1. AFG Industries, Inc.
   2. Ford Motor Co., Glass Division.
   3. Pilkington Group.
   4. PPG Industries, Inc., Glass Group.
   5. Or Approved Equal.

B. Acceptable Fabricators for Coated and Laminated Units are limited to:
   1. HGP.
   2. Viracon, Inc.
   3. Interpane Glass Company.
   4. Guardian Industries Corporation.
   5. Oldcastle Glass Group.
   6. Or Approved Equal.

C. Acceptable Fabricators for Clear and Tinted Insulated Glass Units
   1. Any manufacturer/fabricator with a "CBA" classification.

2.02 MATERIALS

A. Note: Provide tempered or heat strengthened glass as indicated or where required by current applicable building codes.

B. Float Glass (**GL-1**): 1/4-inch thickness, unless otherwise indicated. Comply with ASTM C1036, Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).

C. 1 Inch Insulated Glass (**GL-2**): Low Emissivity coating, Exterior lite - 1/4-inch thick clear float glass, 1/2-inch air space filled with Argon gas, Interior lite - 1/4-inch thick clear float glass. Provide tempered insulating glass units where necessary to comply with safety code requirements and/or indicated on the Drawings.

D. Safety Glass: 1/4-inch thickness, unless otherwise indicated. All tempered glass shall meet the current requirements of the ASTM C1048 "Standard Specification for Heat Treated Flat Glass Kind HS, Kind FT Coated and Uncoated Glass." All Tempered Glass shall have a permanent logo which signifies Safety Commission 16 CFR-1201 and the safety glass test requirements of ANSI Z-97 (current editions).

2.03 GLAZING TAPE

A. Polymerized butyl, rubber tape, coiled on release paper, manufacturer's standard.

2.04 SEALANT

A. 1 part silicone rubber, FS TT-S-001543 non-sag type, Class B.

2.05 ACCESSORIES

A. Setting Blocks: Neoprene, 70-90 Shore "A" durometer hardness, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.

B. Spacers and Shims: Neoprene, 40-50 Shore "A" durometer hardness, chemically compatible with glazing sealant or compound, length as recommended by glass manufacturer.

C. Glazing Points and Wire Spring Clips: Corrosion resistant, manufacturer's standard.

D. Filler Rod: Compressible synthetic rubber or foam, chemically compatible with sealant used.

E. Primer-Sealers and Cleaners: As recommended by glass manufacturer.

PART 3 EXECUTION

3.01 INSPECTION

A. Check that glazing channels are free of burrs, irregularities, and debris.

B. Check that glass is free of edge damage or face imperfections.

C. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

A. Field Measurements
   1. Measure size of frame to receive glass.
   2. Compute actual glass size, allowing for edge clearances.

B. Preparation of Surfaces
   1. Remove protective coatings from surfaces to be glazed.

2. Clean glass and glazing surfaces to remove dust, oil, and contaminants, and wipe dry.

3.03 INSTALLATION

A. Install glass in accordance with manufacturer's recommended instructions.

3.04 CLEANING

A. Remove excess glazing compound from installed glass.

B. Remove labels from glass surface as soon as installation has been inspected.

C. Wash and polish both faces of glass.

D. Remove debris from Site.

3.05 PROTECTION OF COMPLETED WORK

A. Attach crossed streamers away from glass face.

B. Do not apply markers to glass surface.

C. Replace damaged glass.

END OF SECTION

SECTION 08 91 19

METAL WALL LOUVERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Exterior wall louvers.

B. Related Sections
   1. 04 22 00 – Concrete Unit Masonry.
   2. 06 10 00 – Rough Carpentry.
   3. 07 46 13 – Fiber Cement Siding.
   4. 07 92 00 – Joint Sealants.
   5. 09 29 00 – Gypsum Drywall.
   6. Dampers and Connections of Mechanical Ductwork: Refer to Division 23.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data, including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.
   3. Test data or certification indicating water penetration and free area according to AMCA Standard 500.
   4. Certified test reports indicating compliance with specified performance requirements.

B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, relationship to adjoining work, hardware, and installation procedures.

C. Samples: Submit 2 sets of color samples for color selection.

D. Quality Control
   1. Statement of qualifications for manufacturers.
   2. AMCA certification.
   3. Statement of compliance for performance requirements.

1.04 SYSTEM DESCRIPTION

A. Provide louvers and structural support systems to withstand a design wind load of 40-psf positive and negative.

B. Performance Requirements
   1. Provide louver to permit passage of air velocity of 1,000 feet per minute without blade vibration or noise with static pressure loss of 0.10-inch as measured at 1,000 fpm.
   2. Water Penetration: Less than 0.025 ounce of water per square foot of free area at velocity of 1,000 fpm.
   3. Pressure Drop: Less than 0.10-inch w.g. (intake or exhaust) at a free area velocity of 1,000 fpm.
   4. Free Area: Not less than 50 percent.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.

B. Installer's Qualifications: Firm with 3 years of experience in installation of systems similar in complexity to those required for this Project, plus the following:
   1. Acceptable to or licensed by manufacturer.
   2. Successfully completed not less than 5 comparable scale projects using this system.

C. Product/Material Qualifications: Provide AMCA certified rating and seal indicating compliance with specified air flow requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver products in original unopened packaging with legible manufacturer's identification.

B. Storage and Protection: Comply with manufacturer's recommendations.
   1. Protect from the elements and from damage.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Acceptable Manufacturers for 6-inch deep Aluminum Wall Louvers
   1. The Airolite Company, Model CB6776.
   2. Arrow United Industries, Model EA-615-D.
   3. Industrial Louvers, Inc., Model 653-XP.
   4. Ruskin Louvers, Inc., Model ELF6375DX.
   5. American Warming and Ventilating, A Mestek Company, Model LE-31.

B. Drawings and Specifications are based on manufacturer's proprietary literature from The Airolite Company. Other manufacturers shall comply with the minimum levels of material and detailing indicated on the Drawings or specified herein.

2.02 MATERIALS

A. Aluminum: Comply with the following:
   1. Aluminum Shapes: Extruded aluminum, ASTM B221.
   2. Sheet Aluminum: ASTM B209.

2.03 CONTINUOUS TYPE WALL LOUVERS – DRAINABLE BLADES

A. 6 Inch Drainable Blade Wall Louver: Aluminum of continuous type design. Construct of not less than 0.081-inch thick extruded aluminum for frame and blades. 6-inch depth with channel shaped frame. Blades at 35-degree slope.
   1. Performance Requirements: Based on 4 foot by 4 foot size unit.
      a. Approximate Free Area: 9.10 square feet (57 percent).
      b. Approximate Pressure Drop, Free Area Velocity at 0.18 Inch Water Gauge: 1,250 fpm.
      c. Approximate Water Penetration, 0.01 Ounce per Square Foot of Free Area: 1,250 fpm.

2.04 SCREENS

A. Provide framed removable screens. Insect screens are to be installed on all intake louvers and bird screens on all exhaust louvers.

B. Bird screens shall be galvanized steel mesh with 1/4-inch spacing.

C. Insect screens shall be 18 by 16 mesh aluminum.

2.05 ACCESSORIES

A. Sill At Aluminum Louvers: Not less than 0.080-inch thick extruded aluminum of shape as indicated or required to accommodate construction conditions. Finish same as louver.

B. Insulated Blank-Off Panels: Not less than 0.050-inch thick aluminum plate with louver manufacturer's standard insulation adhered on interior face. Finish exposed exterior surface to match louver finish, unless otherwise indicated.

C. Bituminous Coating: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness per coat.

D. Fasteners: Type 302 stainless steel. Size and type as recommended by louver manufacturer to resist loads.

2.06 FABRICATION

A. Shop/Factory Assembly
   1. Fabricate louvers free of visible defects with tight joints.
   2. Neatly miter corners and reinforce with brackets.
   3. Continuous weld corners and intersections. Grind exposed welds flush and smooth to match original metal before applying finish coating.
   4. Use partial blades to achieve even blade spacing.
   5. At continuous type louvers, provide structural supports and blade braces located at each vertical mullion and at intermediate intervals not more than 72 inches on center to produce an exterior elevation without vertical mullions over the entire assembly.
      a. Integral Structural Steel Supports: Designed by louver manufacturer to resist implied wind loads.
      b. Provide complete with manufacturer's interlocking blade braces.
      c. Structural angles, either steel or aluminum, is the responsibility of louver manufacturer to size and provide.

d. Provide for thermal movement and expansion of louver assembly and supports.

2.07 FINISHES

A. Anodic Coating: Clean exposed surfaces with caustic etch and anodize to an Architectural Class 1 coating.
   1. Color Anodic Coating: Clean exposed surfaces with medium matte caustic etch and anodize to an Architectural Class 1 coating (thickness not less than 0.7 mil).
      a. As selected by Architect from manufacturer's full range of anodic coatings.

B. Furnish manufacturer's matching touch-up anodic coating for touch-up of fasteners and abrasions.

C. Thoroughly clean, etch, and give metal surfaces a chromate conversion pretreatment before application of the primer coat.

D. Apply a heavy coating of bituminous paint where aluminum contacts masonry, concrete, mortar, plaster, or a dissimilar metal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper and timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate size and location of cutouts in blank-off panels with mechanical installer.

B. Protection: Protect aluminum in contact with masonry, concrete, steel, and other dissimilar materials from galvanic and corrosive action with neoprene gaskets or a coat of bituminous paint applied before installation of aluminum product.

3.03 INSTALLATION

A. Comply with manufacturer's recommendations.

B. Install louvers straight, plumb, level, and in plane of wall at locations indicated.

C. Use concealed fasteners of non-corrosive material compatible with materials encountered.

3.04 PROTECTION

A. After installation, carefully protect Work against disfiguration or damage from mechanical abuse or harmful materials.

3.05 ADJUST AND CLEAN

A. Adjust louvers so moving parts operate smoothly.

B. Repair damage to louvers to match original or replace.

END OF SECTION

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SECTION 09 29 00

GYPSUM DRYWALL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Gypsum drywall.

B. Related Sections
   1. 06 10 00 – Rough Carpentry.
   2. 07 21 00 – Insulation.
   3. 07 92 00 – Joint Sealants.
   4. 08 11 00 – Metal Doors and Frames.
   5. 08 11 16 – Aluminum Doors and Frames.
   6. 08 51 13 – Aluminum Windows.
   7. 09 91 00 – Painting.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Submittals and shop drawings in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. Gypsum Board Standard: GA-216 by Gypsum Association.

B. Metal Support Standard: ASTM C754.

C. Installation Standard: Gypsum Construction Handbook, US Gypsum Company.

D. Fire Resistance Rating: Where systems with fire resistance ratings are indicated, provide materials and installations which have been tested and listed by recognized authorities.

E. Manufacturer: Obtain products from a single manufacturer or from manufacturers recommended by the prime manufacturer of gypsum board.

F. Allowable Tolerances: 1/16 inch offset between planes of gypsum base faces, and 1/8 inch in 8 feet for plumb, level, warp, and bow.

1.05 PRODUCT HANDLING

A. Deliver, identify, store and protect gypsum drywall materials to comply with referenced standards.

1.06 JOB CONDITIONS

A. Environmental Conditions: Comply with referenced standards.

PART 2 PRODUCTS

2.01 GYPSUM BOARD PRODUCTS

A. Exposed Gypsum Board: ASTM C1396, regular type, unless otherwise indicated:
   1. Edge Profile: Manufacturer's standard.
   2. Thickness: 5/8 inch, unless otherwise indicated on the Drawings.
   3. Sheet Size: Maximum length available which will minimize end joints.
   4. Type X: Provide special fire-retardant gypsum board where indicated or required for fire-resistance rated assemblies, 5/8 inch thick, unless otherwise indicated on the Drawings.
   5. Tile Backer Board: Silicone-treated core with glass mat moisture protectant coating and embedded glass mats, both sides. The face side is surfaced with heat-cured copolymer water and vapor retardant coating, 1/2 inch thick. Provide 2 inch wide coated glass fiber tape for joints and corners.

2.02 TRIM ACCESSORIES

A. General: Provide manufacturer's standard trim accessories of types indicated for gypsum drywall, formed of galvanized steel with flanges for concealment in joint compound, including corner beads, edge trim, control joints, RC-1 resilient channels, etc.

B. Wet or Moist Areas: Sheet steel, galvanized.

2.03 JOINT REINFORCEMENT MATERIALS

A. General: Except as otherwise indicated, comply with ASTM C587.

B. Joint Tape: Perforated type.

C. Joint Compound: Ready-mixed vinyl-type for interior use, single multi-purpose grade for entire application.

2.04 MISCELLANEOUS MATERIALS

A. Concealed Acoustic Sealant: Mastic type; non-shrinking, non-migrating, and non-staining.

B. Water-Resistant Sealant: Type recommended by gypsum board manufacturer. Seal cut edges and penetrations of water-resistant backing board.

C. Sound Attenuation Insulation: Formaldehyde-free Acoustical Glass Fiber Insulation, ASTM C665 Unfaced Type 1, Class 25 flame-spread, thickness equal to or greater than stud dimension.

D. Acoustical Sealant: As recommended by manufacturer.

PART 3 EXECUTION

3.01 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1 foot–0" inch in alternate courses of base.

B. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

C. Install gypsum board with face side out. Do not install imperfect, damaged, or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

D. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts.

E. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories. Locate as indicated and as required by reference standards and not to exceed 30 lineal feet.

F. Cover both faces of master partition framing with gypsum board in concealed spaces, except in chase walls which are properly braced internally. Except where concealed application is required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 square feet area and may be limited to not less than 75 percent of full coverage.

G. Isolate edges of gypsum board from abutment with structure except at floors. Provide 1/4-inch acoustical sealant, coordinated with trim.

H. Floating Construction: Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated, unless control or expansion joints are indicated, or unless fire rating is indicated.

I. All interior stud partitions shall receive sound attenuation blankets as specified in Paragraph 2.04.C above for full height of partition.

J. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

K. Use water-resistant board at all wet locations such as toilets, janitor's closets, bathrooms, etc.

L. Extend partition system, including both faces of gypsum board, sound attenuation blankets, etc. to structure above, unless otherwise indicated.

3.02 INSTALLATION OF TRIM AND JOINT REINFORCEMENT

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or

stapling to substrate in accordance with manufacturer's instructions and recommendations.

B. Install metal corner beads at external corners of gypsum drywall with 9/16 inch galvanized staples at 9 inches on center on both flanges.

C. Install metal edge trim wherever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flanges for embedment in plaster, except where semi-finishing type is indicated. Install L-type where work is tightly abutted to other work and install special Kerf-type where other work is kerfed to receive long leg of L type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints). Conceal all trim in joint compound.

D. Install metal control joint (beaded type) where required.

E. Install joint reinforcement on gypsum wallboard joints (including internal corners). Comply with manufacturer's recommendations for attachment and embedment of joint reinforcement in plaster or other joint compound. Provide either mesh-type or paper-type joint reinforcement, at Installer's option, except comply with manufacturer's recommendations and requirements. Comply with Gypsum Construction Handbook for three-coat application on all gypsum board.

3.03 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840, GA-216 or GA-214:
   1. Locations to receive Level 0 finish (no taping, finishing, or accessories required): Non-fire-rated, non-sound-rated, and non-smoke-rated assemblies in ceiling plenums and concealed areas, and in temporary construction.
   2. Locations to receive Level 1 finish (all joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable): Fire rated, sound rated, and smoke rated assemblies in plenum areas above ceilings, in attics, and in areas where the assembly would generally be concealed.
   3. Locations to receive Level 2 finish (all joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound): Surfaces to receive moisture resistant gypsum board as a surfacing.
   4. Locations to receive Level 3 finish (all joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound): Areas which are to receive heavy or

medium-texture (spray or hand applied) before final painting, or where heavy-grade wallcoverings are to be applied as the final decoration. This level of finish is not recommended where smooth painted surfaces or light to medium wall coverings are specified.

5. Locations to receive Level 4 finish (all joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints): All flat and eggshell paints, light textures, or wallcoverings.
6. Locations to receive Level 5 finish (all joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges): Gloss or semi-gloss paints, and areas where severe lighting conditions occur.

3.04 INSTALLATION OF ACOUSTICAL BACKING

A. Install continuously with no cut joints using adhesive as recommended by manufacturer.

3.05 CLEANING AND PROTECTION

A. Remove temporary coverings used to protect other work.

B. Remove spillage promptly from door frames, windows, and other adjoining work. Repair surfaces which have been damaged by plastering work.

C. Protect gypsum drywall work from damage and deterioration during the remainder of the construction period.

END OF SECTION

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SECTION 09 31 13

CERAMIC TILE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Porcelain Stone tile for floor and wall applications, using thin-set application method.
   2. Grout, setting materials, and related accessories.

B. Related Sections
   1. 03 30 00 – Cast-In-Place Concrete.
   2. 04 22 00 – Concrete Unit Masonry.
   3. 07 92 00 – Joint Sealants.
   4. 09 29 00 – Gypsum Drywall.

1.02 REFERENCES

A. For installation methods see the 2007 version of the "TCA Handbook for Ceramic Tile Installation" published by the Tile Council of North America, Inc.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Submit for the Architect's Review
   1. Product Data for each tile, grout, and accessory item.
   2. Color Selection Samples for the Following:
      a. Grout colors.
      b. Sealant colors.
   3. Record Samples for the Following:
      a. Each tile type in each size, color, and finish indicated.
      b. Grout colors.
      c. Sealant colors.

B. Submit for the Owner's Use/Records
   1. Statement of Qualifications from manufacturers.
   2. Statement of Qualifications from installer.
   3. Certificates of Compliance for coefficient of friction requirements.
   4. Master Grade Certificate for each tile, in the form, and including information specified in ANSI A137.1.
   5. Manufacturer's published cleaning and maintenance instructions for each type of tile.

1.05 QUALITY ASSURANCE

A. Comply with standards of Tile Council of North America, Inc.

B. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of the specified products.

C. Installer Qualifications: Firm with not less than 5 years' experience in installation of systems similar in complexity to those required for this Project, plus other specified requirements:
   1. Successfully completed a minimum of 5 comparable scale projects using this system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original sealed containers with legible labels and hallmarks certifying compliance with reference standards.

B. Deliver mastic grout ready for use.

C. Deliver dry-set mortar in sealed, moisture-proof containers.

D. Store materials under cover so as to prevent damage or contamination.

E. Store at a temperature of not less than 55 degrees F for at least 24 hours before installation.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature within range of 50 to 90 degrees F during and for at least 24 hours after installation of tile materials.

B. Provide adequate ventilation to carry off excess moisture.

C. Do not apply setting materials to surfaces containing frost.

D. Do not install tile in areas where temperature of substrate is above 100 degrees F.

E. Protect adjoining work surfaces before tile work begins.

PART 2 PRODUCTS

2.01 TILES

A. Floor Tile (CT-1): 12 inch by 12 inch unglazed porcelain with smooth finish and absorption of not more than 0.5 percent.
   1. Edge Design: Cushion.
   2. Thickness: 1/4 inch.
   3. Tile Colors: Architect shall have option to select from manufacturer's colors in Price Groups 1, 2, 3, and 4.
   4. Standard of Quality: American Olean, Daltile, Crossville, Inc.
   5. Silicone Rubber Grout: Silicone sealant, moisture and mildew resistant type, complying with ANSI A118.6.
   6. Grout Color: As selected from the manufacturer's full range of available colors.

B. Porcelain Base Tile (CT-2): 6 inch by 12 inch coved base porcelain stone tile with smooth glazed finish and absorption of not more than 0.5 percent.
   1. Edge Design: Cushion.
   2. Thickness: 5/16 inch.
   3. Tile Colors: Architect shall choose from colors up through Price Group IV.

4. Special Shapes.
5. Coved base.
6. Bullnose edge.
7. Standard of Quality: American Olean, Daltile, Crossville, Inc.
8. Silicone Rubber Grout: Silicone sealant, moisture and mildew resistant type, complying with ANSI A118.6.
9. Grout Colors: As selected from the manufacturer's full range of available colors.

C. Porcelain Wall Tile (**CT-3**): 12-inch by 12-inch porcelain stone tile with smooth glazed finish and absorption of not more than 0.5 percent.
1. Edge Design: Cushion.
2. Thickness: 5/16-inch.
3. Tile Colors: Architect shall choose from colors up through Price Group IV.
4. Special Shapes:
5. Bullnose edge.
6. Standard of Quality: American Olean, Daltile Crossville, Inc.
7. Silicone Rubber Grout: Silicone sealant, moisture and mildew resistant type, complying with ANSI A118.6.

D. Trim: Include all trim and accessories needed for a complete installation. Base trim shall match tile and shall terminate in a bullnose where wall tile is not specified.

2.02 SETTING MATERIALS

A. Portland Cement: ASTM C150, Type 1.

B. Sand: ASTM C144.

C. Water: Potable.

D. Lime: ASTM C206, Type S or ASTM C207, Type S.

E. Bond Coat: Dry - Set Mortar - ANSI 118.1.

F. Latex: Portland Cement Mortar - ANSI 118.4.

G. Reinforcement: 2-inch by 2-inch by 16/16-gauge welded wire mesh, or equivalent.

H. Metal Lath: Galvanized or painted expanded metal lath.

I. Cleavage Membrane: 15 lb. roofing felt or 4-mil polyethylene film.

2.03 EXPANSION JOINTS

A. Back Up Strip: Flexible, compressible, close-cell foam polyethylene or butyl rubber, rounded at surface to contact sealant.

2.04 THRESHOLDS

A. Solid surface transition strip by Corian or approved equal at doors where floor finish changes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before tiling, make sure variations of surface to be tiled fall within maximum variations shown below:
   1. Dry Set Mortar: (Walls) 1/8-inch in 8-feet; (Floors) 1/8-inch in 10-feet.

B. Report all unacceptable surfaces to the Architect and do not tile such surfaces until they are leveled enough to meet above requirements. Leveling coat is included in this Section.

C. Before tiling commences visually confirm surfaces to be tiled are free from coating, curing membranes, oil, grease, wax, and dust.

3.02 LAYOUT

A. Determine locations of all movement joints before starting tilework.

B. Lay out all tilework so as to minimize cuts less than 1/2 tile in size.

C. Locate tile cuts in both walls and floors so as to be least conspicuous.

D. Align all floors and wall joints to give straight uniform grout lines parallel with walls.

E. All tile joints shall be the same width.

F. Porcelain base shall be installed first and ceramic tile shall be installed flush with abutting surface of base. Under no circumstances shall porcelain base be installed on top of ceramic tile flooring.

3.03 WORKMANSHIP

A. Supply first-class workmanship in all tilework.

B. Use all products in strict accordance with recommendations and directions of manufacturer.

C. Proportion all mixes in accordance with latest ANSI Standard Specifications.

D. Be sure all tilework is free of grout film upon completion.

E. Be sure cut tile edges are clean before installing.

F. Fit tile carefully against trim, accessories, pipe, electrical boxes, and other built-in fixtures so that escutcheons, plates, and collars will completely overlap cut edges.

G. Be sure tilework is free of grout film upon completion.

3.04 SETTING METHODS

A. Ceramic Floor Tile - Tile Council of North America, Inc. Method:
   1. F113 - Dry set mortar to be used for cast-in-place concrete.

B. Porcelain Ceramic Base and Wall Tiles - Tile Council of North America, Inc. Method:
   1. W202 - Dry set mortar.

3.05 GROUTING

A. Follow grout manufacturer's recommendations as to grouting procedures and precautions.

B. Remove all grout haze, observing grout manufacturer's recommendations as to use of acid and chemical cleaners.

C. Rinse tilework thoroughly with clean water before and after chemical cleaners.

D. Polish surface of wall tiles with a soft cloth.

3.06 PROTECTION FROM CONSTRUCTION DIRT

A. Cover all tile floors with heavy-duty, non-staining construction paper, masked in place.

3.07 EXPANSION JOINTS

A. Provide expansion joints as recommended by Tile Council of America in any room larger than 12 feet in any dimension.

3.08 PROTECTION FROM TRAFFIC

A. Prohibit all foot and wheel traffic from using newly tiled floors for at least 7 days.

B. Place large, flat boards in walkways and wheel ways for 7 days where use of newly tiled floors with cement type grout is unavoidable.

END OF SECTION

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SECTION 09 65 19

RUBBER BASE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Rubber base (**RB**).

B. Related Sections
   1. 03 30 00 – Cast-In-Place Concrete.
   2. 09 29 00 – Gypsum Drywall.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Select an installer who is competent in the installation of rubber base.

B. Provide accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

1.04 SUBMITTALS

A. Submit the manufacturer's standard samples showing the available colors for rubber base.

1.05 ENVIRONMENTAL CONDITIONS

A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65 degrees F (18 degrees C) and a maximum temperature of 100 degrees F (38 degrees C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55 degrees F (13 degrees C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

D. Install rubber base after the other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 WALL BASE MATERIALS

A. Rubber wall base (**RB**)
   1. Manufacturers: Roppe, Johnsonite.
   2. Material: Rubber with ribbed back.
   3. Profile: Height 4 inches, gauge 0.080 inch.
   4. Toe: Coved at hard surface floors.
   5. Corners (Inside and Outside): Preformed.
   6. Colors: As selected from the range currently available from manufacturer.

2.02 ADHESIVES

A. Provide Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.

2.03 ACCESSORIES

A. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSPECTION

A. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

B. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.02 PREPARATION

A. Vacuum or broom-clean surfaces to be covered immediately before the application of rubber base. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.03 INSTALLATION OF ACCESSORIES

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

3.04 CLEANING AND PROTECTION

A. Protect installed rubber base as recommended by the manufacturer against damage from other trades, or the placement of fixtures and furnishings.

END OF SECTION

SECTION 09 77 20

DECORATIVE FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Prefinished polyester glass reinforced plastic sheets adhered to concrete masonry units or gypsum board partitions.
2. PVC and/or harmonizing trim.

B. Related Sections
1. 06 10 00 – Rough Carpentry.
2. 07 92 00 – Joint Sealants.
3. 09 29 00 – Gypsum Drywall.

1.02 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
1. D-256 – Izod Impact Strengths (ft #/in).
2. D-570 – Water Absorption (percent).
3. D-638 – Tensile Strengths (psi) & Tensile Modulus (psi).
4. D-790 – Flexural Strengths (psi) & Flexural Modulus (psi).
5. D-2583 – Barcol Hardness.
6. D-5319 – Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
7. E-84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives and sealants prior to their delivery to the site.

1.05 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
   1. ASTM E-84 (Method of test for surface burning characteristics of building Materials)
      a. Wall Required Rating – Class C.

B. Sanitary Standards: System components and finishes to comply with:
   1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (70 degrees F) for 48 hours prior to installation.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70 degrees F) and ventilation consistent with good working conditions for finish work.

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.08 WARRANTY

A. Furnish one-year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURER

A. Marlite: 202 Harger Street, Dover, OH 44622. 800-377-1221, Fax (330) 343-4668, Email: info@marlite.com www.marlite.com.

B. Products:
   1. Standard FRP (**FRP**) with PVC trim.

2.02 PANELS (FRP)

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
   1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
   2. Dimensions:
      a. Thickness – 0.090 inch (2.29mm) nominal.
      b. Width - 4'-0" (1.22m) nominal.
      c. Length – 10'-0" (3.0m) nominal.
   3. Tolerance:
      a. Length and Width: +/-1/8 inch (3.175mm).
      b. Square - Not to exceed 5/32 inch (3.96mm) for 10 foot (2.4m) panels.

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
   1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter).
   2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter).
   3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter).
   4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter).
   5. Water Absorption - 0.72 percent per ASTM D 570.
   6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
   7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256.

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

2.03 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
   1. Match panel colors.
   2. Length to suit project conditions.

B. Adhesive
   1. Marlite C-551 FRP Adhesive - Water- resistant, non-flammable adhesive.

C. Sealant
   1. Marlite Brand MS-250 Clear Silicone Sealant.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
   1. Verify that stud spacing does not exceed 24 inch (61cm) on-center.

B. Repair defects prior to installation.
   1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

3.02 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8 inch (3 mm) clearance for every 8 foot (2.43m) of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
   2. Pre-drill fastener holes 1/8 inch (3.175mm) oversize with high speed drill bit.
      a. Space at 8 inches (20.32cm) maximum on center at perimeter, approximately 1 inch from panel edge.
      b. Space at in field in rows 16 inches (40.64cm) on center, with fasteners spaced at 12 inches (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
      b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
   1. All moldings must provide for a minimum 1/8 inch (3.18mm) of panel expansion at joints and edges, to insure proper installation.
   2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.03 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

SECTION 09 88 13

CONCRETE FLOOR SEALER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Concrete floor sealer.

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

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Submit manufacturer's specification for floor sealer and application requirements.

1.04 PRODUCT HANDLING

A. Deliver containers to project site in sealed, unopened, and labeled containers.

B. Store and handle to prevent damage to product and environment.

1.05 PRODUCT CONDITIONS

A. Assure concrete has been cured a minimum of 7 days.

B. Assure concrete is clean and free of curing compounds, sealers, laitance, grease, oil, and contaminants.

C. Protect adjacent areas from damage due to overspray.

PART 2 PRODUCTS

2.01 MATERIALS

A. **SL-1**: Concrete Sealer Densifier
   1. Color: Clear.
   2. Approved Manufacturers and Products:
      a. L & M Construction Chemicals, Inc.: Seal Hard.
      b. Sonneborn Building Products.
      c. Tennant Company: Eco-Hard-N-Seal™.
      d. Or approved equal.

PART 3 EXECUTION

3.01 APPLICATION

A. Apply sealer in accordance with manufacturer's specifications.

B. Thoroughly clean concrete surface before applying sealer.

C. Apply directly from sealer container onto concrete surface. Do not dilute.

D. Use mechanical walk-behind or riding scrubber.

E. Apply first application at a minimum rate of 1 gallon per 200 square feet.

F. Allow surfaces to remain wet with sealer for a minimum of 60 minutes.

G. Remove excess sealer at end of application procedure by water flushing and squeegeing dry.

H. Apply second application of sealer just prior to project completion at the rate recommended by the manufacturer.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Surface preparation, materials, and application of protective coatings specified herein.
2. Shop applied and field applied coatings.

B. Related Sections
1. 03 30 00 – Cast-In-Place Concrete.
2. 04 22 00 – Concrete Unit Masonry.
3. 05 50 00 – Metals Fabrications.
4. 08 11 00 – Metal Doors and Frames.
5. 09 29 00 – Gypsum Drywall.
6. 22 05 00 – Common Work Results for Plumbing.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. D4414 – "Standard Practice for Measurement of Wet Film Thickness by Notched Gauges."
2. D4541 – "Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers."
3. E-337 – "Test Method for Measuring Humidity by Psychrometer."
4. F1869 – "Standard Method of Measuring Moisture Vapor Emission rate of Concrete Subfloor Using Anhydrous Calcium Chloride."
5. Committee D01.23 – "Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using Ultrasonic Gauge."

B. ICRI – International Concrete Repair Institute
1. Technical Guideline No. 03372, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer overlays.

C. SSPC – The Society for Protective Coatings and NACE- The National Association of Corrosion Engineers – Surface Preparation Specifications. The current preparation standards are joint standards SSPC/NACE.
1. SSPC-SP13/NACE No. 6, Surface Preparation of Concrete.
2. NACE RPO188 "Discontinuity Holiday Testing of Protective Coatings."

D. Green Seal
1. GC-03 – Anti-Corrosive Paints.
2. GS-11 – Product Specific Environmental Requirements.

E. Painting and Decorating Contractors of America
   1. PDCA – Architectural Painting Specification Manual.

F. South Coast Air Quality Management District
   1. SCAQMD Rule 1113 – Architectural Coatings.

1.04 SUBMITTALS

A. Shop Drawings
   1. Furnish shop drawings in accordance with Section 01 33 00. Include data sheets for each paint system required, as well as color charts. Submit shop drawings of the proposed stencil lettering, arrows, and words to be provided.

B. Factory-Applied Coatings
   1. Submit to the Architect for review certified lab testing from manufacturer that the coating system meets or exceeds requirements specified within. Include product data sheets and testing information specified for submittals in Part 2 - Products.

1.05 WARRANTY

A. The Contractor and coating manufacturer shall warrant jointly and severally to the Owner and guarantee the Work under this Section against defective workmanship and materials for a period of 2 years commencing on the date of final acceptance of the Work.

1.06 QUALITY ASSURANCE

A. The paint products mentioned in the following Specification are set up as a standard of quality. The standard "or equal" clause shall apply. Requests for substitution shall include the name of the specified material for which a substitution is sought, the name of the proposed material, product data sheets, and certified lab testing for each of the criteria referenced below. Additional information may be requested by the Architect. No request for substitution shall be considered which would decrease film thickness or change the generic type of the coating specified. The decision of the Architect regarding approval or disapproval of the proposed substitution shall be final.
   1. Performance Criteria to be referenced for each product shall include:
      a. Abrasion – ASTM D4060, CS-17 Wheel, 1,000-grams load.
      b. Adhesion – ASTM D4541.
      c. Hardness – ASTM D3363.
      d. Humidity – ASTM D2247 and D4585.
      e. Salt (Fog) Spray – ASTM B117.
      f. Corrosion Weathering – ASTM D5894.

B. Experience: Contractor must have performed satisfactory installation of protective coatings systems in wastewater treatment facilities and shall have 5 years of practical experience in the application of specified products. Upon request, Contractor shall substantiate this requirement by furnishing a list of references and job completions. In lieu of experience, the Contractor shall provide a guaranty bond or cash deposit equivalent to 100 percent of the Painting Bid Price to guarantee performance. The Contractor shall submit documentation from the manufacturer that he has successfully completed training or obtained certification on the use of the product systems specified herein.

C. A minimum of 30 days prior to the start of any painting, Contractor shall schedule a meeting held at the Site with the manufacturer's representative, painting contractor,

Contractor, the Owner, and the Architect. Items discussed will be application, surface preparation, environmental control, coordination, paint properties, safety, quality assurance measures, etc.

D. Coating manufacturer shall provide a qualified representative to visit the Site as required for quality assurance and to determine compliance with manufacturer's instructions and this Specification. The Architect may require a manufacturer's representative to resolve field problems pertaining to products furnished under this Contract.

E. Inspection by the Architect or the waiver of inspection of any particular portion of the Work shall not be construed to relieve the Contractor of his or her responsibility to perform the Work in accordance with these Specifications. Owner reserves the right to hire a third-party inspector if deemed necessary. Inspector(s) shall have full access to all areas of Work.

F. Contractor shall complete documentation of quality assurance for the Project. Documentation shall be available to Owner/Architect for periodic analysis throughout the Project and submitted to Owner/Architect as a complete package prior to construction completion. Among the minimum items that should be included as part of this quality assurance is
   1. Documentation that preparation procedures meet the standard specified for each system.
   2. Documentation of mil thickness of each coat as it applies to this Specification.
   3. Visually inspect and document coatings especially linings for un-cured resin, bubbles, pinholes, fisheyes, checking and foreign debris. Then mark and repair these areas.
   4. Test for holidays in immersion areas by use of a holiday detector system.
   5. Note: At Contractors' option, he or she may elect to have this done by a third-party inspector at the Contractors expense.

1.07 SURFACES REQUIRED TO BE PAINTED

A. It is the intent that all new interior exposed surfaces of metal, precast concrete planks, precast concrete wall panels, concrete, concrete masonry units without integral coloring, gypsum drywall, sheet metal, process equipment, HVAC equipment, electrical equipment, process piping, plumbing, sanitary piping, wood, and other miscellaneous items be painted, whether specifically mentioned or not, unless indicated otherwise.

1.08 SURFACES NOT REQUIRED TO BE PAINTED

A. Non-ferrous and corrosion-resistant ferrous alloys, such as copper, bronze, monel, aluminum, chromium plate, stainless steel, factory finished metal roofing, metal facing panels, metal soffits, plus fiberglass, **except** as noted below. Therefore, paint the following:
   1. Where required for electrical insulation between dissimilar metals.
   2. Aluminum in contact with concrete or masonry.
   3. All electrical conduit.
   4. Vents, grills, and louvers that are not prefinished.
   5. Aluminum ductwork.
   6. Copper water and drainage piping systems, including accessories.

B. The following surfaces shall not be painted
   1. All HVAC machinery, vents, grills, and louvers that are anodized or factory finished with baked enamel.

2. Non-metallic materials, such as glass and porcelain, except as required for Architectural painting or color-coding.
3. Electrical motor control and supervisory panels furnished with baked enamel finish or specified not to be painted.
4. Non-exposed galvanized steel surfaces, such as conduit above suspended ceilings.
5. Anodized aluminum doors, door frames, and windows.
6. Sprinkler heads.
7. Interior concrete or concrete block walls and ceilings above suspended ceilings.
8. Finish materials with inherent color.
9. Caulking: Pre-colored caulking shall be provided.
10. Surfaces below grade that will be covered with soil.

1.09 COORDINATION AND SCHEDULING

A. Painting shall be done at such times as agreed upon by the Contractor and Architect in order that neat, dust-free work is obtained. All painting shall be done strictly in accordance with the manufacturers' instructions and shall be performed in a manner satisfactory to the Architect.

B. Contractor shall strictly adhere to the temperature, dew point, relative humidity, and any other requirements specified on the manufacturer's product data sheets. All heating units shall be indirect-fired and explosion proofed. No open flame heaters may be used during application or curing of coatings. All combustion by-products shall be positively vented to the outside.

C. Conform to the requirements of Division 01.

D. Painting of all steel door tops and bottoms shall be completed prior to hanging of the doors. If this does not occur, all steel doors will be taken off their hinges and laid flat for painting of the tops and bottoms.

E. Damage to painted surfaces incurred during construction shall be repainted by the Contractor at no cost to the OWNER.

F. General Contractor shall coordinate with painting subcontractor, paint supplier, and equipment and material suppliers that factory applied coatings are compatible with final coatings of proposed manufacturers of this Section.

G. Protection
   1. Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

1.10 PAINT DELIVERY AND STORAGE

A. All materials shall be delivered to the Site in the original sealed and labeled containers and shall be subject to inspection by the Architect. All labels shall show the name of the manufacturer, general type of paint, batch date or number, color name or number, and trade name and number identifying each specific product.

B. All materials used on the Project by the Contractor shall be stored in a single place provided by the Contractor or designated by the Architect. Such storage shall comply with OSHA Requirements and the recommendations of the National Fire Protection Association. Product data safety sheets shall be kept on Site at all times.

C. Oily or solvent-soaked rags and all waste shall be removed every night and all necessary precautions shall be taken to reduce fire hazard to a minimum.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Paints, Coatings, Linings, Sealers, and Stains
   1. Tnemec (Standard of Quality). Note, that Series 20 or FC 20 may be substituted for Series N69 or N69F, but Series N69 or N69F shall not be substituted for Series 20 or FC 20.
   2. Equivalent products by Sherwin Williams.
   3. Bid other manufacturers as Substitute items.

B. Latex Paint
   1. The Sherwin Williams Company (Standard of Quality).
   2. Equivalent products by Tnemec, Benjamin Moore, or Ameron.

2.02 COLORS

A. All colored products shall be assumed to be tinted, unless stated otherwise.

B. Room finish colors shall be selected by Owner.

C. The Architect shall select colors from manufacturers' standard and special OHSA safety color guide.

D. Interior room colors shall be selected by the Owner and may be a different color in each room. Ceilings and floors may be different colors than walls and there may be up to 2 wall colors in each area.

E. The Contractor shall submit color charts to the Architect and Owner and obtain an approved color schedule for all coatings prior to application.

F. A typical pipe and equipment color schedule appears as follows. Modifications to this schedule will likely occur and may also require more or less banding of colors:

Piping and Equipment	Color
Raw Water Lines	Olive Green
Finished or Potable	Dark (Safety) Blue
Sludge Lines	Dark Brown
Recycle Lines	Tan
Compressed Air Lines	Safety Green
Blower Air Lines	Medium Green
Gas Lines	Safety Red
Aluminum Sulfate (Alum) Lines	Safety Orange w/Green Band
Fluoride Lines	Light Blue
Potassium Permanganate Lines	Safety Grape
Sodium Hydroxide (Caustic Soda) Lines	Safety Orange
Sewer Lines	Dark Gray
Grey Water Lines	Light Grey
Non-Potable Water Lines	Dark Blue with Red Bands
Reclaimed Effluent Water	Purple

G. Equipment bases and pipe supports shall be painted the same color as equipment. In general, equipment shall receive finish coatings of the same color as piping system of which it is a part. Equipment nameplates shall be removed and re-attached after painting or completely protected from coverage by field-applied coatings.

2.03 MATERIALS

A. The specified products are the standard of quality.

B. All unspecified materials, such as shellac, turpentine, or linseed oil, shall be the "best grade" or "first line" product made by a reputable recognized manufacturer.

C. All materials applied to the same surface shall be compatible.

D. Materials shall be ready-mixed, except for tinting of under coats and possible thinning (if recommended by the manufacturer).

E. Indoor Environmental Quality Characteristics
   1. [Interior] Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.
   2. [Interior] Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
   3. [Interior] Clear Wood Finishes, Floor Coatings, Stains, Primers, and Shellacs: Maximum volatile organic compound content in accordance with SCAQMD Rule 1113.
   4. [Interior] Concrete, Wood, Bamboo, and Cork Floor Finishes: Maximum volatile organic compound content in accordance with SCAQMD Rule 1113, including sealers and stains.

2.04 PIPE IDENTIFICATION

A. All exposed interior and exterior piping having diameters 6 inches or larger shall receive stencil type painted identification utilizing coating FM-2 of Section 3.04. Piping smaller than 6 inches shall receive pipe markers per Section 40 05 10 or Section 22 05 00.

B. Stencils shall be constructed of flexible plastic and shall be re-usable.

C. Stencil letters shall be upper case, 2 inches in height, and proportional in width.

D. Stencils shall identify process or fluid conveyed and direction of flow.

E. Each pipe identification stencil shall be constructed so that all letters and words contained in the identifying label are wholly complete and properly spaced. No combination of differently worded stencils shall be allowed to identify any 1 pipe.

F. Each stencil shall have a 6-inch long by 1-inch wide direction of flow arrow included before and after the identifying words. The arrow on the left shall point left and the arrow on the right shall point right. When the stencil is painted on the pipe, the arrow indicating proper direction of flow shall also be painted while the other arrow shall be covered up.

G. Stencils shall be cleaned and turned over to the Owner after all painting is complete.

H. For Bidding purposes, assume 10 different stencils each having 2 arrows and 20 letters each.

I. A drawing and description of a typical stencil shall be submitted to the Engineer for approval and at that time a list will be provided of all stencils required.

J. Placement
   1. Each pipe shall be labeled with a minimum of 2 stencils in each room.
   2. Stencils shall be applied on all branch lines of all header pipes.
   3. Stencils shall be installed on all header lines between branches.
   4. Where the same pipe goes through a wall or a piece of equipment, stencils on each side are required.
   5. Stencils for chemical piping shall in no case exceed 10-foot spacing.
   6. In no case on all other piping shall stencils exceed 20-foot spacing.

PART 3 EXECUTION

3.01 GENERAL SURFACE PREPARATION

A. All surfaces to be painted shall be prepared with the objective of obtaining the cleanliness and profile required for the specified coating system and intended service environment. No painting shall be done before the prepared surfaces are approved by the Architect. Approval by the Architect does not relieve the Contractor of responsibility to meet all requirements of Specifications, paint manufacturer requirements/recommendations, rework as required, etc.

B. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on valves and machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring any adjacent surfaces. Protect working parts of all mechanical and electrical equipment from damage during surface preparation and painting process. All openings in motors shall be masked to prevent paint and all other materials from entering the motors.

C. Perform preparation procedures for each substrate in strict accordance with paint manufacturers written instructions and as outlined in the following schedule. Refer to the subsequent discussions for specific preparation requirements.
   1. S1: SSPC-SP1 Solvent Cleaning
      a. The removal of all visible oil, grease, soil, drawing, and cutting compounds, and other soluble contaminants from surfaces with solvents or commercial cleaners using various methods of cleaning, such as wiping, dipping, steam cleaning, or vapor degreasing.
   2. S2: SSPC-SP2 Hand Tool Cleaning
      a. The removal of all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by the use of non-power hand tools.
   3. S3: SSPC-SP3 Power Tool Cleaning
      a. The removal of all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by the use of power-assisted hand tools.
   4. S4: SSPC-WJ4 Light Water Jetting (Pressure Wash)
      a. The entire surface shall high pressure washed at a minimum 1,500 psi removing all loose paint, dirt, or foreign matter. Upon completion of pressure washing procedure, rinse all areas with potable water and allow to dry. Dryness of surface shall be verified by use of polyethylene moisture test or a reading of 17 percent or less utilizing a moisture meter.

5. S5: Concrete/Gypsum
    a. Prepare cementitious surfaces of concrete, concrete block, cement plaster, and mineral fiber board to be painted by removing all efflorescence, chalk, dust, laitance, dirt, grease, oils, and by roughening as required to remove glaze. Scrape and grind fins and protrusions flush with surface. Rake mortar joints clean.
6. S6: SSPC-SP6 or NACE 3 Commercial Blast Cleaning
    a. The removal of all visible oil, grease, dirt, dust, mill scale rust, paint, oxides, corrosion products, and other foreign matter by compressed air nozzle blasting, centrifugal wheels, or other specified method. Discoloration caused by certain stains shall be limited to no more than 33 percent of each square foot of surface area. The blast profile specified by the coating manufacturer's product requirements shall be achieved.
7. S7: SSPC-SP7 or NACE 4 Brush-Off Blast Cleaning.
    a. The removal of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint by compressed air nozzle blasting, centrifugal wheels, or other specific method. Tightly adherent mill scale, rust, and paint may remain on the surface.
8. S8: SSPC-WJ4 Light Waterjetting (High Pressure Wash)
    a. The entire surface shall be high pressure (minimum 2,500 psi) washed with a biodegradable, phosphate, and residue free additive. A stiff bristle brush shall be used to assist in the removal of all dirt, mildew, dust, and other foreign matter.
9. S9: SSPC-SP13 Acid Etching
    a. Remove residual dust and dirt with water using a high-pressure hose. Remove excess water and allow concrete to dry until the surface is damp. Uniformly apply a solution of 1-part Muriatic Acid and 2 to 4 parts fresh water utilizing low pressure spray equipment or sprinkling cans. When bubbling begins to subside, immediately rinse with clean water while scrubbing with a stiff bristle broom. Test with pH paper and continue the rinsing operation until a pH of 7 or higher is obtained. Allow floor to dry thoroughly before coating.
10. S10: SSPC-SP10 or NACE 2 Near-White Metal Blast Cleaning
    a. The removal of all visible oil, grease, dirt, dust, mill scale rust, paint, oxides, corrosion products, and other foreign matter by compressed air nozzle blasting, centrifugal wheels, or other specified method. Discoloration caused by certain stains shall be limited to no more than 5 percent of each square inch of surface area. The blast profile required by the coating manufacturer's product requirements shall be achieved.
11. S11: Concrete (Severe Exposure, Including Immersion)
    a. SSPC-SP13/NACE No. 6 and ICRI Guideline No. 310.2 according to manufacturer's recommendations:
        1) Abrasive blast all surfaces to remove all laitance and solid contaminants. Blasting shall be performed sufficiently close to the surface so as to open up surface voids, bug holes, air pockets, and other subsurface irregularities.
12. SSPC-SP11 Power Tool Cleaning to Bare Metal
    a. Removal of all visible oil, grease, dirt, mill scale, rust, paint, oxide, corrosion products, and other foreign matter. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted.

D. Cast-In-Place Concrete, Precast Concrete, and Concrete Block
    1. All surfaces shall be cleaned or any loose scale, cement, form oil, curing compounds, dirt, or other deleterious material.
    2. Concrete Masonry Unites
        a. Mortar joints cured 28 days.
        b. Substrate must be clean and dry, and free of all contaminants, including laitance.

c. Tooled joints shall be brushed to remove pieces of mortar and other foreign matter.
d. Chipped block shall be patched with concrete patching materials prior to application of paint coatings.
e. All holes or chips shall be carefully filled and properly repaired prior to painting.

3. Poured-In-Place and Precast Concrete
   a. Allow 28 days for concrete to cure.
   b. Substrate must be clean and dry, and free of all contaminants, including form release agents and laitance.
   c. Roughen surface to create a profile capable of supporting the coating system specified.
   d. All concrete for immersion service shall be prepared per SSPC-SP13/NACE No. 6 or ICRI Guideline 310.2.
   e. All concrete for immersion service shall have successfully passed the leak testing requirements of this Project prior to application of paint coatings.

E. Wood Surfaces
   1. Wood surfaces shall be thoroughly cleaned and free of all matter with cracks, nail holes, and other defects properly filled and smoothed or cleaned, smooth and dust free.
   2. Prior to the application of any stain, the wood surfaces must be thoroughly sanded to remove all mill marks and scratches.

F. Galvanized Steel
   1. Immersion Service - SSPC-SP16 Brush Blast Abrasive sweep blast followed by SSPC-SP1 Solvent Cleaning.
   2. Non-Immersion Service - Roughen surface to create a profile capable of supporting the specified system. Follow with SSPC-SP1 Solvent Cleaning.

G. Copper and Aluminum (Non-Submerged)
   1. Sand and follow with SSPC-SP1 Solvent Cleaning, apply coating within 8 hours, or before an oxide layer can form.

H. Pipe Insulation, Interior Rigid, and Interior Semi-Rigid Insulation
   1. Substrate must be clean and dry, and free of oil, grease, and other contaminants.

I. Valves
   1. All shop primed valves shall be solvent cleaned in accordance with SSPC-SP1 solvent cleaning to remove grease and oil prior to field painting.

J. PVC, RTRP and Other Non-Metal Piping
   1. Sand and solvent wash with clean rags and MEK.

3.02 PRIMING

A. Shop Priming: All steel and iron surfaces shall receive the following:
   1. Surface Preparation
      a. NAPF 500-03-04
         1) Exterior of submerged and non-submerged ductile iron piping, fittings, and appurtenances: NAPF 500-03-04, surface profile of 2.0 to 3.0 mils.
   2. Coating
      a. Tnemec 161, Sherwin-Williams Macropoxy 646, or equal. 3.0 to 5.0 mils dry film thickness. Color shall be Tnemec 1255 Beige or equivalent.

3. Whenever the shop priming coat has been damaged in transit or during construction, the metal shall be spot cleaned in accordance with the specified surface preparation and touched-up. Where the steel is delivered to the Site unprimed, it shall receive surface preparation and prime coating as required above.

B. Field Priming: Non-ferrous and Galvanized Metals.
   1. Surface Preparation
      a. SSPC-SP16 Brush Off Blast cleaning of Non-Ferrous Metals: Brush blast and clean entire surface to be coated to roughen substrate and remove contaminants.
   2. Coating
      a. Tnemec 161, Sherwin-Williams Macropoxy 646, or equal. 3.0 to 5.0 mils dry film thickness. Color shall be Tnemec 1255 Beige or equivalent.

3.03 PAINT APPLICATION

A. Apply each coat at the rate specified for application by the manufacturer. All dry film thickness requirements must be met per this specification regardless of brush roll or spray application. Brush and Roller applications may require additional coats to meet the minimum requirement for each coat in each system.

B. Stripe coat each coat onto bolts, edges, irregularities, welds, corners, joints, etc. by brush, in addition to spray application.

C. Curing time shall not be determined by average curing time under ideal laboratory conditions. Drying time shall be construed to mean "under normal conditions." Temperature, relative humidity, and other environmental factors must be observed. Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer curing and drying times will be necessary. Additional coats of material shall not be applied over previously applied coats until those coats are adequately cured and thoroughly dried. Units shall not be placed in service until coatings are properly cured and thoroughly dry.

D. Where thinning is necessary, only the products of the manufacturer furnishing the paint for that particular purpose shall be accepted and all such thinning shall be done strictly in accordance with the manufacturers' instructions as well as with the full knowledge and approval of the Architect.

E. Protection of Materials Not To Be Painted: Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, etc. and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring any adjacent surfaces. Protect working parts of all mechanical and electrical equipment from damage during surface preparation and painting process. All openings in motors shall be masked to prevent paint and all other materials from entering the motors.

F. Paint shall not be applied in extreme heat, temperatures below or above manufacturer's recommendation as listed on the product data sheet, nor in dust, smoke-laden atmosphere, and damp or humid weather. Apply paint in strict accordance with all product data sheet recommendations.

G. Abrasive blast cleaning shall not be performed whenever the relative humidity exceeds 85 percent, nor whenever the surface temperature is less than 5 degrees F above the dew point of the ambient air. Coating manufacturer's recommendations are to be strictly adhered to. Blast cleaned surfaces shall be primed prior to any evidence of rust bloom.

H. Finish coats shall be uniform in color and sheen without streaks, laps, runs, sags, pinholes, missed areas, etc.

I. In the event heating devices are used, they shall be explosion-proof and of the type that do not exhaust moisture, sooty or oily residues or any other contaminants into the structure, tank, building, etc. Forced air electric heat or heat exchangers with all combustion products positively vented to the exterior is required.

J. Yellowing or any other discoloration of paint will be unacceptable and will require repainting at no additional expense to OWNER. Contractor shall be responsible to provide all ventilation, heating, etc. to provide proper curing for painting and to prevent discoloration.

3.04 COATING SCHEDULE

A. The following surfaces shall receive the surface preparation described in Article 3.01 and the product mentioned below. Prime, intermediate, and finish coats shall be of noticeably different, but compatible colors.

Note: For items in the following schedule where immersion service is indicated, it is meant that that the entire interior structure shall be coated from floor to top of the wall, not just the portion of the structure that is immersed.

FM-1 Interior Metal Doors and Frames, and Metal Window Frames.
a. Surface Preparation: S1 thru S4 as necessary based on condition of metal.
b. Shop/Field Primer: Sherwin-Williams - Kem Bond HS at 2.5 to 3.5 mils DFT.
c. Intermediate Coat: Sherwin-Williams Steel-Master 9500 Enamel at 2.0 to 3.0 mils DFT.
d. Finish Coat: Sherwin-Williams Steel-Master 9500 Enamel at 2.0 to 3.0 mils DFT.
e. Total DFT: 6.5 to 9.5 mils.

FM-2 Ferrous Metals – Immersion service – NSF 61 certified paint system, including steel and ductile iron pipe systems, fittings, valves, and all ferrous metals in sludge storage tanks and in primary clarifiers, etc., whether above or below the water line:
a. Surface Preparation: S10.
b. Shop/Field Primer: Sherwin-Williams Macropoxy 646 PW Potable Water Epoxy at 3.0 to 5.0 mils DFT.
c. Intermediate Coat: Sherwin-Williams Macropoxy 646 PW Potable Water Epoxy at 3.0 to 5.0 mils DFT.
d. Finish Coat: Sherwin-Williams Macropoxy 646 PW Potable Water Epoxy at 3.0 to 5.0 mils DFT.
e. Total DFT: 9.0 to 15.0 mils.

FM-3 Ferrous Metals – Exterior Exposure, including Exterior of all Outside Metal Doors and Frames:
a. Surface Preparation: S1 thru S4 or S6 as necessary based on condition of metal.
b. Shop/Field Primer: Sherwin-Williams Macropoxy 646 Fast Cure Epoxy at 3.0 to 5.0 mils DFT.
c. Intermediate Coat: Sherwin-Williams Macropoxy 646 Fast Cure Epoxy at 2.0 to 4.0 mils DFT.

d. Finish Coat: Sherwin-Williams Acrolon 218 HS Polyurethane – Gloss at 3.0 to 5.0 mils DFT.
e. Total DFT: 8.0 to 14.0 mils.

M-1 Concrete Masonry Units - Interior Exposure.
a. Surface Preparation: S4 and S5.
b. 1 Coat of Sherwin-Williams Loxon Masonry Coating System Block Surfacer, 10 mils DFT.
c. 2 Coats of Sherwin-Williams Pro Industrial Waterbased Epoxy Gloss at 150 to 200 square feet per gallon.

M-2 Precast Architectural Wall Panels – Exterior Water Repellent Clear Finish
a. Surface Preparation: S4.
b. 2 coats of Chemprobe Prime-A-Pell 200 or Hydrozo Clear 40 VOC, first coat at 75 square feet per gallon, second coat at 100 square feet per gallon,

OR

a. 2 coats of Professional Water Sealant and Anti-Graffitiant Super Strength as manufactured by Professional Products of Kansas, Inc., first coat at 75 square feet per gallon, second coat at 100 square feet per gallon.

M-3 Extruded Plank - Interior Exposure:
a. Surface Preparation: S4 and S5.
b. 1 Coat of Sherwin-Williams Loxon Masonry Coating System Block Surfacer, 10 mils DFT. (Not required for smooth concrete surfaces).
c. 2 Coats of Sherwin-Williams Pro Industrial Waterbased Epoxy Gloss at 150 to 200 square feet per gallon.

M-4 Poured-In-Place Concrete - Interior Exposure, including interior walls, equipment bases, pipe supports, and other non-submerged concrete:
a. Surface Preparation: S4 and S5.
b. 1 Coat of Sherwin-Williams Loxon Masonry Coating System Block Surfacer, 10 mils DFT.
c. 2 Coats of Sherwin-Williams Pro Industrial Waterbased Epoxy Gloss at 150 to 200 square feet per gallon.

M-5 Poured-In-Place Concrete – Secondary Containment Areas (Floor and Walls of the Containment Area).
a. Surface Preparation: S4.
b. Apply Sherwin-Williams Steel Seam FT910 or Duraplate 2300 as needed to fill bugholes, honeycombs and rough surfaces to create a smooth transition. Cove or round all inside and outside corners.
c. 2 coats Tnemec Series 282 Tneme-Glaze or Sherwin-Williams Cor-Coate HCR FF at 225 sq.ft./gallon (Walls).
d. 2 coats Tnemec Series 282 Tneme-Glaze or Sherwin-Williams Cor-Coate HCR FF at 150 sq.ft./gallon (Floor).

W-1 Wood Surfaces – Interior Surfaces
a. 1 coat oil-based stain.
b. 3 coats waterborne polyurethane satin varnish.

MP-1 Metal Moving Parts – Chains, plates, gates, valves, and similar submerged and non-submerged moving parts
a. 1 coat of Koppers Inertol Grease Coating at 40 sq.ft./gal).

B. Ductwork and conduit exposed to view shall receive finish coatings the same color as walls and/or ceilings to which they are adjacent. Color selections to be made by Owner.

3.05 DAMAGED COATINGS

A. Damaged coatings and pinholes shall have the edges feathered and repaired in accordance with paint manufacturer's directions.

B. All finish coats, including touch-up and damage-repair coats, shall be applied in a manner that will present an appearance of uniform color and texture.

3.06 UNSATISFACTORY APPLICATION

A. If the item has an improper finish color or insufficient film thickness, the surface shall be cleaned and topcoated with the specified paint material to obtain the specified color and coverage. Specific surface preparation information shall be obtained from the paint manufacturer and the Architect.

B. All visible areas of chipped, peeled, or abraded paint shall be hand or power sanded feathering the edges. The areas shall be primed and finish coated in accordance with the Specifications. Depending on the extent of repair and its appearance, a finish sanding and topcoat may be required by the Architect.

C. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of the conditions is grounds for rejection.

D. Any defects in the coating system shall be repaired by the Contractor per written recommendations of the coating manufacturer.

3.07 CLEANUP

A. All rags and waste that may be constituted a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work all staging, scaffolding, and containers shall be removed from the Site or destroyed in a legal manner. Paint spots, oil, or stains upon adjacent surfaces and floors shall be completely removed and the entire Site left clean and acceptable to the Architect.

END OF SECTION

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SECTION 09 97 23

CONCRETE FLOOR COATING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Concrete floor coating.

B. Related Sections
   1. 03 30 00 – Cast-In-Place Concrete.
   2. 04 22 00 – Concrete Unit Masonry.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Submit manufacturer's specification for floor sealer and application requirements.

1.04 PRODUCT HANDLING

A. Deliver products in original factory packaging bearing identification of product, manufacturer, and batch number. Provide Material Safety Data Sheets for each product.

B. Store product in location protected from freezing, damage, construction activity, precipitation, and direct sunlight, in strict accordance with manufacturer's recommendations.

C. Condition products to approximately 60 to 70 degrees F for use in accordance with manufacturer's recommendations.

D. Handle all products with appropriate precautions and care as stated on Material Safety Data Sheet.

1.05 PRODUCT CONDITIONS

A. Assure concrete has been cured a minimum of 7 days. Do not use products under conditions of precipitation or freezing weather or when such conditions are imminent. Use appropriate measures for protection and supplementary heating to ensure proper drying and curing conditions in accordance with manufacturer's recommendations if application during inclement weather occurs.

B. Assure concrete is clean and free of curing compounds, sealers, laitance, grease, oil, and contaminants.

C. Protect all adjacent work from contamination due to mixing, handling, and application of preparation and repair products.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. For purpose of defining Standard of Quality in this Section, BASF Construction Systems, Shakopee, Minnesota conforms to requirements of this Specification.
   1. Tennant Company: Eco-Flex Deck.

B. Substitutions
   1. Alternates to acceptable manufacturer will be considered only on basis of written requests. Include substantiation of product performance as listed in Section 2.02 below.

2.02 PERFORMANCE CRITERIA

A. Compliance: ASTM C957.

B. Liquid Properties of Self-Leveling Base Coat:

1.	Solids by weight:	ASTM D1259	84-percent
2.	Weight per gallon:	ASTM D1475	9.9 pounds
3.	Viscosity:	ASTM D2393	4000 to 9000 cps
4.	Specific Gravity:	ASTM D1475	1.19
5.	Flash point:	ASTM D56	104 degrees F

C. Cured Properties of Self-Leveling Base Coat:

1.	Hardness, Shore A:	ASTM D2240	58
2.	Tensile strength:	ASTM D412	752 psi
3.	Elongation:	ASTM D412	595-percent
4.	Tear strength:	ASTM D1004	74 pit
5.	Crack bridging:	ASTM C836 modified	System Passes
6.	Weight loss:	ASTM C836	16 percent

D. Liquid Properties of Self-Leveling Top Coat:

1.	Solids by weight:	ASTM D1475	77-percent
2.	Weight per gallon:	ASTM D1475	9.1 pounds
3.	Viscosity:	ASTM D2393	3000 to 6000 cps
4.	Specific Gravity:	ASTM D1475	1.09
5.	Flash point:	ASTM D56	105 degrees F
6.	Color:		As selected by Architect

E. Cured Properties of Self-Leveling Top Coat:

1.	Hardness, Shore A:	ASTM D2240	89
2.	Tensile strength:	ASTM D412	1840 to 2040 psi
3.	Elongation:	ASTM D412	305-percent
4.	Tear strength:	ASTM D1004	199 pit
5.	Crack bridging:	ASTM C836 modified	System Passes
6.	Weight loss:	ASTM C836	23-percent
7.	Abrasion resistance:	ASTM C501 modified	0.03 grams (CS 17 wheel 1000 grams 1000 cycles)
8.	Weatherability:		Excellent

F. Physical Properties of Reinforcing Fabric:

1.	Elongation:	ASTM D1682	
		Machine direction:	54-percent
		Cross Direction:	147-percent
2.	Grab breaking:	ASTM D1682	
		Machine direction:	54 pounds
		Cross Direction:	32 pounds
3.	Width:		37.5-inches minimum
			38.5-inches maximum
4.	Length:		300 feet - 0 inch minimum
			300 feet - 4 inches maximum
5.	Thickness:	FTM-5136	0.024 inch (minus 0 plus 0.002 inch)
6.	Nominal weight:		2.13 ounces per square yard
7.	Construction:		34 by 30 per square inch
8.	Yarn Denier:		70
9.	Mullen Burst:		80.6 psi

2.03 MATERIALS **(SL-2)**

A. MasterSeal® M 200 BASE COAT: (Self leveling and flashing/slope grade) Single component, moisture curing urethane used as base waterproofing coat.

B. MasterSeal® TC225HT TOPCOAT TINT BASE: (Self leveling) Single component, moisture curing aliphatic urethane used as an intermediate coat and finish coat in heavy traffic areas, and as finish coat in pedestrian and light-duty areas to provide ultraviolet light, chemical, and wear resistance:
   1. Color: Manufacturer's standard gray.

C. Substrate Priming Materials:
   1. MasterSeal P 220: 2-component waterborne, epoxy primer and sealer.

D. Repair and Detailing Materials:
   1. MasterSeal® NP 150: (Self leveling or slope grade) premium, very low-modulus, high-movement, non-sag, fast-curing, ready to use, silyl-terminated polyether sealant for use in expansion and control joints, saw cuts, horizontal crack repair (self-leveling), or slope grade for joints inclined greater than 0.5 percent and for forming cants.

E. MasterSeal® AGGREGATE: Rounded, silica aggregate for broadcast into intermediate and topcoats to impart slip resistance.

F. Use BASF Construction Systems products in all other instances and applications as recommended by manufacturer pertaining to this work to provide OWNER with single source system and warranty.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect all areas involved in work to establish extent of work, access, and need for protection of surrounding construction.

B. Protect all surroundings from Primers, Patching Repair Compounds, and Finish products to include but not be limited to windows and frames, walls, doors and frames, roofs, walkways, drives, automobiles, and landscaping.

3.02 SITE VERIFICATIONS OF CONDITIONS

A. Conduct all pre-application inspections of Site verification with authorized BASF Representative.

B. Inspect all expansion joints to ensure there is no deteriorated sealant, adhesion loss, or non-elastomeric caulks installed in joints. Repair all deficient sealant or caulk with NP 150.

C. Inspect all through deck penetrations, including electrical, lighting, signage, plumbing, HVAC, fire sprinkler piping, for watertight seal. Repair all deficiencies with NP 150.

3.03 SURFACE PREPARATION: CONCRETE

A. Power shot-blast new and old concrete surfaces to remove previous coatings, laitance, and all surface contamination to provide profile for proper adhesion.

B. Remove all dust, dirt, and contaminants from surfaces that require detail work by vacuuming. Prime 3 inches beyond crack and joint details using short-nap roller with Primer 770.

C. Apply 25 wet mil pre-stripe of base coat for nonmoving joints and cracks less than 1/16-inch wide. Fill and overlap joint or crack 3 inches on each side. Feather edges.

D. Rout cracks and joints over 1/16-inch wide to minimum of 1/4-inch by 1/4-inch and clean. Install bond breaker tape to prevent adhesion to bottom of joint. Prime joint faces only with MasterSeal P 220. Seal with NP 150 sealant. Allow sealant to cure.

E. Prime deck 3-inches on either side of sealant with MasterSeal P 220. Do not apply primer to sealant bead itself. Allow primer to dry. Apply 25 wet mil pre-striping of base coat over joint and adjacent 3-inches of pre-primed deck on either side. Feather edges.

F. Seal expansion joints exceeding 1 inch wide by priming with MasterSeal P 220. Use NP 150. Do not coat such joints, including primary wide expansion-joint system, with MasterSeal® so they can perform independently of deck coating system.

G. Cut 1/4-inch by 1/4-inch keyway into concrete deck where coating system will be terminated and no wall, joint, or other appropriate break exists. Fill and coat keyway as application progresses.

H. Wire brush or sandblast all metal details to bright metal condition. Prime with MasterSeal P 220 before application of coating.

I. Remove dust, debris, and any other contaminants from vent, drain-pipe, and post penetrations. Clean metal surfaces to bright metal and prime with MasterSeal P 220. Install appropriate cant with NP 150 Slope Grade Sealant.

J. Prime voids exceeding 1/16-inch and reglets with Primer 766. Seal with MasterSeal® NP 150 sealant and pre-stripe with 25 wet mils of base coating to minimum width of 4 inches after first priming same 4-inches with MasterSeal P 220. Do not apply primer over sealant.

K. Provide sealant cants at rigidly connected wall and slab intersections. Form sealant cant into corner at junction of all horizontal and vertical surfaces (wall sections, curbs, columns) by priming with MasterSeal P 220. Lay 1/4-inch Closed Cell Backer-Rod in corner and apply 1-inch diameter bead of NP 150 Slope Grade sealant. Tool to form 45-degree cant. Allow sealant to cure.

L. Apply masking tape to vertical sections at appropriate height above sealant cant to provide clean termination of vertical detail coat. Prime with MasterSeal P 220 and apply 25 wet mils of base coat over treated cant up to masking tape and 4-inches onto deck surface. Feather onto deck surface.

M. Install sheet flashing at locations of potential high movement, such as wall and slab intersections that are not structurally connected. Sheet flashing: 0.050-inch thick uncured commercial-grade neoprene or an appropriate substitute.

3.04 APPLICATION: HEAVY-DUTY TRAFFIC

A. Complete all preparatory work before application begins. Apply base coat, intermediate, and topcoats with properly sized squeegee to arrive at required mil thickness. Optionally, apply intermediate and topcoats with 1/2-inch nap roller. Verify mil thickness of all coats by use of wet-mil thickness gauge.

B. Vacuum thoroughly all surfaces to be coated. Apply MasterSeal P 220 to all deck surfaces at 200 to 250 square feet per gallon using medium-nap roller. Force primer into pores and voids to eliminate pinholes. Do not apply primer over pre-striping.

C. Allow primer to dry tack free. Apply base coat same working day.

D. Apply base coat 25 wet mils thick to entire deck and ramp surface, overcoating properly prepared cracks, joints, and integral flashings. Use flashing/slope grade base coat for sloped areas. Do not coat expansion joints over 1 inch wide. Allow overnight cure (16 hours minimum) at 75 degrees F and 50-percent relative humidity. Extend curing time at temperatures less than 75 degrees F and relative humidity less than 50-percent.

E. Stir MasterSeal® Topcoat Tint Base before using. Apply topcoat material 15 wet mils thick to entire deck and ramp surfaces as intermediate coat. Broadcast Aggregate while coating is wet at rate of 10 to 25 pounds per 100 square feet. Back roll immediately with short-nap roller lightly wetted initially with topcoat. Apply sufficient pressure to encapsulate aggregate and distribute evenly. Allow to cure approximately 16 hours at 75 degrees F and 50-percent relative humidity. Extend curing time at temperatures less than 75 degrees F and relative humidity less than 50-percent.

F. Plan intermediate coat and aggregate placement to avoid unnecessary walking in freshly applied material. Work small sections on large areas to ensure aggregate is applied before membrane begins to skin over.

G. Apply topcoat 15 to 20 wet mils thick to entire deck and ramp areas. Broadcast Aggregate while coating is wet at rate of 10 to 25 pounds per 100 square feet. Back roll immediately with short-nap roller lightly wetted initially with topcoat. Apply sufficient pressure to encapsulate aggregate and distribute evenly.

H. Cure 72-hours minimum before allowing vehicular traffic onto coating at 75 degrees F and 50-percent relative humidity. Extend curing time at temperatures less than 75 degrees F and relative humidity less than 50-percent.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service Final Inspection: Warranty request. Manufacturer's representative will inspect finished surface preparation, application, and finished coating and may require further preparation or application to achieve appropriate result. In no case will manufacturer's representative approve surface or finish if following conditions are found: pinholes, insufficient coating thickness, or any other conditions that in manufacturer's representative's opinion may cause failure of installation.

3.06 CLEANING

A. Remove wet MasterSeal P 220 and Patching Repair products from tools and equipment with water. Remove dried materials mechanically.

B. Remove wet MasterSeal® products from tools and equipment with solvent, such as xylene, toluene, or MEK. Remove dried materials mechanically.

C. Clean up and properly dispose of all debris remaining on Site related to application.

END OF SECTION

SECTION 10 14 00

SIGNS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Plastic interior signs.
   2. Cast aluminum letters/numbers.
   3. Exterior room signs.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Two samples of each sign material.

B. Complete sample sets of colors and finishes available for Section by Owner.

PART 2 PRODUCTS

2.01 CAST ALUMINUM LETTERS/NUMBERS

A. Signs shall be equal to Gemini, Inc. Cast Aluminum Letters.

B. Letters/numbers shall be suitable for exterior use.

C. Finish: Finish #3 Satin Anodized Aluminum.

D. Style: as selected by Architect from manufacturers' standard fonts.

E. Size: 8 inches high and 1/2 inch thick:
   1. Text: 5 digits TBD.

F. Mounting: Stainless steel stud mounted with 1/2-inch aluminum spacers.

2.02 PLASTIC ROOM SIGNS

A. Manufacturers and Products:
   1. Best Sign Systems: Graphic Blast FG (Standard of Quality).
   2. Sign Solutions Inc.
   3. Comparable products from other approved manufacturers.

B. Letters: Raised 1/32 inch, upper case, sans serif accompanied with Grade 2 braille.

C. Mounting: Stainless steel vandal-resistant screws with stainless steel expansion anchors (4 per sign minimum).

D. Color
   1. Core color to be selected by the Owner.
   2. Face color to be selected by the Owner.

E. Size and Quantity of Signs as Listed Below:
   1. Room Identification Signs - Provide the following room identification signs with 1-inch-high letters and sign size (4-3/4 inches by 6 inches minimum):
      a. SCALE OFFICE (Quantity 1 – At Door A101-1).
      b. OFFICE (Quantity 2 – One at Door A106-1 and One at Door 107-1).
      c. CONFERENCE ROOM (Quantity 1 – At Door A108-1).
      d. CONTROL ROOM (Quantity 1 – At Door 101-1).
      e. STORAGE (Quantity 1 – At Door 109-1).
      f. MECH/ELEC (Quantity 1 – At Door A112-1).
      g. JANITOR (Quantity 1 – At Door A113-1).
      h. BREAK ROOM (Quantity 1 – At Door B101-1).
      i. LUBE ROOM (Quantity 1 – At Door B104-1).
      j. MECH/ELEC (Quantity 1 – At Door B107-1).

F. 6-inch by 8-inch international symbol of accessibility which indicates which sex the restroom is in 1-inch-high letters raised 1/32 inch, upper case, sans serif and Grade 2 Braille below the symbol:
   1. UNISEX (Quantity 4 – One at Door A103-1, One at Door A110-1, One at Door A111-1, and One at Door B102-1).

2.03 EXTERIOR ROOM SIGNS

A. Manufacturers and Products:
   1. ADA Sign Factory, MetalGraph Brushed Aluminum signs (Standard of Quality).
   2. Best Manufacturing Standard Sign Systems.
   3. Sign Solutions SR Series.
   4. Comparable products from other approved manufacturers.

B. Letters: Raised 1/32 inch, upper case, sans serif accompanied with Grade 2 braille.

C. Mounting: Countersunk stainless-steel vandal-resistant screws at each corner into stainless steel expansion shields drilled into precast concrete wall panels with 1-inch minimum embedment.

D. Color
   1. Black text and graphics.
   2. Brushed aluminum acrylic sign.

E. Size and Quantity of Signs as Listed Below:
   1. Room Identification Signs - Provide the following room identification signs with 5/8-inch-high letters and sign size (4-3/4 inches by 6 inches minimum):
      a. TRUCKER ENTRY (Quantity 1 – At Door A102-1).
      b. STAFF ENTRY (Quantity 1 – At Door A104-1).

PART 3 EXECUTION

3.01 INSTALLATION

A. Field-verify surface conditions before installing signs. If surfaces are unsuitable for the fastener type specified, notify Architect in writing before proceeding with the installation.

B. All signs must be securely installed plumb, level, and in the proper location.

C. Review locations with Architect prior to installation.

D. Cast aluminum letters/numbers mounting location and height shall be coordinated with Owner and/or Fire Chief.

END OF SECTION

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SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Toilet accessories.
2. Building accessories.
3. Fasteners, locks and keys, and related accessories.

B. Related Sections
1. 04 22 00 – Concrete Unit Masonry.
2. 06 10 00 – Rough Carpentry.
3. 09 29 00 – Gypsum Drywall.
4. 09 31 13 – Ceramic Tile.

1.02 REFERENCES

A. Americans with Disabilities Act (ADA)
1. Standards: Americans with Disabilities Act Architectural Barrier Removal and Compliance Manual, based on Minnesota Accessibility Code Chapter 1341.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Submit for the Architect's review:
1. Product Data.
2. Shop Drawings.
3. Material samples if requested by Architect.
4. Sample Warranties.

B. Submit for Owner's Use/Records:
1. Certificate of Compliance for performance requirements.
2. Operating and Maintenance Manuals.
3. Keys.
4. Executed Warranties.

1.05 QUALITY ASSURANCE

A. Mounting heights shall first comply with the applicable building code and secondly comply with the Americans with Disabilities Act, unless it conflicts with the building code for all handicap-related accessories.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original unopened protective packaging with legible manufacturer's identification.

B. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.

C. Handle to prevent damage to finished surfaces.

D. Protection
   1. Maintain protective covers on all units until installation is complete.
   2. Remove protective covers at final clean-up of installation.

1.07 WARRANTY

A. Contractor, manufacturer, and installer shall warrant the finish of installed products for a period of 5 years from date of Substantial Completion against the conditions indicated below. Upon written notice from the Owner, they shall promptly and without inconvenience and cost to Owner correct said deficiencies.
   1. Warrant mirrors against deterioration of silver coating.
   2. Warrant chrome plating against peeling, flaking, or discoloration.
   3. Warrant stainless steel against rusting, staining, or discoloration.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. A & J Washroom Accessories.

B. American Specialties, Inc.

C. Bobrick Washroom Equipment, Inc.

D. Bradley Corporation.

E. Or Approved Equal.

F. Standard of Quality: The Construction Documents are based on the proprietary literature from Bradley Corporation. The Contractor may at its option use equivalent materials by one of the other specified acceptable manufacturers.

2.02 MANUFACTURED UNITS

A. Toilet Tissue Holders: (**TPH-1**) Surface mounted double roll with shelf and non-controlled delivery. Heavy gauge Type 304, stainless steel with satin finish.
   1. Standard of Quality: Bradley Corporation: No. 5263.

B. Paper Towel Cabinet (**PTC-1**): Recessed combination towel cabinet and waste receptacle shall be fabricated of Type 304, 22-gauge stainless steel with architectural satin finish. Door of non-flexing construction, equipped with full length piano hinge and tumbler lock. Towel dispenser capacity 800 multi-fold or 600 C-fold towels. Waste container capacity

4.9 gallons; tumbler lock; approximately 56 inches high by 17 inches wide. For mounting in 4-inch wall. Provide vinyl liner for waste and equip steel waste container with hanger hooks for vinyl liner.
1. Standard of Quality: Bradley Corporation: No. 235.

C. Soap Dispenser: (**SDISP**) Surface mounted liquid soap dispenser shall be fabricated of 20-gauge satin finish stainless steel. Dispenser shall have completely concealed mounting, vandal-resistant filler hole cover and sight gauge. Push-in corrosion-resistant liquid soap valve. Capacity: 40 oz. liquid soap.
1. Standard of Quality: Bradley Corporation: No. 6562.

D. Grab Bars (**GB-1X**): 1-1/2-inch diameter, stainless steel bars fabricated to have 1-1/2-inch clearance from mounting surface with concealed fastener mounting. Furnish with proper type of anchor for construction conditions and code required loads.
1. Lengths:
   a. GB-1A: 18 inches.
   b. GB-1B: 36 inches.
   c. GB-1C: 42 inches.
   d. GB-1D: 18-1/8 inches by 33-1/8 inches horizontal two-wall shower grab bar.
2. Standard of Quality: Bradley Corporation: No. 812.

E. Folding Shower Seat (**SS-1**): Folding stainless steel shower seat shall be fabricated of 16-gauge stainless steel with exposed surfaces in satin finish. Seat welded to 1 inch diameter, 18-gauge stainless steel tubing. Support leg locks into 16-gauge retaining bracket with bullet-type catch. Shower seat shall meet or exceed ADA guidelines.
1. Standard of Quality: Bradley Corporation: No. 956-30.

F. Shower Curtain Rod (**SR-1**): 1-1/4 inch diameter 18-gauge stainless steel, seamless construction with exposed surfaces in architectural satin finish. 22-gauge stainless steel escutcheon plates shall be 1-piece drawn construction with exposed surfaces in architectural satin finish. Snap over flanges to conceal mounting screws.
1. Standard of Quality: Bradley Corporation: No. 9539.

G. Shower Curtain (**SC-1**): Shower curtain shall be of 10-ounce nylon reinforced antimicrobial vinyl fabric, flameproof, stain resistant, self-deodorizing, furnished with aluminum grommets on 6-inch centers. All sides hemmed. Provide stainless steel curtain rings to suspend curtain from rod.
1. Standard of Quality: Bradley Corporation: No. 9537.

H. Robe Hook (**RH-1**): Surface mounted hat and coat hook shall be fabricated of heavy gauge No. 4 satin finish stainless steel.
1. Standard of Quality: Bradley Corporation: No. 9134.

I. Utility Shelf (**US-1**): Surface mounted utility shelf shall be fabricated of Type 304, 18-gauge stainless steel with satin finish. Hooks shall be of 16-gauge stainless steel. Holders shall be with spring activated rubber cams.
1. Standard of Quality: Bradley Corporation: No. 9933.

J. Mirrors Glass: (**MIR-1**) Channel framed mirrors. 1/4-inch polished plate glass, triple-silvered, electro-plated with baked enamel backing. Guaranteed against silver spoilage for 15 years. Stainless steel channel frame with bright-annealed finish. Mitered corners. 18-gauge steel wall hanger with all-welded construction. Galvanized steel back plate with

shock absorbing waterproof filter. Mirror sizes shall be 24 inches wide by 36 inches high unless otherwise indicated on the Drawings.

1. Standard of Quality: Bradley Corporation: No. 781.

PART 3 EXECUTION

3.01 INSPECTION

A. Check with Architect for locations of all units prior to installation.

B. Check areas to receive surface mounted units for conditions that would affect quality and execution of work.

C. Verify spacing of plumbing fixtures that affect installation of accessories.

D. Do not begin installation of washroom accessories until surfaces are acceptable.

3.02 INSTALLATION

A. Install according to manufacturer's recommendations and comply with Barrier-Free requirements.

B. Drill holes to correct size and application that so that they are concealed by items, with 1/4-inch tolerance.

C. Mount surface mounted accessories to back up with toggle bolts, plumb and align.

D. Anchor grab bars to wall in such a way as to support 250 pounds for 5 minutes.

3.03 ADJUST AND CLEAN

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Deliver instruction sheets to Owner.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Fire extinguishers.
   2. Security Key Box.

B. Related Sections
   1. 04 22 00 – Concrete Unit Masonry.
   2. 06 10 00 – Rough Carpentry.
   3. 07 46 13 – Fiber Cement Siding.
   4. 09 29 00 – Gypsum Drywall.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 QUALITY ASSURANCE

A. Conform to NFPA 10 requirements for portable fire extinguishers.

B. Fire extinguishers and accessories by single manufacturer.

1.04 SUBMITTALS

A. Manufacturer's data and catalog cuts.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Approved Manufacturers for Fire Extinguishers:
   1. J.L. Industries.
   2. Larsen's Manufacturing Company.

2.02 MATERIALS

A. Fire Extinguisher (**FE**): 10 lb., multi-purpose, dry chemical, UL Rating 4A-60B:C.

B. Wall Bracket: Larsen B-2 Series.

C. Key Box: KnoxBox® 3200 by Knox Company or an approved equal.
   1. Surface mount with hinged door, with UL Listed tamper switches. 1/4-inch plate steel housing, 1/2-inch-thick steel door with interior gasket seal and stainless-steel hinge. Box and lock UL Listed. Lock has 1/8-inch-thick stainless steel dust cover with tamper seal mounting capability.
      a. Exterior Dimensions: Surface mount body: 4 inches H x 5 inches W x 3-7/8 inches deep.
      b. Lock: UL Listed. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
      c. Finish: Knox-Coat proprietary finishing process.
      d. Color: Dark Bronze
      e. Mounting Location: Verify with Owner and/or Fire Chief.
         1) Provide one key box per building.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify fire extinguisher installation locations with Owner/Fire Chief before starting the Work.

B. Verify installation locations and mounting heights for the security key boxes with Owner/Fire Chief.

C. Verify servicing, charging, and tagging of all fire extinguishers before leaving Site.

3.02 INSTALLATION

A. Install according to manufacturer's directions.

B. Securely anchor wall brackets 48 inches above floor.

END OF SECTION

SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Metal Building System:
1. Structural steel framing system.
2. Metal roof system.
3. Metal wall system.
4. Wall and Roof insulation.
5. Interior metal wall liner panels.

B. Related Sections:
1. 04 22 00 – Concrete Unit Masonry.
2. 08 11 00 – Metal Doors and Frames.
3. 08 36 13 – Upward Acting Sectional Doors.
4. 08 51 13 – Aluminum Windows.
5. 08 71 00 – Door Hardware.
6. 08 91 19 – Metal Wall Louvers.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Buildings**.
2. Work described under the following Divisions shall be considered incidental to this item:
a. Division 3 – Concrete.
b. Division 4 – Masonry.
c. Division 5 – Metals.
d. Division 6 – Woods, Plastics, Composites.
e. Division 7 – Thermal and Moisture Protection.
f. Division 8 – Openings.
g. Division 9 – Finishes.
h. Division 10 – Specialties.
i. Division 22 – Plumbing.
j. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC).

1.03 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC):
1. AISC Design Guide 3 – Serviceability for Steel Buildings
2. AISC 341 – Seismic Provisions for Structural Steel Buildings (when appropriate).
3. AISC 360 - Specification for Structural Steel Buildings.

B. American Iron and Steel Institute (AISI):
1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Welding Society (AWS):
   1. AWS D1.1 / D1.1M – Structural Welding Code – Steel.
   2. AWS D1.3 / D1.3M – Structural Welding Code – Sheet Steel.

D. Association for Iron & Steel Technology (AISE):
   1. AISE 13 – Specifications for Design and Construction of Mill Buildings.

E. ASTM International (ASTM):
   1. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   2. ASTM A 653 / A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A 792 / A 792M – Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
   5. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   6. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
   7. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
   8. ASTM D 523 – Standard Test Method for Specular Gloss.
   9. ASTM D 968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
   10. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
   11. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
   12. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity.
   13. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   14. ASTM D 3361 – Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
   15. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
   16. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   17. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
   18. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
   19. ASTM G 87 – Standard Practice for Conducting Moist SO2 Tests.

F. FM Global:
   1. FMRC Standard 4471 – Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance.

G. Metal Building Manufacturers Association (MBMA):
   1. MBMA Metal Building Systems Manual.
   2. Seismic Design Guide for Metal Building Systems.

H. The Society for Protective Coatings (SSPC):
   1. SSPC-Paint 15 - Primer for Use Over Hand-Cleaned Steel performs to SSPC-Paint 15 standards.
   2. SSPC-SP2 – Hand Tool Cleaning.

I. Underwriters Laboratories (UL):
   1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.
   2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 PREINSTALLATION MEETINGS

A. Convene pre-installation meeting 2 weeks before start of installation of metal building system.

B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, Engineer, installer, and metal building system manufacturer's representative.

C. Review materials, installation, protection, and coordination with other work.

1.05 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.

C. Erection Drawings: Submit metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, indicating roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

D. Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in Minnesota verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
   1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
   2. Submit certification on the metal building system manufacturer's letterhead.

E. Submit certification verifying that the metal roof system has been tested and approved by Underwriter's Laboratory as Class 90.

F. Dealer Certification: Submit certification that the metal building system supplier or metal roof system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished.

G. Certification shall state date on which authorization was granted.

H. Installer Certification: Submit certification that the metal building system or roof system installer has been regularly engaged in the installation of building systems of the same or equal construction to the system specified.

I. Warranty Documentation: Submit manufacturer's standard warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer regularly engaged, for past 10-years, in manufacture of metal building systems of similar type to that specified.
   2. Accredited based on IAS Accreditation Criteria AC472 and requirements in International Building Code (IBC), Chapter 17.

B. Installer's Qualifications:
   1. Installer regularly engaged, for past 5-years, in installation of metal building systems of similar type to that specified.
   2. Employ persons trained for installation of metal building systems.

C. Certificate of design and manufacturing conformance:
   1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in Minnesota verifying that building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
   2. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
   3. Certificate shall be on metal building system manufacturer's letterhead.
   4. Refer to Submittals article of this specification section.

D. Material Testing:
   1. In addition to material certifications of structural steel, metal building system manufacturer shall provide, upon request at time of order, evidence of compliance with specifications through testing.
   2. This quality assurance testing shall include testing of structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
   3. Do not store materials directly on ground.
   4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.

5. Protect materials and finish during storage, handling, and installation to prevent damage.

1.08 WARRANTY

A. Metal building system manufacturer shall provide a written weathertightness warranty for 25-years against leaks in standing seam roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.
   1. Warranty shall be signed by both the metal roof system manufacturer and the metal roof system installer.

B. Metal building system manufacturer shall provide a paint film written warranty for 25-years against cracking, peeling, chalking, and fading of exterior coating on painted roof and wall panels.
   1. Warranty shall be signed by metal building system or roof system manufacturer and state that the coating contains 70 percent "Kynar 500" or "Hylar 5000" resin.
   2. Metal building system manufacturer shall warrant that the coating shall not peel, crack, or chip for 25-years.
   3. For a period of 25-years, chalking shall not exceed ASTM D 4214, #8 rating and shall not fade more than 5 color difference units in accordance with ASTM D 2244.

C. Metal Building System Manufacturer's Certification: Metal building system manufacturer shall submit a signed written Certification stating that the metal roof system manufacturer or approved representative will provide warranties and Inspection and Report Service specified in this specification section.
   1. Warranty terms shall be included with the submittals listed above under Paragraph 1.04.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Metal Building System Manufacturers:
   1. Butler Manufacturing (Standard of Quality).
   2. Nucor Building Systems.
   3. Rhino Metal Building.
   4. American Steel Buildings.
   5. Allied Steel Buildings.
   6. Burke Steel Buildings.
   7. Armstrong Steel Buildings.

2.02 BUILDING DESCRIPTION

A. Building Dimensions: Indicated on the Drawings.
   1. Horizontal Dimensions: Measure to inside face of wall sheets.
   2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
   3. Clear Height Between Finished Floor and Bottom of Roof Beams: Indicated on the Drawings.

B. Primary Structural Members:
   1. Primary Framing System: Butler Manufacturing framing system as specified in this specification section.

2. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
3. Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
4. Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
5. Exterior Columns: Welded-up "H" sections or cold-formed “C” sections.
6. Interior Columns: “H” sections or tube columns.
7. Connection of Primary Structural Members: ASTM A 325 bolts through factory-punched holes.
8. Primary Structural Members: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section.

C. Secondary Structural Members:
   1. Secondary Framing System: Butler Manufacturing framing system as specified in this specification section.
      a. C/Z Purlins and Girts: Acrylic-coated G30 galvanized finish.
      b. Truss Purlins: Acrylic-coated G30 galvanized finish.

D. Metal Roof System: Butler Manufacturing metal roof system as specified in this specification section.

E. Metal Wall System: Butler Manufacturing metal wall system as specified in this specification section.

F. Where metal panels are required to be painted, use coating system as specified in this specification section.

2.03 DESIGN REQUIREMENTS

A. Governing Design Code:
   1. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
      a. Governing Building Code: 2020 Minnesota State Building Code, with amendments, has adopted the International Building Code, 2018 Edition.
      b. Risk Category: II.

B. Roof Live Load:
   1. Roof live loads are loads produced during the life of the structure by moveable objects.
   2. Wind, snow, seismic, or dead loads are not live loads.
   3. Roof live loads are applied based on the Tributary Area as stated in code.
   4. Roof live load shall not be less than 20 psf.

C. Roof Snow Load:
   1. Roof snow load used for designing the structure shall not be reduced and shall be the product of the following criteria:
      a. Snow Load Coefficient (Ce): 1.0.
      b. Thermal Factor (C_t): 1.1.
      c. Snow Importance Factor (I): 1.0.
      d. Ground Snow Load (Pg): 60 psf.
      e. Roof Snow Load (Pf): 46.2 psf.

2. Design snow load shall include the effects of minimum flat roof load limits, rain on snow, drifting snow, and unbalanced snow load as defined in the governing building code specified above.

D. Wind Load:
   1. Wind load used for designing the structure shall be the product of the following criteria:
      a. Wind Exposure Category: C.
      b. Wind Velocity Pressure Exposure Coefficient (K_z): 0.85
      c. Wind Topographic Factor (K_{zt}): 1.0.
      d. Wind Directionality Factor (K_d): 0.85.
      e. Wind Velocity (V), miles per hour: 115.
      f. Wind Risk Factor: II.
      g. Building Wind Load (q_z): 24.5 psf.
   2. Wind Pressure Coefficients and the design pressures shall be applied in accordance with the governing code.

E. Wall Pressures (minimum):
   1. Inward – Field: 30 PSF.
   2. Inward – Corner Areas: 40 PSF.
   3. Outward – Field: 30 PSF.
   4. Outward – Corner Areas: 40 PSF.
   5. Wall Design Safety Factor: 2.0.
   6. Perimeter and Corner dimension: 3'-0".

F. Seismic Load:
   1. Seismic load used for designing the structure shall be based on the following criteria:
      a. Spectral response acceleration for short periods (S_{Ds}): 0.54 g.
      b. Spectral response acceleration for 1-sec. period (S_{D1}): 0.18 g.
      c. Site Class: D.
      d. Seismic Importance Factor (I): 1.0.
   2. Seismic loads shall be applied in accordance with the governing code.

G. Dead Load: Dead load shall consist of the weight of building system construction, such as roof, framing, and covering members.

H. Collateral Load:
   1. Collateral load in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.
   2. This allowance does not include the weight of hung equipment weighing 50 pounds or more.
   3. Equipment loads of 50 pounds or more shall be indicated on the Drawings and the structure shall be strengthened as required.
   4. Architect will provide the metal building system manufacturer with the magnitude and approximate location of concentrated loads greater than 50 pounds before design of the building starts.

I. Auxiliary Loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems, and will be defined in the Contract Documents.

J. Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.

2.04 DEFLECTIONS

A. Structural Members:
   1. Maximum deflection of main framing members shall not exceed 1/240 of their respective spans.
   2. Maximum deflection due to snow load in roof panels and purlins shall not exceed 1/180 of their respective spans.
   3. Maximum deflection due to wind load in wall panels and girts shall not exceed 1/240 of their respective spans.

B. Lateral deflections, or drift, at the roof level of the structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall not exceed H/180.

C. Calculations for deflections shall be done using only the bare frame method.
   1. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed.
   2. Drift shall be in accordance with AISC Serviceability Design Considerations for Low-Rise Buildings.
   3. Use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project.
   4. When maximum deflections are specified, calculations shall be included in the design data.

2.05 STRUCTURAL STEEL FRAMING SYSTEM

A. General:
   1. Design of Structural System: Clear or multi-span rigid frame with straight or tapered columns and roof beams, with monoslope roof.
   2. Actual Building Length:
      a. Structural line to structural line.
      b. Same as nominal; i.e., number of bays times length of bays.
      c. Structural Line: Defined as inside face of wall sheets.
   3. Actual Building Width:
      a. Structural line to structural line.
      b. Nominal building width.
   4. Roof Slope: 1/2 inch in 12 inches.
   5. Components and Parts of Structural System:
      a. Indicated on the Drawings or the Specifications.
      b. Clearly marked.
      c. Erection Drawings: Supply for identification and assembly of parts.
      d. Drawings: Carry stamp of a registered Professional Engineer.
   6. Foundations:
      a. Foundations, Including Anchor Bolt Embedment Length: Properly designed by qualified engineer, retained by other than metal building system manufacturer, in accordance with specific soil conditions for building site.
      b. Reactions for Proper Design of Foundations: Supplied by metal building system manufacturer.
      c. Anchor Bolts:
         1) Anchor Bolt Diameter: Indicated on anchor bolt layout drawings furnished by metal building system manufacturer.
         2) Anchor Bolts: Supplied by metal building system manufacturer.

3) Anchor Bolts on Moment-Resisting Column Bases: Nuts above and below base plates.

B. Structural Steel Design:
1. Structural Mill Sections or Welded-up Plate Sections: Design in accordance with AISC Specification for Structural Steel Buildings.
2. Cold-Formed Steel Structural Members: Design in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
3. Structural System: Design in accordance with specified building code (Refer to Design Loads and Building Codes).

C. Primary Framing:
1. Rigid Frames:
a. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.
1) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.
2) Columns and Roof Beams: Fabricated complete with holes in webs and flanges for attachment of secondary structural members and bracing, except for fieldwork as noted on erection drawings furnished by metal building system manufacturer.
b. Bolts for Field Assembly of Frame Members: ASTM A 325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.
2. Endwall Structural Members: Cold-formed channel members designed in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with AISC Specification for Structural Steel Buildings.
a. Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
1) Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
2) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.
3) Beams and Posts: Factory fabricated complete with holes for attachment of secondary structural members, except for field work as noted on erection drawings furnished by metal building system manufacturer.
b. Intermediate Frames: Substituted for end-wall roof beams, when specified.
1) Factory fabricate necessary endwall posts and holes for connection to intermediate frame used in endwall.

D. Secondary Structural Members:
1. Purlins:
a. Purlins:
1) "Z"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
2) 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" sections.
b. Outer Flange of Purlins: Factory-punched holes for panel connections.
c. Attach purlins to main frames and endwalls with 1/2-inch-diameter bolts.
d. Brace purlins at intervals indicated on erection drawings furnished by metal building system manufacturer.
e. Concentrated Loads: Hung at purlin panel points.

2. Eave Members:
   a. Eave Struts: Factory punched 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
3. Girts:
   a. "Z" or "C"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
   b. 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" or "C" sections.
   c. Outer Flange of Girts: Factory-punched holes for panel connections.
4. Bracing:
   a. Locate bracing as required to accommodate design loads.
   b. Diagonal Bracing:
      1) Hot-rolled rods of sizes as required to accommodate design loads.
      2) Attach to columns and roof beams as required to accommodate design loads.
   c. Optional fixed-base wind posts or pinned-base portal frames may be substituted for wall rod bracing on buildings as required.
   d. Flange Braces and Purlin Braces: Cold formed and installed as required to accommodate design loads.

E. Welding:
1. Welding Procedures, Operator Qualifications, and Welding Quality Standards: AWS D1.1 - Structural Welding Code – Steel and AWS D1.3 - Structural Welding Code – Sheet Steel.
2. Welding inspection, other than visual inspection as defined by AWS D1.1, paragraph 6.9, shall as required to comply with current building codes and authority having jurisdiction.
3. Certification of Welder Qualification: Supply when requested.

F. Painting of Structural Steel Framing System:
1. General:
   a. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
   b. Perform subsequent finish painting with FM-2 system in field as specified in Section 09 91 00 - Painting.
   c. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials as specified in Section 09 91 00 - Painting.
2. Primary Frames:
   a. Clean steel in accordance with SSPC-SP6 to receive FM-2 paint system per Section 09 91 00 - Painting.
   b. Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements SSPC-Paint 15.
   c. Minimum Coating Thickness: 3.0 – 5.0 mil.
3. Secondary Structural Members – Roll-Formed:
   a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
   b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.
4. Truss Purlins:
   a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
   b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.

2.06 METAL ROOF SYSTEM

A. Metal Roof System: Butler Manufacturing "VSR II™" roof system.

B. Roof System Design:
   1. Design roof panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   2. Design roof paneling system and attachments to support design live, snow, and wind loads.

C. Roof System Performance Testing:
   1. UL Wind Uplift Classification Rating, UL 580: Class 90.
   2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
   3. RoofNav Assembly Number: 267000-0-0 with uplift rating of 120 psf.
   4. FM Global (Factory Mutual):
      a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
      b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global and RoofNav Assembly Number indicated above.
      c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:
   1. Factory roll-formed, 16-inches wide, with 2 major corrugations, 2-inches high, 16-inches on center, and with minor longitudinal striations in the flat of the panel.
   2. Due to steel mill tolerances, slight waviness known as "oil canning" may appear in erected panels.

E. Panel Material and Finish:
   1. 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
   2. Paint with exterior colors of "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
   3. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25-years for the following.
      a. Not to peel, crack, or chip.
      b. Chalking: Not to exceed ASTM D 4214, #8 rating.
      c. Fading: Not more than 5 color-difference units, ASTM D 2244.

F. Provision for Expansion and Contraction:
   1. Provision for Thermal Expansion and Contraction Movement of Roof Panels: Clips with movable tab.
      a. Tabs: Factory centered on roof clip to ensure full movement in either direction.
   2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and roof panels.

G. Fasteners:
   1. Make connections of roof panel clips to structural members with self-drilling fasteners.
   2. Self-drilling fasteners attach concealed clips to secondary structural members.
   3. Make roof panel side laps with field-formed lock seam, formed by a machine seaming device.

H. Insulation:
   1. Faced Blanket Insulation in Specified Thickness: Use with option of using thermal blocks to eliminate "thermal short circuits".

I. Accessories:
   1. Accessories (i.e., ventilators, skylights, eave and gable trim, gutters, jacks, and curbs): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
   2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
   3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.07 METAL WALL SYSTEM

A. Exterior Metal Wall System: Butler Manufacturing™ "Butlerib® II" wall system.

B. Wall System Design: Design wall panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. Wall Panels:
   1. Roll-formed panels, 3-feet wide with 4 major corrugations, 1-1/2 inches high, 12-inches on center, with 2 minor corrugations between each of the major corrugations entire length of panel.
   2. 1 piece from base to building eave.
   3. Upper End of Panels: Fabricate with mitered cut to match corrugations of "Butlerib® II" roof panels of 1/2 inch to 12 inches and square cut for all other roof panels and slopes.
   4. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.
   5. Panel Material and Finish:
      a. 24-gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
      b. Paint with exterior colors of "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
      c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25-years for the following.
         1) Not to peel, crack, or chip.
         2) Chalking: Not to exceed ASTM D 4214, #8 rating.
         3) Fading: Not more than 5 color-difference units, ASTM D 2244.

D. Fasteners:
   1. Wall Panel-to-Structural Connections: Torx-head "Scrubolt™" fasteners.
   2. Wall Panel-to-Panel Connections: Torx-head self-drilling screws.
   3. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.
   4. Exposed Fasteners: Factory painted to match wall color.

E. Accessories:
   1. Accessories (i.e., doors, windows, louvers): Provide doors, windows, and louvers in accordance with related specification sections.

2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.08 METAL COATING SYSTEM

A. Metal Coating System: Butler Manufacturing™ "Butler-Cote™" finish system a factory-applied, exterior metal coating system

B. Substrate Preparation:
1. G90 Hot-Dipped Galvanized Steel or AZ50 Galvalume: Factory-controlled chemical-conversion treatment.

C. Coating:
1. Material: Full-strength, 70 percent, "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) color coating.
2. After steel preparation, coat exterior exposed surface with primer and PVDF.
3. Nominal Total Dry Film Thickness: 1.0 mil.
4. Interior Exposed Surfaces: Coat with polyester color coat.
5. Apply coatings to entire material dimensions of steel sheets before forming of panels.

D. Physical Characteristics of Exterior Coating:
1. Resistance to failure through cracking, checking, peeling, and loss of adhesion.
2. Measure by the following laboratory weather-simulating tests to obtain test results justifying metal building system manufacturer's 25-year warranty:
a. Humidity resistance at 100 degrees F and 100 percent relative humidity, ASTM D 2247.
b. Salt-spray resistance at 5 percent salt fog, ASTM B 117.
c. Reverse impact resistance, ASTM D 2794.
d. Resistance to accelerated weathering, Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
e. Resistance to dry heat.
f. Abrasion resistance, ASTM D 968.
g. Chemical/acid/pollution resistance, ASTM D 1308 and G 87.
h. Maintain gloss of finish evenly over entire surface, ASTM D 523.

2.09 INSULATION

A. Laminated Fiberglass: Owens-Corning Fiberglas, NAIMA 202, "Certified R" metal building insulation.
1. TIMA Insignia and Insulation Thickness: Ink-jet printed on fiberglass.

B. Back-Fill Insulation: Owens-Corning Fiberglas unfaced "Pink Metal Building Insulation Plus".

C. Roof Insulation:
1. Nominal Thickness: 12-1/4 inches.
2. Certified R-Value: 41.

D. Wall Insulation:
1. Nominal Thickness: 6 inches.
2. Certified R-Value: 22.

E. Roof and Wall Insulation Facing: PSK Standard Duty (WMP-10).
   1. 0.0015-inch-thick, UV-stabilized, white metalized polypropylene laminated to 14-pound Kraft paper, reinforced with glass-fiber scrim.
   2. Adhere facing to Owens-Corning Fiberglas "Certified R", NAIMA 202, fiberglass blanket.
   3. Assembly of Insulation Blanket and Facing:
      a. Flame Spread Rating: Less than 25.
      b. UL Label: Submit as specified in Submittals article of this section.
      c. Perm Rating: 0.02.

2.10 INSULATION SUPPORT SYSTEM

A. Insulation Support System: Butler Manufacturing™ "Sky-Web®" insulation support system.

B. Description:
   1. 1,000 denier polyester yarn interwoven on nominal 1/2-inch-square grid coated with fire-retardant, UV-stabilized, PVC-based binder.
   2. Polypropylene tape bindings on all 4 edges.
      a. Two Edges that Attach to Building Eave Members: Reinforce with 1/4-inch-diameter polypropylene rope.
   3. Furnish in building bay lengths by building widths.
      a. Cover 1 bay of building length.
      b. Extend eave-to-eave across building.

C. Physical Properties:
   1. Tensile Strength (pounds/yarn):
      a. Machine Direction: 15 pounds.
      b. Cross Direction: 15 pounds.
   2. Ends per Inch:
      a. Machine Direction: 2.5.
      b. Cross Direction: 2.0.
   3. Weight: 0.28 to 0.32 ounces per sq ft

D. Fasteners and Attachment Hardware:
   1. Connections to Eave Members: Steel strapping and self-drilling screws.
   2. Mesh-to-Insulation Support System Edge Connections: Plastic cable ties.

E. Fire-Hazard Classification:
   1. UL Fire-Hazard Classification Ratings, UL 723:
      a. Flame Spread: 15.
      b. Smoke Developed: 400.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine area to receive metal building system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.02 ERECTION – STRUCTURAL STEEL FRAMING SYSTEM

A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.

B. Field Modifications:
   1. Require approval of metal building system manufacturer.
   2. Responsibility of building erector.
   3. Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.

C. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.03 INSTALLATION – METAL ROOF SYSTEM

A. Metal Roof System Installation: Butler Manufacturing™ "VSR II™" roof system.
   1. Install roof system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   2. Install roof system weathertight.
   3. Attach roof panels to supporting structural members with seamed-in-clip device.
      a. Install clip at panel major corrugation.
   4. Design roof panel side laps to be interlocking seams with return leg on lower edge of female rib.
      a. Factory apply side lap sealant.
   5. Roof Panel End Laps:
      a. Minimum of 6-inches.
      b. Seal with field-applied sealant.
      c. Swage 1 panel end to ensure nestible, watertight end laps.
      d. Install backing plate directly over, but not fastened to, structural support members.
      e. Self-Drilling Fasteners: Do not use to make panel end splices.

3.04 INSTALLATION – METAL WALL SYSTEM

A. Metal Wall System Installation: Butler Manufacturing™ "Butlerib® II" wall system.
   1. Install wall system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   2. Install wall system weathertight.
   3. Verify structural system is plumb before wall panels are attached.
   4. Align and attach wall panels in accordance with erection drawings furnished by metal building system manufacturer.
   5. Install side laps with minimum of 1 full corrugation.
   6. Seal wall panels at base with metal trim and foam or rubber closures.
   7. Exterior Trim: Apply same finish as exterior color of wall panels, except the following:
      a. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Paint with exterior colors of "Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating in standard color of metal building system manufacturer.
   8. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

3.05 PROTECTION

A. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Administrative and procedural requirements for plumbing systems and Division 22 Sections:
   a. References to standards.
   b. Submittals.
   c. Quality Assurance.
   d. Delivery, storage and handling.
2. Pipe, pipe fittings and installation requirements common to multiple Sections:
   a. Facility water distribution.
   b. Facility sanitary sewerage.
   c. Facility storm drainage.
   d. Compressed air system.
3. General duty valves common to multiple Sections.
4. Pipe hangers and supports common to multiple Sections.
5. Pipe and equipment identification.
6. Cleaning.
7. Selective demolition.

B. Related Sections:
1. Division 00 and 01 Sections:
   a. Administrative procedures and requirements.
   b. Environmental conditions affecting products.
2. Section 01 88 00 – Seismic Design Criteria.
3. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this Section.
4. Section 09 91 00 - Painting and Coating: Product and execution requirements for painting specified by this Section.
5. Section 22 07 00 - Plumbing Insulation: Insulation requirements related to sizing pipe hangers to encompass insulation.
6. Section 22 11 00 Facility Water Distribution: Specialty valves and plumbing specialties.
7. Section 22 13 00 Facility Sanitary Sewerage: Floor drains and cleanouts.
8. Section 22 14 00 Facility Storm Drainage: Area drains, roof drains, downspout nozzles.
9. Section 23 05 00 Common Work results for HVAC: Administrative and procedural requirements for HVAC ductwork, piping and equipment.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. A13.1 - Scheme for the Identification of Piping Systems.
2. B16.3 - Malleable Iron Threaded Fittings.
3. B16.4 - Gray Iron Threaded Fittings.
4. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

6. B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes
7. B31.9 - Building Services Piping.

B. ASTM International (ASTM):
1. A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
3. A536 - Standard Specification for Ductile Iron Castings.
4. A674 - Standard practice for polyethylene encasement for ductile iron pipe for water or other liquids.
5. A 888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, And Vent Piping Applications.
6. B88 - Standard Specification for Seamless Copper Water Tube.
7. C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
8. C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
9. C1540 - Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
10. C 1563 - Standard Test Method for Gaskets for Use in Conjunction With Hub and Spigot Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, Vent, and Storm Piping Applications.
11. D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
12. D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series).
13. D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
14. D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
15. D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
16. D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
17. D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
18. D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
19. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
20. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
21. E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
22. E1966 - Standard Test Method for Fire-Resistive Joint Systems.
23. F492 - Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings
24. F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
25. F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
26. F1866 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings.

C. American Welding Society (AWS):
1. A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. D1.1 - Structural Welding Code - Steel.

D. American Water Works Association (AWWA):
   1. 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.
   2. C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   3. C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   4. C600 - Standard for Installation of Ductile-Iron Water Mains and their Appurtenances.
   5. M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

E. Cast Iron Soil Pipe Institute (CISPI):
   1. 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   2. 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.

F. International Association of Plumbing and Mechanical Officials (IAPMO):
   1. PS 117 – Copper and Copper Alloy Tubing System Incorporating Press-Type or Nail-Type Connections.

G. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
   1. SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   4. SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   5. SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   6. SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
   7. SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Sanitation Foundation International (NSF):
   1. 61 - Drinking Water System Components - Health Effects.

I. Underwriters Laboratories Inc. (UL):
   1. 263 - Fire Tests of Building Construction and Materials.
   2. 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. 1479 - Fire Tests of Through-Penetration Firestops.
   4. 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. Fire Resistance Directory.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code for fire resistance ratings and surface burning characteristics.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 for:
   1. Electronic Submittal requirements.
   2. Transmittal requirements.

3. Submittals regarding color selections.
4. Substitutions.
5. Coordination with other trades.
6. Coordination and approval from public agencies.
7. Deviations from Contract Documents.

B. Product Data:
   1. Submit data on pipe materials and fittings.
   2. Submit manufacturers catalog information:
      a. Valves.
      b. Pipe identification.
      c. Equipment Identification.

C. Closeout Submittals:
   1. Submit certification of water disinfection and chlorination.
   2. Submit copies of plumbing inspector acceptance of air and water column tests.
   3. Submit Operation and Maintenance manuals in accordance with closeout procedures.

D. Project Record Documents:
   1. Provide dimensioned drawings indicating installed location of underground piping.
   2. Record actual locations of tagged valves; include valve tag numbers.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems.

B. Use joint grooving tools and materials provided from a single manufacturer.

C. For domestic water piping and valves, use products certified to meet NSF 61.

D. Dezincification resistant: Bronze valve chemical make-up for components in the waterway to not exceed 15 percent zinc.
   1. Certify valves to be dezincification resistant to the criteria listed above.

E. Perform Work to comply with the latest edition of the Wisconsin State Building Code.

F. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.07 QUALIFICATIONS

A. Explanation of manufacturer listings for Part 2 - Products of Division 22 Sections:
   1. Select equipment from the listed manufacturers where a list of manufacturers is under the heading "Manufacturers":
      a. Manufacturers not listed must submit for and be granted approval prior to the end of the bidding period for use on this Project.
      b. The list of manufacturers is provided as a convenience to the Contractor, indicating manufacturers that may be able to meet the indicated requirements.
      c. Being listed does not indicate the availability of any product or approval of a product not containing the indicated features.

2. Use products meeting the indicated requirements where a list of manufacturers is under the heading "Acceptable Manufacturers":
   a. Approval to use products from manufacturers not listed is not a bid requirement.
   b. The list of manufacturers is provided as a convenience to the Contractor, indicating manufacturers that may be able to meet the indicated requirements.
   c. Being listed does not indicate the availability of any product or approval of a product not containing the indicated features.
3. Use products meeting the indicated requirements where manufacturers are not listed for products:
   a. Approval to use products from manufacturers not listed is not a pre-bid requirement.

B. Manufacturers: Company specializing in manufacturing products specified in this Division with minimum 3 years experience.

C. Installer: Company specializing in performing work of this Division with minimum 3 years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Provide temporary caps on fittings and valves removed from shipping containers and not immediately installed.

C. Provide temporary end caps and closures on pipes stored on site, but not installed.

D. Protect installed piping from entry of foreign materials using temporary covers for idle sections of the Work.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Refer to Section 01 60 00: Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet or frozen.

1.10 COORDINATION

A. Refer to Section 01 31 00: Requirements for Coordination.

B. Coordinate installation of buried piping with trenching and footing installation.

1.11 WARRANTY

A. Refer to Section 01 07 00: Product warranties and product bonds.

PART 2 PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Match material specified by Civil for water service entrance.

B. Ductile iron pipe conforming to AWWA C151/ANSI 21.51.
   1. Joints conforming to AWWA C111.
   2. Provide anchor rods for bends, tees and plugs.
   3. Use thrust blocks for 45 degree or greater elbows.
   4. Cast iron mechanical joint fittings: AWWA C110
   5. Joint restraints: MJ FIELD-LOK as manufactured by U.S. Pipe or equivalent.

C. Copper Tubing conforming to ASTM B88:
   1. 2-1/2 inches and smaller, Type K, soft copper, seamless.
   2. No underground fittings except at connection to site utility.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L seamless, hard temper:
   1. Fittings: ASME B16.18, wrought copper.
   2. Joints: 95/5 solder or brazing.

B. Copper Tubing: ASTM B88, Type L, seamless, hard temper:
   1. Press Fitting Systems:
      a. ASTM F3226/F3226M copper alloy
      b. IAPMO PS 117 performance criteria.
      c. EPDM sealing elements.
      d. Viega – ProPress, up to 4 inch.
      e. Victaulic – Permalynx up to 1-1/2 inch.
      f. Nibco – Nibco Press System up to 4 inch.

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, compression type with ASTM C564 neoprene gaskets.

B. Hubless Cast Iron Pipe: CISPI 301 and ASTM A888.
   1. Fittings: Cast iron, CISPI 301.
   2. Couplings: ASTM C1540 heavy duty, shielded.

C. PVC Pipe: Schedule 40, ASTM D2665 with mechanical ring, or fusion or solvent cement.
   1. Fittings: PVC, ASTM F1866.
   2. Joints: Solvent weld with ASTM D2564 solvent cement.
   3. Provide contrasting color primer for solvent weld joints.
   4. Do not use plastic piping in the following locations:
      a. Commercial kitchen drains, boiler room drains.

2.04 SANITARY SEWER PIPING, ABOVE GRADE (WASTE AND VENT)

A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends:
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: Hub-and-spigot, compression type with ASTM C564 neoprene gaskets.

B. Hubless Cast Iron Pipe: CISPI 301 and ASTM A888.
   1. Fittings: Cast iron, CISPI 301.
   2. Couplings: ASTM C1277 and CISPI 310, shielded.

C. Pressurized waste discharge (i.e. elevator sump pumps, sewage ejectors, etc.):
   1. Pipe: Schedule 40 galvanized steel.
   2. Fittings: ASME B16.3 Malleable iron galvanized steel, threaded.
   3. Fittings: ASME B16.4 Grey iron, threaded.

D. PVC Pipe:
   1. Schedule 40, ASTM D2665 with solvent welded joints.
   2. Fittings: PVC, ASTM D1866.
   3. Joints: Solvent weld with ASTM D2564 solvent cement.
   4. Do not use plastic piping in the following locations:
      a. Ceiling cavities above rooms served by transfer grilles (air plenums).
      b. Commercial kitchen drains, boiler room drains.
      c. Locker rooms or shower areas where piping is exposed.
      d. Within 8 feet of the floor where piping is exposed [to public].

2.05 COMPRESSED AIR PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
   1. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
   2. Joints: Threaded for pipe 2 inch and smaller; welded or grooved for larger pipe.
   3. Joints: Grooved mechanical couplings meeting ASTM F1476.
      a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, compatible with steel piping sizes, rigid clamps for exposed locations, flexible clamps for concealed locations.
      b. Gasket: Elastomer composition for operating temperature range from minus 30 degrees F to 250 degrees F.
      c. Accessories: Steel or stainless steel bolts, nuts, and washers.

2.06 EQUIPMENT DRAINS AND OVERFLOWS

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

B. Copper Tubing: ASTM B88, Type M, hard temper.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.GATE VALVES

A. Acceptable Manufacturers:
   1. Crane.
   2. Grinnell.
   3. Hammond.
   4. Milwaukee.
   5. Nibco, Inc.
   6. Stockham.

B. 2-1/2 inch and larger:
   1. MSS SP-70, 200 psi CWP, bolted bonnet, non-rising stem.
   2. Cast iron body, bonnet, stuffing box, handwheel and wedge; ASTM A 126 Class B.
   3. Stem: Steel, ASTM A 108.
   4. Non-asbestos packing.
   5. Flanged ends.

2.08 BALL VALVE

A. Acceptable Manufacturers:
   1. Apollo Valve.
   2. Grinnell.
   3. Milwaukee.
   4. Nibco, Inc.
   5. Watts.

B. 2 Inches and Smaller: NSF 61. MSS SP 110.
   1. 600 WOG, 2-piece, full port, forged brass body.
   2. Chrome plated brass or stainless steel ball.
   3. Reinforced PTFE seats.
   4. Extended stems for insulation.
   5. Threaded or sweat ends.

2.09 HORIZONTAL SWING CHECK VALVES

A. Acceptable Manufacturers:
   1. Crane
   2. Grinnell.
   3. Hammond.
   4. Milwaukee.
   5. Nibco, Inc.
   6. Stockham.

B. 2 inch and smaller:
   1. 200 pound CWP, bronze body, bronze disc.
   2. Buna-N coated bronze seat disc.
   3. Threaded ends.

2.10 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 ends.

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. Gaskets: 1/16 inch thick preformed neoprene gaskets.
   4. Grooved mechanical couplings for grooved piping systems.

C. Dielectric Connections: Union or waterway fitting with galvanized or plated steel or ductile iron casing, with threaded end, grooved end, copper solder end, water impervious isolation barrier. NSF 61, ASTM F-492; Victaulic Style 47 or acceptable substitute.

2.11 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers:
   1. Anvil (Grinnell).
   2. B-Line - Cooper.
   3. Elcen
   4. Erico - Caddy System.
   5. Fee and Mason.
   6. Michigan Hanger Co.
   7. PHD Manufacturing.

B. Plumbing Piping - DWV:
   1. Conform to ASME B31.9.
   2. Grinnell Fig. 69 Carbon steel, adjustable, clevis.
   3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   4. Wall Support for Pipe Sizes 3 inches and Smaller: Grinnell Fig. 126 Cast iron hook.
   5. Wall Support for Pipe Sizes 4 inches and Larger: Grinnell Fig. 194 or 15 Welded steel bracket and wrought steel clamp.
   6. Vertical Support: Steel riser clamp.
   7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   8. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
   15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

D. ACCESSORIES
   1. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.
   2. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.12 FLASHING

A. Metal Flashing: 26-gauge galvanized steel.

B. Metal Counterflashing: 22-gauge galvanized steel.

C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

D. Caps: Steel, 22-gauge minimum; 16-gauge at fire resistant elements.

2.13 SLEEVES

A. Sleeves for Pipes Through Non-Fire Rated Floors: 18-gauge thick galvanized steel.

B. Sleeves for Pipes Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18-gauge thick galvanized steel.

2.14 ESCUTCHEONS

A. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

2.15 FORMED STEEL CHANNEL

A. Acceptable Manufacturers:
   1. Elcen.
   2. B-Line Systems.
   3. Hilti.
   4. Powerstrut, Inc.
   5. Unistrut Corp.
   6. Fee and Mason.

B. Product Description: Galvanized 12-gauge thick steel. With holes 1-1/2 inches on center.

2.16 VALVE TAGS

A. Metal Tags:
   1. Acceptable Manufacturers:
      a. W.H. Brady.
      b. Marketing Systems, Inc.
      c. MSI.
      d. Seton Identification Products.
   2. Aluminum with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

2.17 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Tape Pipe Markers:
   1. Acceptable Manufacturers:
      a. W.H. Brady.
      b. Marketing Systems, Inc.
      c. MSI.
      d. Seton Identification Products.
   2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Underground Pipe Markers:
   1. Acceptable Manufacturers:
      a. W.H. Brady.
      b. Marketing Systems, Inc.
      c. MSI.
      d. Seton Identification Products.
   2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.18 LABELS

A. Acceptable Manufacturers:
   1. W.H. Brady.
   2. Champion.
   3. MSI.
   4. Ready Made.
   5. Seton Identification Products.

B. Description: Laminated 3-layer rigid plastic with engraved black letters on light colored background. 1.9 inch by 0.75 inch minimum size, adhesive backed. Comply with ASME A13.1 standard for colors and locations.

2.19 WATER METER

A. Refer to Section 22 11 00. [or]

B. Main service meter: Furnished by the City of Superior, WI. Coordinate and pay associated fees to obtain city water meter for installation under this section.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: 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.

D. The Contractor is responsible for verifying invert elevations with respect to building finished floor elevations and site provisions.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Make piping connections to equipment with flanges, grooved joint couplings, or unions.

D. Protect open ends of installed pipe with temporary plugs or caps.

E. Select hangers to surround insulation, shield and piping on insulated pipe.

3.03 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counter-flashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent pipes projecting above roof surface with flexible flashing and secure with stainless steel bands or other method approved by roofing contractor.

C. Flash floor drains in floors with topping over finished areas with flexible flashing, 10 inches clear on sides with minimum 36 by 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower and drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.04 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing or firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.05 INSTALLATION - BURIED PIPING SYSTEMS

A. Coordinate underground piping locations with structural footings.

B. Establish elevations of buried domestic water piping with not less than 7-feet of cover outside of building.

C. Install, support and restrain cast iron pipe, fittings and couplings in compliance with procedures detailed in ASTM C1540.

D. Establish minimum separation of 10 feet from water piping or sanitary sewer piping in accordance with Wisconsin code.

E. Excavate pipe trench in accordance with Division 31.

F. Install ductile iron piping in accordance with AWWA C600.

G. Install pipe on prepared bedding.
   1. Install PVC piping on a continuous granular bed in accordance with ASTM D2321.
   2. Place bedding material at trench bottom to provide uniform bedding for piping.
   3. Level bedding materials in one continuous layer not exceeding 4 inches depth.
   4. Compact to 95 percent modified Proctor density.

H. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.
   6. Install plastic ribbon tape continuous over top of pipe.
      a. Bury ribbon tape 6 inches below finished grade, directly above pipe.

3.06 INSTALLATION - ABOVE GROUND PIPING

A. Install piping to conserve building space, to not interfere with use of space and other work.
   1. Route piping in orderly manner and maintain gradient.
   2. Route parallel and perpendicular to walls.
   3. Group piping whenever practical at common elevations.

B. Sleeve pipe passing through partitions, walls and floors.

C. Slope piping and arrange systems to drain at low points.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

E. Provide shut-off valves:
   1. Required by Code.
   2. At each fixture supply.
   3. At branch lines serving more than one fixture.
   4. With extended valve stems for insulated piping applications.
   5. With screwed connections for piping 2-1/2 inch and smaller.
   6. With flanged connections for piping 3 inch and larger.

7. With hose end caps on low point drains.

F. Install unions downstream of valves and at equipment or apparatus connections.

G. Where pipe support members are welded, clean, and apply 1 coat of zinc rich primer to welding.

H. Support cast iron drainage piping at every joint.

I. Hubless fittings and couplings: Use the procedures described in ASTM C1277.

J. Cleanouts:
1. Provide cleanouts at the base of sanitary waste and storm drain risers.
2. Install floor cleanouts at elevation to be flush with finished floor.
3. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.
4. Locate cleanouts to allow clearance for snaking drainage system.
5. Encase exterior cleanouts in concrete, flush with grade.

K. Install piping penetrating roofed areas to maintain integrity of roof assembly.
1. Install vent piping penetrating roofed areas with frost proof jackets having air space of at least 1 inch between outside surface of pipe and inside surface of frost proof jacket.

L. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

3.07 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping to allow for insulation. Refer to Section 22 07 00.

B. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

C. Provide swing joint offsets for branch piping penetrating adjacent walls and floors.

D. Install non-conducting dielectric unions for domestic water piping joining dissimilar metals.

E. Install press type and grooved joints in accordance with the manufacturer's latest published installation instructions. Select gaskets of an elastomer grade suitable for the intended service, produced by the coupling manufacturer.

3.08 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

B. Establish invert elevations, slopes for vents. Match drainage slope below grade; 1/16 inch per foot minimum above grade. Maintain gradients.

C. Cast iron pipe, fittings and standard couplings: Installed, supported and restrained using the installation procedures detailed in ASTM C1277.

D. Cast iron pipe, fittings and heavy duty couplings: Installed, supported and restrained using the installation procedures detailed in ASTM C1540.

E. Terminate vent pipes passing through roofs at least 12 inches above the roof line.
   1. Support at increments not to exceed those allowed by the Wisconsin Plumbing Code.

F. Limit above grade plastic drain and vent piping to 35 feet total length.
   1. Support at increments not to exceed those allowed by the Wisconsin Plumbing Code.

G. Provide contrasting color primer for solvent weld joints.

H. Water meter:
   1. Install water meter furnished by the Utility. Pay the meter charge if there is one.
   2. Provide meter support and other equipment and materials required by the Utility.
   3. Install upstream and downstream isolation valves. Provide union fitting or flange fitting between the isolation valves.
   4. Install remote reader in accordance with City requirements.

I. Chlorination: Refer to Section 22 05 00.

3.09 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Install horizontal rain water conductors to allow for insulation. Refer to Section 22 07 00.

C. Cast iron pipe, fittings and standard couplings: Installed, supported and restrained using the installation procedures detailed in ASTM C1277.

D. Cast iron pipe, fittings and heavy duty couplings: Installed, supported and restrained using the installation procedures detailed in ASTM C1540.

3.10 VALVE INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install uniform length nipple and threaded fittings on both sides of solder end valves. Install union on one side of valve if union or flange is not located within 5 feet for other service reasons.

C. Install 3/4-inch hose-end ball valves with threaded cap for drains at low points of piping, bases of vertical risers, and at equipment.

D. Install branch isolation valves where the branch piping is equal to or larger than half the upstream main pipe size. This does not apply to mains smaller than 1-1/2 inch.

E. Install valves with clearance for installation of insulation.

F. Locate valve to be accessible through access panels where valves are installed above gypsum or plaster ceilings and chases. Coordinate size and location of access doors.

G. Refer to Section 22 07 00 for insulation requirements for valves.

3.11 FIRESTOPPING SCHEDULE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gauge minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings not less than 1 hour:
   1. Wall Penetrations: Fire F-Ratings not less than 1 hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings not less than 1 hour:
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion:
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of 3 stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of 2 stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve 1 hour fire resistant rating for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gauge minimum positive pressure differential to achieve one hour fire resistant rating for floor assembly.

E. Surface Burning Characteristics: Maximum 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.

3.12 HANGER SCHEDULE

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) w/10 foot pipe length	10	5/8
Cast Iron (All Sizes), buried under footprint of building.	4	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
PVC (All Sizes)	Per Plumbing Code	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

A. Note for Cast Iron Pipe: Locate a hanger within 18 inches of each joint. Also provide hanger at each change of direction and each branch connection.

B. Cast Iron Pipe, buried: Locate a hanger on each side of joint. Where not practical due to arrangement of fitting, support pipe continuously.

C. Select hangers for insulated piping to surround the insulation and pipe saddle.

3.13 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 Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports using steel members, formed steel channel, angle iron or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

3.14 INSTALLATION - HANGERS AND SUPPORTS

A. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

B. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

C. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

3.15 VALVE APPLICATIONS

A. Install gate valves in domestic water systems to isolate branch piping 2-1/2 inch and larger.

B. Install ball valves for shut-off service and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves in domestic water systems to isolate branch piping 2 inch and smaller.

D. Install shutoff and drain valves at locations indicated on Drawings and/or specified herein.

3.16 VALVE IDENTIFICATION

A. Provide a typewritten list identifying numbered valves. Include valve number, service, location and area served.

B. Plumbing stop valves at fixtures are exempt from valve tagging and inclusion on the valve list.

C. Include a copy of the valve identification list in each maintenance manual.

D. Post one framed copy under acrylic glazing in the mechanical room or other owner designated location.

3.17 STENCILS

A. 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. Plumbing Equipment: 1-3/4 inches high letters.

B. Stencil Paint: Semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

3.18 PIPE IDENTIFICATION

A. Use pressure sensitive labels, pre-formed markers or stenciling.

B. Include labeling of service, direction of flow and tape bands at each end of labels with approved colors.

C. For Screen Rooms, Chemical Storage Rooms, Mechanical Rooms, Equipment Room and other spaces, provide tags satisfying the Plumbing Code:
   1. "SAFE WATER" tags on cold water, hot water and circulating hot water piping.
   2. "NONPOTABLE WATER" tags on piping downstream of RPZ backflow preventers.
   3. “NONPOTABLE WATER” tags on all outlets, hydrants, and hosebibbs served by non-potable water.

D. Provide pipe identification for exposed piping within the building and in accessible concealed spaces, such as above lay-in ceilings and at access panels. Minimum locations:
   1. At not more than 30 foot intervals on straight runs of pipes.
   2. Wherever a pipe turns 90 degrees.
   3. Wherever a pipe passes through a wall, on both sides.
   4. At other locations deemed necessary for ease of maintenance, e.g. access panels.

E. Piping that does not require identification:
   1. Fixture supplies.
   2. Below grade piping.
   3. Inaccessible piping concealed in chase walls.
   4. P-traps.
   5. Indirect waste piping from kitchen equipment.
   6. Fire sprinkler piping.

F. Abbreviations: label the piping as follows:

1. Condensate Drain	CD
2. Domestic Cold Water (Softened)	CW
3. Domestic Hot Water	HW
4. Domestic Circulating Hot Water	CHW
5. Hard Water	HARD W
6. Non-Potable Water	NON-POT WTR
7. Storm Drainage	RWL

3.19 EQUIPMENT IDENTIFICATION

A. Provide identification labels for scheduled equipment (except drains and plumbing fixtures) permanently affixed to equipment with mechanical fasteners (rivets, screws, bolts or other approved methods) in a prominent location.

B. Install labels level and drawn tight to the equipment surface. Provide backing or back-up plates where required by the fastening devices. On pumps and similar small equipment, the label may be located on the wall adjacent to the equipment.

C. Spell out the description of each piece of equipment (Water Heater #1, for example).

3.20 CHLORINATION OF DOMESTIC WATER LINES

A. Chlorination of Domestic Water Lines: Clean domestic water system in building, disinfect system in accordance with governing codes and State Health Department Requirements, and flush entire system clean with potable water:
   1. Flush the piping system with clean, potable water until no dirty water appears at the points of outlet.
   2. Isolate portion of system to be chlorinated.
      a. Fill with a water-chlorine solution containing at least 50 parts per million of chlorine and allow to stand for 24 hours or
      b. Fill with a water-chlorine solution containing at least 200 parts per million of chlorine and allow to stand for 3 hours.
   3. Following the standing time, flush with clean potable water until no chlorine remains in the water coming from the system.
   4. Provide written certification to Architect/Engineer that chlorination and flushing of domestic water system has been completed.

3.21 CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash from site periodically and dispose off-site; do not burn or bury.

E. Refer to Section 01 70 00: Requirements for cleaning.

3.22 DEMONSTRATION AND TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain systems and components, including:
   1. Adjusting equipment modes.
   2. Step-by-step procedures associated with:
      a. Start up.
      b. Shut down.

c. Day-to-day usage.
d. Emergency shutdown and restart.
e. Manual and bypass operation.
f. Winterization, seasonal change over, long term storage, and restart after prolonged inactivity.

3. Include a minimum of 4 hours dedicated instructor time on-site.
4. Review data in maintenance manuals.
5. Schedule training with Owner, with seven days' advance notice.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:
1. Section 09 91 00 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.02 REFERENCES

A. ASTM International (ASTM):
1. C547 - Standard Specification for Mineral Fiber Pipe Insulation.
2. C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
4. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
6. C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
7. C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
8. C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
9. C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
10. D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
11. E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
12. E2231 - Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics.

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

C. Underwriters Laboratories, Inc. (UL):
1. -723 – Tests for Surface Burning Characteristics of Building Materials.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

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

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

1.05 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL-723, and NFPA 255.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Insulation accessories, such as adhesives, mastics, cement, tapes and glass cloth shall have the same component rating as listed in Paragraph 1.02 of this Section.

1.06 QUALIFICATIONS

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

B. Applicator: Company specializing in performing Work of this section with minimum 3 years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

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

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   3. Johns Manville.
   4. Owens-Corning.
   5. Substitutions: Section - Not Permitted.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:
   1. Aeroflex, Aerocell.
   2. Armacell, LLC, Armaflex.
   3. Nomaco, K-Flex.

2.02 PIPE INSULATION

A. Type P-1: ASTM C547, molded glass fiber pipe insulation:
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Operating Temperature Range: 0 to 850 degrees F.
   3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil Kraft with self-sealing adhesive joints.
   4. Jacket Temperature Limit: Minus 20 to 150 degrees F.

2.03 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
   1. ASTM C921, white kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water Vapor Permenance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:
   1. Product Description: ASTM D1784, 1-piece molded type fitting covers and sheet material, off-white color.
   2. Thickness: 15 mil.
   3. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape. Closed-cell foam tubing insulation.

C. Connections: Brush on welding adhesive or pressure sensitive color matching vinyl tape. closed-cell foam tubing insulation.

2.04 PIPE INSULATION ACCESSORIES

A. Adhesives and mastic: Compatible with insulation and jacket materials.

B. Piping 1-1/2 Inches Diameter and Smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: Coordination and project conditions.

B. Verify piping and equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.02 GLASS FIBER INSULATION WITH AP JACKET

A. Insulate piping with fiberglass insulation and all purpose jacket:
   1. Apply insulation to clean piping. Verify that insulation is correct size to snugly fit around exterior of specific piping material to be insulated. Apply mastic to piping to temporarily secure insulation to pipes when jacket is not permanently affixed to outside of insulation system.
   2. Seal jackets and end laps with mastic applied to 2 surfaces or with self-sealing type lap system. Seal exposed ends of insulation with a full coat of mastic.
   3. Fittings, valve bodies and flanges for pipe sizes 4 inches and smaller shall be finished with mineral fiber cement to same thickness as adjacent pipe insulation.
   4. Fittings, valve bodies, roof drain bodies and flanges for pipes over 4 inches shall be insulated with 3/4-lb. density fiberglass blanket compressed to the same thickness as adjacent pipe insulation, or mitered pipe insulation segments, or pre-molded fittings secured with 3-ply jute twine, fiberglass tape or 18-gauge galvanized steel wire, and finished with a smooth coat of mineral fiber cement.
   5. After the cement is dry, fittings shall be finished with 4-oz. canvas adhered with permanent adhesive.
   6. Fittings shall be sealed with vapor barrier mastic over the canvas for the following piping systems:
      a. Domestic Cold Water (Hard and Soft Water).
      b. Condensate Drain.

3.03 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Insulation shall be applied in accordance with the manufacturer's published recommendations, unless otherwise specified.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Hot Piping Systems less than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

E. Hot Piping Systems greater than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Insulate flanges and unions at equipment.

F. Inserts and Shields:
   1. Piping 1-1/2 Inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
   2. Piping 2 Inches Diameter and Larger: Install insert between support shield and piping and under finish jacket:
      a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
      b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
   3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces less than 10 feet above finished floor: Finish with PVC jacket and fitting covers or aluminum jacket.

H. Prepare pipe insulation for finish painting. Refer to Section 09 91 00.

3.04 SCHEDULES

A. Plumbing Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS Inches
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Domestic Hot Water Supply and Recirculation systems with domestic water temperature maintenance cable	P-1	1 inch and smaller 1-1/4 inches to 2 inches 2-1/2 inches and larger	1.0 1.5 2.0
Domestic Cold Water (Hard and Soft Water)	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0

END OF SECTION

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Hose bibs.
2. Wall Hydrants.
3. Backflow preventers.
4. Water hammer arrestors.
5. Thermostatic mixing valves.
6. Trap Primers
7. Chlorination.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete house keeping pads specified by this Section.
2. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this Section.
3. Section 09 91 00 - Painting and Coating: Product and execution requirements for painting specified by this Section.
4. Section 22 05 00 – Common Work Results for Plumbing:
   a. Administrative procedures:
      1) Submittals.
      2) Quality Assurance.
      3) Delivery Storage and Handling.
   b. Hangers and supports.
   c. Flashing and Sleeves.
   d. Pipe and equipment identification.
   e. Installation requirements for piping materials applying to various systems.
   f. Cleaning.
5. Section 22 07 00 - Plumbing Insulation: Execution requirements for insulated pipes.
6. Section 26 27 26 - Wiring Devices: Execution requirements for electric connections to equipment specified by this Section.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. Z358.1 - Emergency Eyewash and Shower Equipment.

B. American Society of Mechanical Engineers (ASME):
1. B16.3 - Malleable Iron Threaded Fittings.
2. B16.4 - Gray Iron Threaded Fittings.
3. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
4. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
5. B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
6. B31.9 - Building Services Piping.
7. B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.

C. American Society of Sanitary Engineering (ASSE):
   1. 1010 - Performance Requirements for Water Hammer Arresters.
   2. 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
   3. 1012 - Performance Requirements for Backflow Preventer With Intermediate Atmospheric Vent.
   4. 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
   5. 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
   6. 1052 – Performance Requirements for Hose Connection Backflow Preventer, Field Testable.
   7. 1053 – Performance Requirements for Double check Backflow Prevention, Wall Hydrants, Field Testable.

D. ASTM International (ASTM):
   1. A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   2. A536 - Standard Specification for Ductile Iron Castings.
   3. B88 - Standard Specification for Seamless Copper Water Tube.
   4. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
   5. D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   6. D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
   7. D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   8. D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   9. D2855 - Standard Practice for Making Solvent-Cemented Joints With Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
   10. F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   11. F 891 - Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.
   12. F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

E. American Welding Society (AWS):
   1. A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association (AWWA):
   1. 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.
   2. C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   3. C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   4. C600 - Standard for Installation of Ductile-Iron Water Mains and their Appurtenances.
   5. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches, for Water Distribution.
   6. C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inches through 3 inches, for Water Service.
   7. C950 - Fiberglass Pressure Pipe.
   8. M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
   1. SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. SP 67 - Butterfly Valves.
   3. SP 69 - Pipe Hangers and Supports - Selection and Application.
   4. SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   5. SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   6. SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   7. SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   8. SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
   9. SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
   10. SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association (NEMA):
   1. 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. National Sanitation Foundation International (NSF):
   1. 61 - Drinking Water System Components - Health Effects.

J. Plumbing and Drainage Institute (PDI):
   1. WH201 - Water Hammer Arrester Standard.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Product Data:
   1. Piping: Submit catalog information on pipe materials, fittings, and accessories.
   2. Valves:
      a. Submit manufacturers catalog information with valve data and ratings for each service.
      b. Identify valve application in the submittal.
   3. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
   4. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and equipment.
   1. Submit certification of water disinfection and chlorination.

B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.06 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum 3 years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Accept valves and equipment on Site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00.

B. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Refer to Section 22 05 00.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Refer to Section 22 05 00.

2.03 UNIONS AND FLANGES

A. Refer to Section 22 05 00.

2.04 INTERIOR HOSE BIBBS

A. Manufacturers:
   1. Chicago Faucet.
   2. Josam.
   3. Nibco.

4. Smith.
5. Woodford.
6. Zurn.

B. 3/4 inch: 125 psi, CWP, copper to hose, bronze body, angle type, vacuum breaker on hose outlet. NIBCO Fig. 72VB, or approved equal.

2.05 WALL HYDRANTS (HB-1) NOT FREEZE PROOF

A. Manufacturers:
1. Chicago Faucet.
2. Josam.
3. Nibco.
4. Smith.
5. Woodford.
6. Zurn.

B. ASSE 1019; bronze wall plate hose thread spout, and removable key operator, vacuum breaker. Rough bronze finish. Woodford Model 84 (surface mounted).

2.06 EXTERIOR WALL HYDRANTS (HB-2) (FREEZE-PROOF)

A. Manufacturers:
1. Chicago Faucet.
2. Josam.
3. Nibco.
4. Smith.
5. Woodford.
6. Zurn.

B. ASSE 1019; non-freeze, self-draining type with bronze wall plate hose thread spout, and removable key operator, vacuum breaker. Rough bronze finish. Woodford Model 67 (surface mounted).

2.07 BACKFLOW PREVENTERS

A. Manufacturers:
1. Conbraco.
2. Febco.
3. Watts.
4. Wilkins.

B. Reduced Pressure Zone Principal (RPZ) Backflow Preventers:
1. Comply with ASSE 1013.
2. 2 Inch and Smaller: NPT threaded connections and quarter-turn, full port, resilient seated, bronze ball valve shut-offs, with drain connection.
3. 2-1/2 Inch and Larger: Flange connecting, wedge gate valves with non-rising stem and resilient seats, FDA approved epoxy coated check and relief valves, replaceable bronze check seats and stainless-steel relief valve seat.
4. Accessories: Air gap funnel.

2.08 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Josam.
   2. Precision Plumbing Products
   3. Sioux Chief.
   4. Smith.
   5. Zurn.

B. Josam Series 7500, or approved equal, stainless-steel construction, bellows type sized in accordance with PDI WH-201.
   1. Barrel-piston type water hammer arresters with hard drawn copper barrel, brass piston and "O" rings, seal lubricant, pre-charged permanently sealed air cushion and male IPS plug. Arresters shall be designed for 150 PSI working pressure and PDI certified.

2.09 PIPE HANGERS AND SUPPORTS

A. Refer to Section 22 05 00.

2.10 THERMOSTATIC MIXING VALVE

A. Manufacturers:
   1. Bradley.
   2. Lawler.
   3. Powers.

B. Emergency Fixture Application features:
   1. Positive shut-off upon failure of cold-water supply.
   2. Integral cold-water bypass.
   3. High-low capability to serve eyewash flow or shower flow.
   4. Inlet thermometers and outlet thermometers.
   5. Emergency Shower/Eyewash, basis of design: Lawler model 911 Unit No. 8334.
   6. Emergency Eyewash only, basis of design: Lawler model 911E/F.

2.11 TRAP PRIMER

A. Manufacturers:
   1. MIFAB, Inc.
   2. Precision Plumbing Products, Inc.
   3. Sioux Chief Manufacturing Company, Inc.
   4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   5. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

B. Construction: ASSE 1018, lead free bronze body, chrome plated finish where exposed, 1/2 inch inlet and outlet connections. 125 psi rated pressure, 25 psi minimum system pressure, 10 psi pressure drop to operate.
   1. Provide distribution.

C. Basis of Design: Watts LFTP300

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

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.

3.03 INSTALLATION

A. Pipe and fittings: Refer to Section 22 05 00.

B. Valves: Refer to Section 22 05 00.

C. Hose bibs: Provide vacuum breakers where directed by the Plumbing Inspector.

D. Wall Hydrants:
   1. Insulate piping through the wall and maintain the integrity of the vapor barrier.
   2. Apply sealant to wall surface behind the wall hydrant.

E. Backflow preventers:
   1. Register installation with the Department of Labor and Industry.
   2. Extend drain piping from funnel to floor drain.

F. Water hammer arrestors: Install with shut-off valve and threaded fitting.

G. Balancing valves: Refer to Section 22 05 00.

H. Thermostatic mixing valves:
   1. Set outlet temperature limit to not exceed 115 degrees F.
   2. Set outlet temperature limit to not exceed 85 degrees F for emergency fixtures.

I. Trap Primer: Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

J. Chlorination: Refer to Section 22 05 00.

3.04 INSTALLATION - THERMOMETERS AND GAUGES

A. Install thermometers in piping systems where indicated on Drawings.

B. Install one pressure gauge for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gauge. Omit tap upstream of strainer for in-line pumps.

C. Install gauge taps in piping.

D. Install pressure gauges with snubbers. Provide needle valve or ball valve to isolate each gauge.

E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

F. Provide instruments with scale ranges selected according to service with largest appropriate scale.

G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate.

3.05 INSTALLATION - HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Section 22 05 00.

3.06 INSTALLATION – BURRIED PIPING SYSTEMS

A. Verify connection size, location, and inverts are as indicated on Drawings.

B. Coordinate underground piping locations with structural footings.

C. Establish elevations of buried domestic water piping with not less than 7.5-feet of cover outside of building.

D. Establish minimum separation of 10 feet from water piping in accordance with Minnesota code.

E. Remove scale and dirt on inside of piping before assembly.

F. Excavate pipe trench in accordance with Division 31.

G. Install pipe to elevation as indicated on Drawings.

H. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted loose depth; compact to 95 percent maximum density.

I. Install pipe on prepared bedding.

J. Route pipe in straight line.

K. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

5. Do not use wheeled or tracked vehicles for tamping.

3.07 INSTALLATION - ABOVE GROUND PIPING

A. Refer to Section 22 05 00 - Common Work Results for Plumbing for additional requirements.

B. Install non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

E. Group piping whenever practical at common elevations.

F. Install piping level, or slope piping and arrange to drain at low points.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

H. Provide access where valves and fittings are not accessible.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.

L. Install domestic water piping in accordance with ASME B31.9.

M. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 00.

N. Install unions downstream of valves and at equipment or apparatus connections.

O. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

P. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

Q. Provide flow controls in water circulating systems as indicated on Drawings.

R. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, irrigation systems.

S. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

T. Test backflow preventers in accordance with ASSE 5013.

U. Install water hammer arrestors complete with accessible isolation valve on hot and cold-water supply piping.

3.08 INSTALLATION - SERVICE CONNECTIONS

A. Verify connection size, location, and inverts are as indicated on Drawings.

B. Coordinate underground piping locations with structural footings.

C. Provide mechanical sleeve seal for wall penetrations. Anchor service main to concrete.

D. Establish elevations of buried piping with not less than 7.5 feet of cover.

3.09 FIELD QUALITY CONTROL

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

B. Test domestic water piping system in accordance with applicable code or local authority having jurisdiction.

3.10 PIPING TESTS:

A. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

C. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

D. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

E. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

F. Prepare reports for tests and for corrective action required.

3.11 PROGRESS CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash from site periodically and dispose off-site; do not burn or bury.

3.12 CLEANING

A. Refer to Section 01 70 00.

B. Refer to Section 22 05 00.

END OF SECTION

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SECTION 22 13 00

FACILITY SANITARY SEWERAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sanitary Drainage Specialties:
      a. Floor drains.
      b. Trench drains.
      c. Floor sinks.
      d. Cleanouts.
      e. Flammable waste interceptor.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
   2. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this section.
   3. Section 22 05 00 – Common Work Results for Plumbing: Product and installation requirements for piping materials applying to various systems.
   4. Section 26 27 26 - Wiring Devices: Execution requirements for electric connections to equipment specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. A112.21.1 - Floor Drains.
   2. B31.9 - Building Services Piping.

B. American Society for Testing Materials (ASTM):
   1. A74 - Standard specification for cast iron soil pipe and fittings.
   2. C564 - Standard specification for rubber gaskets for joining cast iron soil pipe and fittings.

C. Cast Iron Soil Pipe Institute (CISPI):
   1. 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   2. 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 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Section 01 33 00: Submittal procedures.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sewage-ejectors, and manholes.

C. Product Data:
   1. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
   2. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

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

1.05 CLOSEOUT SUBMITTALS

A. Section 01 70 00: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State of Minnesota standards.

B. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum 3 years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00.

B. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 FLOOR DRAINS

A. Acceptable Manufacturers:
   1. Jay R. Smith.
   2. Josam.
   3. Wade.
   4. Watts.
   5. Zurn.

B. Construction:
   1. ASME A112.21.1.
   2. Coated cast iron body.
   3. Flashing collar with threaded strainer connection.
   4. Drainage flange.

C. Basis of Design:
   1. Floor Drain (FD-1): Josam 30000-A series, with 4-inch satin finish bronze strainer, bottom outlet.
   2. Condensate Drain (FD-2): Josam 30000-A-E2 series with satin finish bronze strainer with 4-inch diameter funnel, bottom outlet.

2.02 TRENCH DRAINS (LINEAR PRECAST)

A. Manufacturers:
   1. Dura-Trench.
   2. Smith/ACO.
   3. Polycast.
   4. Watts.
   5. Zurn.

B. Trench Drain (TD-1)
   1. Trench: 12 inches wide by 48 inches long, pre-sloped.
   2. Channel: UV stabilized, fiberglass reinforced polymer, polymer concrete or polypropylene.
   3. Frame: Stainless steel or ductile iron with Stainless Steel Frame Guard.
   4. Outlet: Integral 4 inch side outlet.
   5. Grate: Slotted Load rating special duty, over 10,000 lb rating, DIN Class F
   6. Accessories: Provide frame anchors, grate lockdowns and construction covers.

C. Provide extensions necessary to match size indicated on the Drawings.

2.03 CLEANOUTS

A. Acceptable Manufacturers:
   1. Jay R. Smith.
   2. Josam.
   3. Wade.
   4. Watts.
   5. Zurn.

B. Floor Cleanout (CO): Provide Josam Series 58580-1 series, or equal, with satin finish bronze top and carpet cleanout marker where appropriate. Provide chrome cover when located in a wall.

2.04 SAND/SOLIDS TRAP

A. See structural

2.05 FLAMMABLE WASTE TRAP (OIL/WATER SEPERATOR) (OI-1)

A. Acceptable Manufacturers:
   1. Brown Minneapolis Tank.
   2. Midwest Tank.
   3. PPF Metal Fabricating.

B. Description:
   1. 35 cubic foot retention capacity.
   2. 1/4 inch thick steel cone and neck.
   3. 3/16 inch thick steel shell and bottom.
   4. Bitumastic coating applied to inside and outside surfaces.
   5. 24 inch diameter, 3/8 inch checkered steel plate gas-tight access cover.
   6. 3 inch vent.
   7. 4 inch inlet and outlet fittings with long sweep el.
   8. Piping connections and invert elevations to match orientation indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Verify elevations with site utility work prior to commencing work.

B. Remove scale and dirt, on inside and outside of pipe before assembly. Remove burrs.

C. Protect open ends of pipe from dirt and debris using temporary plugs or caps.

3.03 GENERAL INSTALLATION

A. Pitch drain, waste, and vent piping 1/4 inch per foot minimum. Do not slope more than 1/2 inch per foot.

B. Support piping so it will not sag.

C. Follow manufacturer's installation instructions for neoprene gasket connections to specialties.

D. Install top of hubs below finish floor when masonry partition wall thickness is insufficient to conceal hub and/or outside diameter of hub is greater than stud width.

E. Install an approved expansion joint at intervals not to exceed 35 feet for vertical plastic piping.

F. Floor Drains: Install accurately where indicated on the drawings:
   1. Install with top set level with finished floor, unless indicated otherwise.
   2. Trap and vent as required by local code authority.

G. Cleanouts: Install full size at the following locations:
   1. Base of waste stacks.
   2. Ninety degree turns in mains.
   3. Point where sewer leaves building.
   4. All other necessary points as indicated and required to permit easy system rodding:
      a. Every 50 feet on lines 3 inches or less in size.
      b. Every 100 feet on lines 4 inches or more in size.

H. Encase exterior cleanouts in concrete flush with grade.

I. Install floor cleanouts at elevation to accommodate finished floor.

3.04 INSTALLATION - HANGERS AND SUPPORTS

A. Refer to Section 22 05 00.

3.05 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and inverts are as indicated on Drawings.

B. Coordinate underground piping locations with structural footings.

C. Establish elevations of buried piping with not less than 6.5 feet of cover.

D. Establish minimum separation of 10 feet from water piping in accordance with Minnesota code.

E. Remove scale and dirt on inside of piping before assembly.

F. Excavate pipe trench in accordance with Division 31.

G. Install pipe to elevation as indicated on Drawings.

H. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted loose depth; compact to 95 percent maximum density.

I. Install pipe on prepared bedding.

J. Route pipe in straight line.

K. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.

2. Maintain optimum moisture content of fill material to attain required compaction density.
3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
5. Do not use wheeled or tracked vehicles for tamping.

3.06 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom. Do not spread piping, conserve space.

E. Group piping whenever practical at common elevations.

F. Provide access where valves and fittings are not accessible.

G. Increase vent stacks to 3 inches in diameter (minimum) for vents extending through the roof.

H. Install vent piping penetrating roof with frost proof jackets having air space of at least 1-inch between outside surface of pipe and inside surface of frost proof jacket.

I. Install piping penetrating roofed areas to maintain integrity of roof assembly.

J. Construct the roof jacket with a roof flange of 16 ounce copper or sheet lead of not less than 4 pounds per square foot. Maintain separation from fresh air intakes indicated on the drawings but not less than 10 feet horizontal.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 00.

M. Install bell and spigot pipe with bell end upstream.

N. Sleeve pipes passing through partitions, walls and floors.

O. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 07 84 00.

P. Support cast iron drainage piping at every joint.

3.07 FIELD QUALITY CONTROL

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

B. Test sanitary waste and vent piping system in accordance with the Sate of Minnesota Rules and Regulations, and local authority having jurisdiction.

3.08 PROGRESS CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash from site periodically and dispose off-site; do not burn or bury.

END OF SECTION

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SECTION 22 14 00

FACILITY STORM DRAINAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Roof drains.
2. Overflow roof drains.
3. Downspout nozzles.

B. Related Sections:
1. Section 03 30 10 - Reinforced Cast-In-Place Concrete: Execution requirements for placement of concrete specified by this section.
2. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
3. Section 08 11 00 - Metal Doors and Frames: Product requirements for access doors for placement by this section.
4. Section 09 91 00 - Painting: Execution requirements for painting material specified by this section.
5. Section 22 05 00 – Common Work Results for Plumbing: Product and installation requirements for piping materials applying to various systems.
6. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
7. Section 26 27 26 - Wiring Devices: Execution requirements for electric connections to equipment specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. A112.21.2M - Roof Drains.
2. B31.9 - Building Services Piping.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Per Section 01 33 00.

B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes for sump-pumps, catch basins, and manholes.

C. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Storm Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

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

1.05 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit spare parts lists, exploded assembly views for pumps and equipment.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State of Wisconsin standard.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this Section with minimum 3 years of experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00.

B. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 ROOF DRAINS

A. Manufacturers:
   1. Jay. R. Smith.
   2. Josam.
   3. Zurn.
   4. Wade.

B. Roof Drain (RD): Assembly: ASME A112.21.2M. Josam 21500 Series.
   1. Body: Coated cast iron, large sump.
   2. Dome Strainer: Removable cast iron dome/grate.
   3. Membrane flange and membrane clamp ring with integral gravel stop.
   4. Deck clamp.

C. Overflow Roof Drain (OD):
   1. Similar to roof drain above with internal water guard cut to 2-inch high. Josam 21500-16 Series.

D. Setting of each roof drain shall include one 36 inch by 36 inch noblefex membrane flashing securely anchored into the drain.

2.02 DOWNSPOUT NOZZLES

A. Manufacturers:
   1. Jay. R. Smith.
   2. Josam.
   3. Zurn.
   4. Wade.

B. Downspout Nozzle (DSN): Provide Josam Series 25010, or equal, cast nickel bronze downspout nozzle, loose wall flange and no-hub or threaded connection. Where rainwater leader terminates through an exterior wall above grade, provide a downspout nozzle, satin bronze finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

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 - HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Section 22 05 00.

3.04 INSTALLATION - BURIED PIPING SYSTEMS

A. Establish elevations of buried piping with not less than 5 feet of cover.

B. Establish minimum separation of sanitary sewer piping and domestic water service piping in accordance with Wisconsin State code.

C. Install pipe to elevation as indicated on Drawings.

D. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted loose depth; compact to 95 percent maximum density.

E. Install pipe on prepared bedding.

F. Route pipe in straight line.

G. Coordinate underground piping locations with structural footings.

H. Install Work in accordance with State of Wisconsin standards.

3.05 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearance at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom. Group piping to conserve space.

H. Group piping whenever practical at common elevations.

I. Support cast iron drainage piping at every joint.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

L. Provide access where valves and fittings are not accessible.

M. Install piping penetrating roofed areas to maintain integrity of roof assembly.

N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

O. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 91 00.

P. Install bell and spigot pipe with bell end upstream.

Q. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.

R. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

3.01 FIELD QUALITY CONTROL

A. Section 01 40 00 and 01 70 00: Field inspecting, testing, adjusting, and balancing.

B. Test storm drainage piping system in accordance with applicable code and local authority having jurisdiction and State of Wisconsin Rules and Regulation.

3.02 PROGRESS CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash from site periodically and dispose off-site; do not burn or bury.

END OF SECTION

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SECTION 22 15 00

GENERAL SERVICE COMPRESSED AIR SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Compressed air piping.
2. Unions and flanges.
3. Flexible connectors.
4. Relief valves.
5. Compressed air outlets.
6. Air compressor.
7. Compressed air after cooler.
8. Refrigerated compressed air dryer.
9. Air pressure reducing valve.
10. Pressure regulators.
11. Compressed air filters.
12. Hose connectors.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for equipment bases specified by this section.
2. Section 09 90 00 - Painting and Coating: Execution requirements for painting material specified by this section.
3. Section 22 05 00 - Common Work Results for Plumbing: Product and installation requirements for piping materials and valves applying to various system types.
4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. B16.3 - Malleable Iron Threaded Fittings.
2. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
3. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
4. B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
5. B31.1 - Power Piping.
6. B31.9 - Building Services Piping.
7. Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
8. Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International (ASTM):
1. A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

4. A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
5. A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
6. A536 - Standard Specification for Ductile Iron Castings.
7. B32 - Standard Specification for Solder Metal.
8. B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
9. B88 - Standard Specification for Seamless Copper Water Tube.
10. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
11. D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
12. D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
13. F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
14. F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
15. F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society (AWS):
1. A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. D1.1 - Structural Welding Code - Steel.

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
1. SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. SP 67 - Butterfly Valves.
3. SP 69 - Pipe Hangers and Supports - Selection and Application.
4. SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
5. SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
6. SP 80 - Bronze Gate, Globe, Angle and Check Valves.
7. SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
8. SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

E. National Electrical Manufacturers Association (NEMA):
1. 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NSF International (NSF):
1. 61 - Drinking Water System Components - Health Effects.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Section 01 33 00: Requirements for submittals.

B. Shop Drawings: Indicate piping system schematic with electrical and connection requirements general assembly of components, mounting and installation details, and general layout of control and alarm panels.

C. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
   4. System Components: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes. When applicable, include electrical characteristics and connection requirements.
   5. Compressors: Submit type, capacity, and performance characteristics. Include electrical characteristics and connection requirements.

D. Product Data: Submit manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.

E. Manufacturer's Installation Instructions: Submit hoisting and setting requirements, starting procedures.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Section 01 70 00: Requirements for submittals.

B. Project Record Documents: Record actual locations of equipment piping, valves, outlets and components.

C. Operation and Maintenance Data: Submit assembly views, lubrication instructions, replacement part numbers and availability.

1.06 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.

B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing work of this Section with minimum of 5 completed projects that included installing compressed air systems.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Accept equipment on site in factory fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

C. Protect piping and equipment from weather and construction traffic. Maintain factory packaging and caps in place until installation.

D. Deliver each length of piping with manufacturer's plugged or capped ends and keep sealed until installation.

E. Deliver fittings, valves, and other components in sealed containers and keep sealed until installation.

1.09 MAINTENANCE MATERIALS

A. Section 01 70 00: Requirements for maintenance materials.

B. Furnish 1 container of compressor oil.

PART 2 PRODUCTS

2.01 COMPRESSED AIR PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
   1. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type.
   2. Joints: Threaded for pipe 2 inch and smaller; welded or grooved for larger pipe.
   3. Joints: Grooved mechanical couplings meeting ASTM F1476.
      a. Housing Clamps: ASTM A395/A395M and ASTM A536 ductile iron, compatible with steel piping sizes, rigid clamps for exposed locations, flexible clamps for concealed locations.
      b. Gasket: Elastomer composition for operating temperature range from minus 30 degrees F to 250 degrees F.
      c. Accessories: Steel or stainless-steel bolts, nuts, and washers.

2.02 STRAINERS

A. Acceptable Manufacturers:
   1. Mueller Steam Specialty.
   2. O.C. Keckley Company.
   3. Spirax Sarco, Inc.

B. 2 inch and Smaller: Y pattern, ASTM B62 bronze body, threaded ends, Class 150, 50 mesh stainless steel perforated screen.

2.03 FLEXIBLE CONNECTORS

A. Acceptable Manufacturers:
   1. Flex-Hose Co., Inc.
   2. Flex-Weld, Inc./Keflex.
   3. The Metraflex Company.
   4. Twin City Hose, Inc.
   5. US Hose Corp.

B. 2 inches and Smaller: Corrugated bronze hose with single layer of bronze exterior braiding, copper tubing ends; 225 psig working pressure at 70 degrees F, threaded or soldered connections.

2.04 RELIEF VALVES

A. Relief Valves: Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.05 COMPRESSED AIR OUTLETS

A. Compressed Air Outlets: Quick Connector: 3/8 inch brass, female, snap on connector with self closing valve.

2.06 AIR COMPRESSOR

A. Manufacturers:
   1. Quincy Model QP MAX Package.
   2. Hankison Model _____.
   3. Or approved equal.

B. Compressor: Simplex tank mounted compressor unit consisting of air-cooled compressor, air receiver, after cooler, and operating controls.

C. Reciprocating Compressors:
   1. Unit: Reciprocating compressor with positive displacement oil pump lubrication system, suction inlet screen, discharge service valves, on cast iron or welded steel base for motor and compressor with provision for V-belt adjustment.
   2. Automatic Capacity Reduction Equipment: Suction valve unloading device with lifting mechanism operated by gas discharge pressure. Furnish unloaded compressor start.
   3. Motor: Constant speed 1800 rpm with electronic overheating protection in each phase with full voltage starting. Refer to Section 21 05 13.
   4. Control Panel: Factory mounted and wired, NEMA 250 Type 1 enclosure, steel construction, with power and control wiring, molded-case disconnect switch, factory wired for single point power connection.
      a. Starter: Furnish with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
      b. Safety Controls: Manually reset low oil pressure cutout.
      c. Panel Face: Compressor run light, start-stop switch, elapsed time meter.

D. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

E. Disconnect Switch: Factory mount on equipment under provisions of Division 26.

2.07 COMPRESSED AIR AFTER COOLER

A. Construction: Removable tube nests of non-ferrous metal tubes and corrosion resistant tube plates, safety valves, pressure gage, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

B. Working Pressure: 135 psi.

C. Discharge: Cool air to within 12 degrees F of ambient air temperature at specified flow capacity.

2.08 REFRIGERATED COMPRESSED AIR DRYER

A. Manufacturers:
   1. Quincy Model QRHT.
   2. Hankison Model _____.
   3. Or approved equal.

B. Refrigerated Air Dryer: Self contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full refrigerant charge.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat Exchangers: Air to air and refrigerant to air coils. Furnish heat exchangers with automatic control system to bypass refrigeration system on low or no-load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration Unit: Hermetically sealed type to operate continuously to maintain specified 21 degrees F dew point. House unit in steel cabinet with access door and panel for maintenance and inspection.

G. Accessories: Air inlet temperature gauge, air inlet pressure gauge, on/off switch, high temperature light, power on light, refrigerant gauge air outlet temperature gauge, air outlet pressure gauge.

H. Capacity: Match to compressor.

I. Electrical Characteristics:
   1. 120 volts, single phase, 60 Hz.

J. Cord and Plug: Furnish unit with 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.09 AIR PRESSURE REDUCING VALVE

A. Air Pressure Reducing Valve: Consisting of automatic reducing valve and bypass, and low pressure side relief valve and gage. Furnish oil separator .

B. Valve Capacity: Reduce pressure from 200 psi to 30 psi, adjustable upward from reduced pressure.

2.10 PRESSURE REGULATORS

A. High Pressure Regulator:
   1. Brass body, bonnet, bottom plug and cover.
   2. Bolted construction with 302 stainless steel diaphragm, nylon seat and Nitrile seals.
   3. 316 stainless steel supply nozzle and 17-4 stainless steel spring.
   4. Integral 40 micron inlet screen.
   5. 6000 psi inlet rating. 1/4 inch NPT inlet connection, three 1/4 inch NPT outlet(s).
   6. 0 to 150 psi outlet pressure.
   7. Tee handle adjustment.
   8. ControlAir Inc. Model 3500-CD (0-150).

B. Pressure Regulators: Diaphragm operated, bronze body, direct acting, spring loaded, manual pressure setting adjustment, rated for 250 psig inlet pressure.

C. Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring loaded, manual pressure setting adjustment, and rated for 250 psig inlet pressure.

2.11 COMPRESSED AIR FILTERS

A. Coalescing Filters: Furnish with activated carbon capable of removing water and oil aerosols, with color-change dye indicating when carbon is saturated and warning light indicating when maximum pressure drop has been exceeded.

2.12 HOSE CONNECTORS

A. Hose Connectors: Corrugated stainless steel tubing with stainless steel wire braid covering and ends welded to inner tubing.

B. Working Pressure: 250 psig minimum.

C. End Connections:
1. 2 inches and Smaller: Threaded steel pipe nipple.
2. 2-1/2 inches and Larger: Class 150 Flanges.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

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 - INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.04 INSTALLATION - HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with ASME B31.9 and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Prime coat exposed steel hangers and supports. Refer to Section 09 10 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Install pipe hangers and supports in accordance with Section 22 05 00.

3.05 INSTALLATION - ABOVE GROUND PIPING - COMPRESSED AIR SYSTEMS

A. Install drip connections with valves at low points of piping system.

B. Install take-off to outlets from top of main, with shut off valve after take off. Slope take-off piping to outlets.

C. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.

D. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

E. Cut pipe and tubing accurately and install without springing or forcing.

F. Slope piping in direction of flow.

G. Install pipe sleeves where pipes and tubing pass through walls, floors, roofs, and partitions. Refer to Section 22 05 00.

H. Install pipe identification in accordance with Section 22 05 00.

I. Except where indicated, install manual shut off valves with stem vertical and accessible for operation and maintenance.

J. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.

K. Install strainers on inlet side of pressure regulators.

3.06 INSTALLATION - EQUIPMENT

A. Install air compressor on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than compressor base on each side. Refer to Section 03 30 00.

B. Install air compressor unit on vibration isolators. Level and bolt in place.

C. Install air valve and drain connection on horizontal casing.

D. Install line size shut-off valve and check valve on compressor discharge.

E. Install replaceable cartridge type filter silencer for each compressor.

F. Install shut-off valve on water inlet to after cooler. Pipe drain to floor drain.

G. Install condensate drain piping to nearest floor drain.

H. Install bypass with valves around air dryer. Use factory insulated inlet and outlet connections.

I. Provide bypass with valves, around receivers.

3.07 FIELD QUALITY CONTROL

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

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.9.

C. Verify for atmospheric pressure in piping systems, other than system under test.

D. Test system with dry compressed air or dry nitrogen with test pressure in piping system at 50 psi.

3.08 CLEANING

A. Section 01 70 00: Requirements for cleaning.

B. Blow systems clear of free moisture and foreign matter.

END OF SECTION

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SECTION 22 31 00

DOMESTIC WATER SOFTENERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes water softeners.

B. Related Sections:
1. Section 22 11 00 - Facility Water Distribution: Supply connections to domestic water conditioning equipment.
2. Section 26 27 26 - Wiring Devices: Execution requirements for electric connections specified by this section.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

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

B. Product Data: Submit capacity, electrical characteristics and connection requirements. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, drains, controls, and operating sequence.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit operation, maintenance, and inspection data, replacement part numbers and availability.

1.05 QUALIFICATIONS

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

B. Testing Agency: Company specializing in testing products specified in this section with minimum 3 years experience.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State of Wisconsin standard.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for water softener.

1.10 MAINTENANCE SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance service.

1.11 MAINTENANCE MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 PRODUCTS

2.01 WATER SOFTENERS

A. Manufacturers:
1. Culligan
2. Rainsoft Water Conditioning Co.
3. Water Control Corporation.

B. Provide Water Control Corporation, model LF-90-TWIN-ECC.

C. Description:
1. Service Flow: 58 GPM continuous at a pressure loss not exceeding 7 psi.
2. Peak Flow: 110 gpm peak flow, 25 psi pressure drop.
3. Resin Tanks: (2) Glass fiber reinforced polyester construction. 14 inch diameter, 3 cubic foot resin per tank, allowing 50 percent free board for resin expansion.
4. Brine Tank: High density molded polyethylene tank, 24 x 48 inches overall size.
5. Electrical Characteristics:
   a. 120 volts, single phase, 60 Hz, 3.5 amp draw for each valve. 3 prong plug.
6. Control: Top mounted brass multi-port, motor driven, five position control valves with two inch inlet and outlet. Electronic controls stage softeners and control flow to minimize channeling and maintain adequate flow. Controls incorporate a meter on each control valve outlet to monitor individual tank usage between regeneration.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate with plumbing piping and related and electrical Work to achieve operating system.

B. Install the following piping accessories on water conditioning equipment domestic water piping connections. Refer to Section 22 11 00.
   1. On inlet:
      a. Thermometer.
      b. Strainer.
      c. Pressure gage.
      d. Shut-off valve.
   2. On outlet:
      a. Shut-off valve.

C. Install overflow drain piping from brine tank to nearest floor drain.

D. Extend regeneration discharge piping to floor drain.

E. Connect valve electrical power cords to GFI receptacles.

END OF SECTION

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SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Residential electric water heaters.
2. Commercial electric water heaters.

B. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
2. Section: 22 11 00 – Facility Water Distribution: Supply connections to domestic water heaters.
3. Section 26 27 26 - Wiring Devices: Execution requirements for electric connections specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
1. PTC 25 - Pressure Relief Devices.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

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

B. Shop drawings: Indicate size of taps and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.

C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.

1.05 CLOSEOUT SUBMITTALS

A. Section 01 70 00: Closeout procedures.

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State of Wisconsin standard.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum 3 years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00: Product warranties and product bonds.

B. Provide 3 years or longer written guarantee. Tankless type water heaters to have a 1-year warranty.

PART 2 PRODUCTS

2.01 ELECTRIC WATER HEATERS

A. Manufacturers:
1. A.O. Smith.
2. American Water Heater Group.
3. Bradford-White.
4. State.
5. Or approved equal.

B. Type: Provide Bradford-White LD-WH20L3-1, or equal, light duty wall hung electric water heater.

C. Capacity and characteristics as indicated on Drawings.

D. Tank: Glass lined welded steel; thermally insulated with glass fiber; encased in corrosion-resistant steel jacket with baked-on enamel finish.

E. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box, operating light and high temperature limit thermostat.

F. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME temperature and pressure relief valve.

2.02 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Section 26 05 05 and as indicated on Drawings.

B. Disconnect Switch: Factory mount disconnect switch in on equipment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Connect domestic hot water and domestic cold-water piping to supply and return water heater connections.

C. Install the following piping accessories. Refer to Section 22 11 00.
   1. On supply:
      a. Thermometer well and thermometer.
      b. Strainer.
      c. Pressure gauge.
      d. Shutoff valve.
   2. On return:
      a. Thermometer well and thermometer.
      b. Pressure gauge.
      c. Shutoff valve.

D. Install discharge piping from relief valves and drain valves to nearest floor drain.

E. Install water heater trim and accessories furnished loose for field mounting.

F. Install electrical devices furnished loose for field mounting.

G. Install control wiring between water heater control panel and field mounted control devices.

H. Install Work in accordance with State of Wisconsin standards.

3.02 SCHEDULES

A. Water heaters: Refer to schedule on Drawings.

END OF SECTION

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SECTION 22 34 00

FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Commercial gas-fired water heaters.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for concrete housekeeping pads specified by this section.
   2. Section: 22 11 00 - Facility Water Distribution: Supply connections to domestic water heaters.
   3. Section 23 11 23 - Facility Natural-Gas Piping: Execution requirements for gas piping connections specified by this section.
   4. Division 26 - Electrical: Execution requirements for electric connections specified by this Section.

1.02 REFERENCES

A. American National Standards Institute:
   1. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. American Society of Mechanical Engineers:
   1. ASME PTC 25 - Pressure Relief Devices.
   2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. International Code Commission:
   1. International Fuel Gas Code (IFGC).

E. National Fire Protection Association:
   1. NFPA 54 - National Fuel Gas Code.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

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

B. Product Data:
   1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate pump type, capacity and power requirements. Submit electrical characteristics and connection locations.

C. Manufacturer's Installation Instructions: Submit mounting and support requirements.

1.05 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.06 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this Section with minimum 3-years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Accept water heaters on site in original labeled cartons. Inspect for damage.

C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. Furnish three year manufacturer warranty for commercial domestic water heaters.

B. Furnish five year manufacturer warranty for domestic hot water storage tanks.

PART 2 PRODUCTS

2.01 COMMERCIAL GAS FIRED WATER HEATERS

A. Acceptable Manufacturers:
   1. A.O. Smith.
   2. Bock.
   3. Bradford-White.
   4. PVI.
   5. Rheem.
   6. State.

B. Type: Vertical storage, tank type, natural gas fired domestic hot water heater.

C. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

D. Controls: Automatic water thermostat with adjustable temperature range from 120 to 180 degrees F. Automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

E. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME temperature and pressure relief valve.

2.02 DIAPHRAGM-TYPE EXPANSION TANKS

A. Provide diaphragm type pressure tanks of the size and capacity shown on the drawings. Precharge to 40 PSI.

B. Provide suitable inlet and outlet tappings.

C. Construct tank of galvanized steel and provide a 100 percent corrosion free NSF approved lining. Provide permanently sealed heavy-duty butyl diaphragm with five year written warranty for entire assembly. Test for 125 psig working pressure. ASME Compliance.

D. Manufacturer: Amtrol Therm-X-Trol, Bell & Gossett, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Maintain manufacturer's recommended clearances around and over water heaters.

B. Install water heater on concrete housekeeping pad, minimum 3-1/2 inches high and 6 inches larger than water heater base on each side. Refer to Section 03 30 00.

C. Connect natural gas piping in accordance with IFGC.

D. Connect natural gas piping to water heater, full size of water heater gas train inlet. Arrange piping with clearances for burner removal and service.

E. Connect domestic hot water and domestic cold water piping to water heater.

F. Connect domestic circulating hot water line to cold water inlet piping.

G. Install the following piping accessories. Refer to Section 22 11 00.
   1. On cold water inlet piping, downstream of the circulating line connection:
      a. Thermometer well and thermometer.
      b. Strainer.
      c. Pressure gauge.
      d. Check valve.
      e. Vacuum relief valve.
      f. Shutoff valve.
      g. Union.
   2. On hot water piping:
      a. Union.
      b. Shutoff valve.
      c. Thermometer well and thermometer.

H. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23.
   1. Dirt leg.
   2. Shutoff valve.
   3. Pressure regulator suitable for water heater inlet pressure.

I. Install discharge piping from relief valves and drain valves to nearest floor drain.

J. Install water heater trim and accessories furnished loose for field mounting.

K. Install electrical devices furnished loose for field mounting.

L. Connect flue and combustion air piping to water heater, full size of outlet or larger. Refer to Section 23 51 00.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Water closets.
2. Lavatories.
3. Mop sinks.
4. Sinks.
5. Showers.
6. Emergency Eyewash/Shower.

B. Related Sections:
1. Section 07 90 00 - Joint Protection: Product requirements for calking between fixtures and building components for placement by this section.
2. Section 22 05 00 – Common Work Results for Plumbing: Administrative procedures and execution requirements. Explanation of approved manufacturers and prior approvals.
3. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
4. Section 22 11 00 - Facility Water Distribution: Hose bibbs, hydrants, and wall hydrants.
5. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.
6. Section 26 27 26 - Wiring Devices: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. A117.1 - Accessible and Usable Buildings and Facilities.

B. Air-Conditioning and Refrigeration Institute (ARI):
1. 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.

C. American Society of Mechanical Engineers (ASME):
1. A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
2. A112.18.1 - Plumbing Fixture Fittings.
3. A112.19.1 - Enameled Cast Iron Plumbing Fixtures.
4. A112.19.2 - Vitreous China Plumbing Fixtures.
5. A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
6. A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

D. American Society of Safety Engineers (ASSE):
1. 1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. In accordance with Section 01 33 00.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes. Include water surface area for water closet fixtures.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

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

1.05 CLOSEOUT SUBMITTALS

A. Section 01 70 00: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.06 QUALITY ASSURANCE

A. Specified fixtures identify the basis of design and establish the standard of quality for this project. Comparable fixtures from other listed manufacturers are acceptable, providing they meet or exceed the indicated requirements.

B. Water surface area for the water closet fixtures is a salient feature. Fixtures with smaller areas will not be accepted.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.01 [ACCEPTABLE] MANUFACTURERS

A. Vitreous China Fixtures: Water Closets, Urinals, Lavatories and Sinks
   1. American Standard.
   2. Crane.
   3. Kohler Co.
   4. Sloan.

5. Zurn.

B. Fixture Carriers:
1. Josam.
2. Smith.
3. Wade.
4. Watts.
5. Zurn.

C. Stainless Fixtures: Sinks
1. Advance Tabco.
2. Elkay.
3. Just.
4. Kindred Commercial.

D. Faucets and Trim
1. American Standard.
2. Chicago.
3. Delta.
4. Kohler Co.
5. Speakman.
6. T & S Brass.
7. Zurn.

E. Flush Valves
1. American Standard.
2. Sloan.
3. Toto.
4. Zurn.

F. Molded Stone Fixtures: Mop Sinks
1. Fiat.
2. Florestone.
3. Mustee.
4. Pro Flo.
5. Stern Williams.
6. Zurn.

G. Water Coolers
1. Elkay.
2. Halsey Taylor.
3. Haws.
4. Oasis.

2.02 WATER CLOSET (WC-1)

A. American Standard, floor mounted, Cadet Right Height, elongated, pressure assist 1.6 GPF water closet model 2377.100.

B. Bowl: ASME A112.19.2; Floor mount, siphon jet, vitreous china with elongated rim, 10 inch x 12 inch water surface area, white bolt caps.

C. Tank: Pressure assisted Flushmate II system integral to tank. Left hand flush lever.

D. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, corrosion resistant bolts, less cover.

2.03 WALL HUNG LAVATORY (L- 1)

A. Basin: ASME A112.19.2, American Standard Lucerne 0355.012, vitreous china, faucet holes 4 inches on center, 20x18 inch nominal with 15 inch by 10 inch by 6-1/2 inch deep bowl, 4 inch raised back, tapered side splash shields, drilled for concealed arm support, front overflow, self draining deck area.

B. Manual Faucet: ASME A112.18.1; Chicago Faucet Model 420 series. Chrome plated brass faucet with 7-1/4 inch single lever handle, thermostatic ceramic cartridge, with 106 degrees F maximum hot water temperature, model 420-X41KJKABNF, ASSE 1070 , aerator with maximum 1.5 gpm flow.

C. Mixing valve: American Standard Model 605XTMV thermostatic mixing valve mounted below sink. ASSE 1016 performance.

D. Accessories:
   1. Chrome plated 17 gage brass P-trap with clean-out plug and wall escutcheon.
   2. Open grid strainer with tailpiece.
   3. Flexible supplies.
   4. Trap and waste insulated and offset to meet ADA compliance for A suffix fixtures.

E. Floor Mounted Carrier: Josam 17100 Series, cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

2.04 MOP SINKS (S-1)

A. Fiat model MSB2424, floor set mop service basin. 24 inch by 24 inch by 10 inch high, 1-piece molded stone construction with 1 inch wide shoulders, integral molded center drain outlet with dome strainer and lint basket, 3 inch outlet.

B. Faucet: Fiat model 830 AA, wall mounted, chrome plated brass construction with vacuum breaker, integral stops, adjustable wall brace, pail hook and 3/4 inch hose thread on spout cross or lever handles on 8 inch centers.

C. Accessories:
   1. Hose: Provide 30 inch length of 3/4 inch rubber hose threaded to connect to faucet.
   2. Mop Bracket: 24 inch long, 3 inch high, stainless steel bracket with 3 rubber grips.

2.05 SHOWERS (SH-1,)

A. Trim and Valve Assembly and Accessories: ASME A112.18.1.
   1. ADA Compliant.
   2. Model: Chicago Faucet SH-TP1-00-023.
   3. Shower Valve: Chicago Faucet 1920-XJKNF pressure and temperature balanced mixing valve with 3.3 inch chrome plated metal handle, integral checks, screwdriver stops, temperature limit stop.
   4. Slide Bar Kit: 24 inch stainless steel slide bar.
   5. Hand Shower Hose and Holder: 2.5 gpm handspray with 69 inch stainless steel hose, in-line vacuum breaker, and pause control.

2.06 LAVATORY INSULATION KIT

A. Acceptable Manufacturers:
   1. Handi Lav Guard.
   2. Truebro.

B. Product Description: Where Lavatories are noted to be insulated for ADA compliance, furnish the following: Safety Covers conforming to ANSI A117.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

2.07 EMERGENCY EYEWASH AND SHOWER (ESS-1)

A. Acceptable Manufacturers:
   1. Speakman, model SE 695.
   2. Bradley Corp. model S19-310TT.
   3. Encon Safety Products, model 01050251.
   4. Haws Co., model 8320-8325.

B. Fixture:
   1. Drench Shower: ANSI Z358.1, floor mount with base drilled for anchoring, 1-1/4 inch IPS galvanized steel stanchion, 8 inch minimum diameter, 20-gpm plastic or stainless steel shower head, 1-inch stay open valve actuated by aluminum or stainless steel pull rod.
   2. Eyewash: ANSI Z358.1, plastic or stainless steel receptor bowl with dual spray heads with flip top dust caps, 1-1/4 inch galvanized steel frame and drain pipe. Corrosion resistant push handle attached to 1/2 inch full port stay open ball valve.
   3. Universal emergency sign.

2.08 HOSE BIBBS AND HYDRANTS

A. Refer to Section 22 11 00 Facility Water Distribution.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

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

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

B. Install fixture and rough-ins with A suffix at accessible height.

3.03 INSTALLATION

A. Install Work in accordance with Minnesota Plumbing Code.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide 17 gauge, chrome plated brass adjustable p-trap with cleanout on fixtures reducing traps. Traps for mop sinks shall be cast iron.

D. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

E. Provide water temperature limiting valve on lavatories. Set temperature to 110 degrees F.

F. Install components level and plumb.

G. Install and secure fixtures in place with wall supports, wall carriers, and bolts.

H. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 00, color to match fixture.

I. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

J. For ADA accessible water closets, install flush valve with handle to wide side of stall.

K. Refer to Architectural Drawings for fixture locations and mounting heights.

L. Emergency fixtures: Extend discharge piping to floor and terminate with elbow discharging towards nearest floor drain.

3.04 ADJUSTING

A. Section 01 70 00: Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A. Section 01 70 00: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.06 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative requirements for HVAC systems:
      a. Submittals.
      b. Quality Assurance.
      c. Delivery, storage and handling.
   2. Pipe and pipe fittings:
      a. Heating water piping.
      b. Core water (heat pump) piping.
      c. In-slab radiant heating pipe.
      d. Equipment drains.
   3. General duty valves.
   4. Pipe hangers and supports.
      a. Hanger rods.
      b. Inserts.
      c. Flashing.
      d. Sleeves.
      e. Formed steel channel.
      f. Equipment bases and supports.
   5. Pipe and equipment identification.
      a. Tags.
      b. Stencils.
      c. Pipe markers.
   6. Selective Demolition.

B. Related Sections:
   1. Section 01 07 00 - Product warranties and product bonds.
   2. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
   3. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
   4. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
   5. Section 07 90 00 - Joint Protection: Product requirements for sealant materials for placement by this section.
   6. Section 09 91 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
   7. Section 22 05 00 Common Work results for Plumbing: Administrative, and procedural requirements for plumbing piping, fixtures and equipment.
   8. Section 23 07 00 - HVAC Insulation: Insulation requirements related to sizing pipe hangers to encompass insulation.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. A13.1 - Scheme for the Identification of Piping Systems.

2. B16.3 - Malleable Iron Threaded Fittings.
3. B16.4 - Gray Iron Threaded Fittings.
4. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
5. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
6. B31.9 - Building Services Piping.

B. ASTM International (ASTM):
1. A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. A536 - Standard Specification for Ductile Iron Castings.
4. B88 - Standard Specification for Seamless Copper Water Tube.
5. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
6. E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
7. E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
8. E1966 - Standard Test Method for Fire-Resistive Joint Systems.
9. F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. American Welding Society (AWS):
1. A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. D1.1 - Structural Welding Code - Steel.

D. International Association of Plumbing and Mechanical Officials (IAPMO):
1. PS 117 - Copper, Copper Alloy, Carbon Steel, and Stainless-Steel Piping Systems with Press-Type or Nail-Type Connections

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
1. SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. SP 69 - Pipe Hangers and Supports - Selection and Application.
3. SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc. (UL):
1. 263 - Fire Tests of Building Construction and Materials.
2. 723 - Tests for Surface Burning Characteristics of Building Materials.
3. 1479 - Fire Tests of Through-Penetration Firestops.
4. 2079 - Tests for Fire Resistance of Building Joint Systems.
5. Fire Resistance Directory.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Section 01 33 00: Submittal procedures.

B. Product Data:
   1. Identify specific products to be used on the project.
   2. Submit data on pipe materials and fittings including project application.
   3. Submit data on general duty valves.
   4. Catalog data for equipment labels, valve tags and pipe identification.

C. Closeout Submittals:
   1. Submit copies of inspector acceptance of gas piping and mechanical work.
   2. Submit Operation and Maintenance manuals in accordance with closeout procedures.

D. Project Record Documents:
   1. Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems.

B. Use joint grooving tools and materials provided from a single manufacturer.

C. Furnish date stamped castings for couplings, fittings and valve bodies.

D. Perform Work in accordance with Minnesota State Building Code.

E. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.06 QUALIFICATIONS

A. Explanation of manufacturer listings for Part 2 of Division 23 Sections:
   1. Select equipment from the listed manufacturers where a list of manufacturers are listed under the heading "Manufacturers."
      a. Manufacturers not listed must submit for and be granted approval prior to the end of the bidding period for use on this Project.
      b. The list of manufacturers is provided as a convenience to the Contractor, indicating manufacturers that may be able to meet the indicated requirements.
      c. Being listed does not indicate the availability of any product or approval of a product not containing the indicated features.
   2. Use products meeting the indicated requirements where a list of manufacturers are listed under the heading "Acceptable Manufacturers."
      a. Approval to use products from manufacturers not listed is not a requirement.
      b. The list of manufacturers is provided as a convenience to the Contractor, indicating manufacturers that may be able to meet the indicated requirements.
      c. Being listed does not indicate the availability of any product or approval of a product not containing the indicated features.
   3. Use products meeting the indicated requirements where manufacturers are not listed for products.
      a. Approval to use products from manufacturers not listed is not a requirement.

B. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years experience.

C. Installer: Company specializing in performing work of this Section with minimum 3 years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Furnish temporary end caps and closures on pipes.

C. Provide temporary caps on fittings and valves removed from shipping containers and not immediately installed.

D. Protect piping from entry of foreign materials using temporary covers for idle sections of the Work.

1.08 WARRANTY

A. Warranty 12 months from date of substantial completion, unless longer warranty is specified for individual appliance, equipment, or material.

PART 2 PRODUCTS

2.01 EQUIPMENT DRAINS AND OVERFLOWS

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

B. Copper Tubing: ASTM B88, Type M, hard temper.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.02 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 ends.

2.03 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers:
   1. Anvil (Grinnell).
   2. B-Line - Coopers.
   3. Carpenter & Paterson Inc.
   4. Erico - Caddy System.
   5. PHD Manufacturing.

B. Pipe Hangers and Supports:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   10. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.04 DUCT HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.05 HANGER ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.06 INSERTS

A. Acceptable Manufacturers:
   1. Cooper B-Line.
   2. Hilti.
   3. Simpson Strong Tie Company.
   4. Unistrut Corp.

B. Inserts: Galvanized steel shell and expander plug with threaded connection and lateral adjustment. Top slot for reinforcing rods, lugs for attaching to forms. Size inserts to suit threaded hanger rod loading.

2.07 FLASHING

A. Metal Flashing: 26-gauge thick galvanized steel.

B. Metal Counterflashing: 22-gauge thick galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb./sq. ft sheet lead.
   2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gauge minimum; 16-gauge at fire resistant elements.

2.08 SLEEVES

A. Sleeves for pipes and ducts through non-fire rated floors: Schedule 10 steel pipe or 18-gauge galvanized steel sheet metal.

B. Sleeves for pipes or ducts through non-fire rated beams and masonry walls: Schedule 10 steel pipe or 18-gauge galvanized steel sheet metal.

C. Sleaves for pipes through non-fire rated gypsum wall board: 24-gauge galvanized sheet metal.

2.09 FORMED STEEL CHANNEL

A. Acceptable Manufacturers:
   1. Elcen.
   2. B-Line Systems.
   3. Hilti.
   4. Powerstrut, Inc.
   5. Unistrut Corp.
   6. Fee and Mason.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.10 VALVE TAGS

A. Metal Tags:
   1. Acceptable Manufacturers:
      a. W.H. Brady.
      b. Marketing Systems, Inc.
      c. MSI.
      d. Seton Identification Products.
   2. Aluminum with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

2.11 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Tape Pipe Markers:
   1. Acceptable Manufacturers:
      a. W.H. Brady.
      b. Marketing Systems, Inc.
      c. MSI.
      d. Seton Identification Products.
   2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Plastic Underground Pipe Markers:
   1. Acceptable Manufacturers:
      a. W.H. Brady.
      b. Marketing Systems, Inc.
      c. MSI.
      d. Seton Identification Products.
   2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.12 LABELS

A. Acceptable Manufacturers:
   1. W.H. Brady.
   2. Champion.
   3. MSI.
   4. Ready Made.
   5. Seton Identification Products.

B. Description: Laminated 3-layer rigid plastic with engraved black letters on light colored background. 1.9 inch by 0.75 inch minimum size, adhesive backed. Comply with ASME A13.1 standard for colors and locations.

C. Control Device Labels: Pressure sensitive machine printed labels, black print on white field.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00: Acceptance of existing conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

D. The contractor is responsible for verifying invert elevations with respect to building finished floor elevations and site provisions.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end pipe for welding.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges, grooved joint couplings, or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. Select hangers to surround insulation, shield and piping on insulated pipe.

F. Review equipment installation and operation manuals prior to installing equipment.

3.03 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. 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 slab.

3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME 31.9.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping or sheet lead packing between hanger or support and piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.05 INSTALLATION – DUCT HANGERS AND SUPPORTS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.06 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members, formed steel channel, or steel pipe and fittings. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.07 INSTALLATION - SLEEVES

A. Exterior Watertight Entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level; 2 inches for potentially wet floors. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing or firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.08 INSTALLATION - 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.

E. Slope piping and arrange systems to drain at low points.

F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

G. Install piping penetrating roofed areas to maintain integrity of roof assembly.

H. Install piping specialties in accordance with Section 23 21 16.

I. Provide sleeves for piping through footings, foundation walls and floors.

J. Provide shut-off valves:
   1. As required by Code.
   2. At branch lines serving more than one terminal device.
   3. With extended valve stems for insulated piping applications.
   4. With screwed connections for piping 2-1/2 inch and smaller.
   5. With flanged connections for piping 3 inch and larger.
   6. With hose end caps on low point drains.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Install unions downstream of valves and at equipment or apparatus connections.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Install grooved joints in accordance with the manufacturer's latest published installation instructions.
   1. Clean joint surfaces, rejecting defects such as indentations, projections, and roll marks in the area from pipe end to groove.
   2. Use elastomer grade gaskets suitable for the intended service, molded and produced by the coupling manufacturer.

3.09 INSTALLATION - HVAC EQUIPMENT

A. Follow manufacturer's published installation instructions.

3.10 HANGER SCHEDULE

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE MAXIMUM HANGER SPACING Feet	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	3/8	7	3/8
3/4	5	3/8	7	3/8
1	6	3/8	7	3/8
1-1/4	7	3/8	7	3/8
1-1/2	8	3/8	9	3/8
2	8	3/8	10	3/8
2-1/2	9	1/2	11	1/2
3	10	1/2	12	1/2
4	12	1/2	14	5/8
5	13	1/2	16	5/8
6	14	5/8	17	3/4
8	16	3/4	19	3/4

B. Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

3.11 VALVE IDENTIFICATION

A. Provide a typewritten list identifying numbered valves. Identification shall include valve number, service, location and area served.

B. Three copies shall be incorporated in maintenance manuals.

C. Post one framed copy under acrylic glazing in the mechanical room or other owner designated location.

3.12 PIPE IDENTIFICATION

A. Refer to Section 22 05 00 for additional pipe identification requirements.

B. Use pressure sensitive labels, pre-formed markers or stenciling.

C. Include labeling of service, direction of flow and tape bands at each end of labels with approved colors.

D. Provide pipe identification for exposed piping within the building and in accessible concealed spaces, such as above lay-in ceilings and at access panels. Minimum locations:
   1. At not more than 30 foot intervals on straight runs of pipes.
   2. Wherever a pipe turns 90 degrees.
   3. Wherever a pipe passes through a wall, on both sides.
   4. At other locations deemed necessary for ease of maintenance, e.g. access panels.

E. Piping that does not require identification:
   1. Below grade piping.
   2. Inaccessible piping concealed in chase walls.

F. Abbreviations: label the piping as follows:

1.	Condensate Drain	or	CD	
2.	Heating Water Supply	or	HWS	
3.	Heating Water Return	or	HWR	
4.	Condenser Supply Water	or		COND S
5.	Condenser Return Water	or		COND R
6.	Natural Gas	or	GAS	
7.	Refrigeration Liquid	or	REF. LIQ.	
8.	Refrigeration Suction	or	REF. SUC.	

3.13 EQUIPMENT IDENTIFICATION

A. Provide identification labels for scheduled equipment permanently affixed to equipment with mechanical fasteners (rivets, screws, bolts or other approved methods) in a prominent location.

B. Install labels level and drawn tight to the equipment surface. Provide backing or back-up plates where required by the fastening devices. On pumps and similar small equipment, the label may be located on the wall adjacent to the equipment.

C. Equipment labeling shall spell out the description of each piece of equipment (Water Heater #1, for example).

D. Control Device Labels: Install adhesive backed labels inside thermostat and sensor covers to indicate the controlled device. For potentiometers, locate label next to the adjustment knob.

3.14 FIELD QUALITY CONTROL

A. Section 01 40 00 and 01 70 00: Field inspecting, testing, adjusting, and balancing.

B. Provide hydronic radiant pipe manufacturer's representative sign-off that installation meets warranty requirements, prior to placing concrete slabs.

C. On-Site Training for grooved Couplings:
   1. Provide coupling manufacturer's representative to provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products.
   2. The representative is to periodically visit the jobsite and verify installers are following best recommended practices in grooved product installation.

D. Test heating water piping system in accordance with ASME B31.9.

3.15 CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash from site periodically and dispose off-site; do not burn or bury.

E. Refer to Section 01 70 00: Requirements for cleaning.

3.16 DEMONSTRATION AND TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain systems and components, including:
   1. Adjusting equipment modes.
   2. Step-by-step procedures associated with:
      a. Start up.
      b. Shut down.
      c. Day-to-day usage.
      d. Emergency shut down.
      e. Emergency and manual operations.
      f. Seasonal change over.
   3. Include a minimum of 8 hours dedicated instructor time on-site.
   4. Review data in maintenance manuals.
   5. Review service requirements and intervals.
   6. Schedule training with Owner, with seven days' advance notice.

END OF SECTION

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SECTION 23 05 93

HVAC TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Testing, adjusting, and balancing of air systems.
   2. Measurement of final operating condition of HVAC systems.

1.02 REFERENCES

A. Associated Air Balance Council (AABC):
   1. MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   1. 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. National Environmental Balancing Bureau (NEBB):
   1. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

D. Testing Adjusting and Balancing Bureau (TABB):
   1. International Standards for Environmental Systems Balance.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 for administrative procedures.

B. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda and sample report forms.

C. Prior to commencing Work, submit proof of latest calibration date of each instrument.

D. Test Reports: Indicate data on national organization approved forms.

E. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems.

F. Submit draft copies of report data for review prior to final acceptance of Project.

G. Furnish reports in bound, letter size manuals, complete with table of contents page and indexing tabs.

1.05 CLOSEOUT SUBMITTALS

A. Section 01 70 00: Closeout Procedures.

B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report for inclusion in operating and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with 1 of the following:
   1. AABC MN-1 National Standards for Field Measurement and Instrumentation.
   2. Total System Balance.
   3. NEBB Quality Assurance Program - Conformance Certification.
   4. TABB Quality Assurance Program for Environmental Systems Balance.

B. Verify and certify that measuring devices have been calibrated within the past 12 months.

1.07 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this Section with minimum 3-years experience certified by AABC, NEBB or TABB.

B. Perform Work under supervision of one of the following:
   1. AABC Certified Test and Balance Engineer.
   2. NEBB Certified Testing, Balancing, and Adjusting Supervisor.
   3. TABB Certified Professional.

1.08 INSTRUMENTATION

A. Provide instrumentation, such as pitot tubes, inclined gauge or U-tube manometers, magnehelic gages, velometer, direct reading hood, tachometer or rpm counter, insertion thermometers, clamp-on ammeter for motor voltage and ampere readings, and other instruments, required to completely analyze and balance the HVAC systems.

1.09 SEQUENCING

A. Section 01 10 00: Work sequence.

B. Sequence balancing between system installation and Date of Substantial Completion.

PART 2 PRODUCTS

2.01 BELTS AND DRIVES

A. Where factory furnished belts and drives cannot achieve design airflows, replace belts and drives to attain indicated performance.

B. Submit cost of replacement drives and labor to contractor responsible for furnishing the equipment for reimbursement.

2.02 FILTERS

A. Provide one set of clean filters for balancing.

B. Submit cost of replacement filters and labor to contractor responsible for furnishing the equipment for reimbursement.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 31 00: Coordination and Project conditions.

B. Review drawings to verify locations of balancing devices for proper balancing and accessibility.

C. Notify Architect/Engineer of component locations that will inhibit balancing and can be remedied with field modifications to balancing device locations.

D. Verify systems are complete and operable before commencing Work:
1. Piping and duct systems are flushed clean.
2. Systems are started and operating in safe and normal condition.
3. Temperature control systems are installed and operable.
4. Proper thermal overload protection is in place for electrical equipment.
5. Air filters and strainers are clean and in place.
6. Start-up strainers have been removed.
7. Fans and pumps are rotating correctly.
8. Fire and volume dampers are in place and open.
9. Valves are in operating position.
10. Air coil fins are cleaned and combed.
11. Access doors are closed and duct end caps are in place.
12. Air outlets are installed and connected.

3.02 PREPARATION

A. Furnish properly operating instruments required for testing, adjusting, and balancing operations.

3.03 INSTALLATION TOLERANCES

A. Air Handling Systems: With clean filters installed, adjust to plus 15 percent, minus 5 percent of scheduled airflow.

B. Exhaust Fans: Adjust to within plus 10 and minus 0 percent of design.

C. Air Outlets and Inlets: Adjust outlets and inlets to within plus or minus 10 percent of design.

D. Hydronic Systems: Adjust to plus or minus 10 percent of design flow.

E. Hydronic Terminal Units: Adjust to plus or minus 10 percent of design flow.

3.04 ADJUSTING

A. Refer to Section 01 70 00: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Report defects and deficiencies noted during performance of services, preventing system balance.

D. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

E. Under Direction of the Commissioning Authority, take measurements to verify balance has not been disrupted. If disrupted, balance to the satisfaction of the Commissioning Authority.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain indicated supply, return, and exhaust air quantities.

B. Measure and document airflow in main ducts by Pitot tube traverse.

C. Measure and document air quantities at air inlets and outlets.

D. Adjust distribution system to minimize objectionable drafts.

E. Use terminal volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Measure static air pressure conditions on air supply units, including fan, coil, heat wheel and filter pressure drops.

H. Adjust automatic damper stop positions to balance outside air, return air, and exhaust airflows.

I. Measure the amperes of fan and pump motors before adjusting and balancing. Throttle dampers or valves or reduce equipment speed to correct overload conditions.

J. Discontinue adjusting and balancing if hazardous or dangerous conditions are observed. Follow jobsite safety procedures.

K. Verify outlets for compliance with design requirements and report variations before starting the adjusting and balancing process.

L. At modulating damper locations, take measurements and balance damper end position through software settings or installation of a physical stop where actuator is designed to stall under normal operating conditions.

3.06 BALANCING STANDARDS

A. Instruments used for testing and balancing of air systems must have been calibrated within the past 12 months prior to balancing. Include a letter of certification listing instrumentation used and most recent date of calibration.

B. Include 1 plan review prior to start of construction and 1 on Site inspection during the construction, together with a report on recommended modifications and compliance with requirements of the Specification.

3.07 START-UP AND COMMISSIONING

A. Following Substantial Completion, return to the Site, for up to 4 balancing/ commissioning sessions.

B. Commissioning consists of demonstrating both air and water side systems to the extent required to verify proper operation of system components and controls.

C. Coordinate with automatic temperature controls contractor to make required adjustments.

3.08 SCHEDULES

A. Submit a schedule to the Architect for approval containing the information listed below in tabular form.

B. Equipment requiring Testing, Adjusting, and Balancing:
   1. Exhaust and transfer fans.
   2. Air inlets and outlets.
   3. Air coils.
   4. Air handling units.

C. Report Forms:
   1. Title Page
      a. Name, address, telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency.
      b. Project name, location, Architect, Engineer, Contractor and report date.
   2. Summary Comments
      a. Design versus final performance.
      b. Notable characteristics of system.
      c. Summary of outdoor and exhaust flows to indicate building pressurization.
      d. Nomenclature used throughout report.
      e. Test conditions.
   3. Balancing Instrument List
      a. Instrument; Manufacturer, model number, serial number, measurement range and calibration date.
   4. Electric Motors
      a. Manufacturer.
      b. Model/Frame.
      c. HP/BHP and kW.
      d. Phase, voltage, amperage; nameplate, actual, no load.
      e. RPM.
      f. Service factor.

g. Starter size, rating, heater elements.
h. Sheave Make/Size/Bore.

5. V-Belt Drive
   a. Identification/location.
   b. Required driven RPM.
   c. Driven sheave, diameter and RPM.
   d. Belt, size and quantity.
   e. Motor sheave diameter and RPM.
   f. Center to center distance, maximum, minimum, and actual.
6. Air Moving Equipment
   a. Location.
   b. Manufacturer.
   c. Model number.
   d. Serial number.
   e. Arrangement/Class/Discharge.
   f. Air flow, specified and actual.
   g. Return air flow, specified and actual.
   h. Sheave Make/Size/Bore.
   i. Number of Belts/Make/Size.
   j. Fan RPM.
7. Return Air/Outside Air Data
   a. Identification/location.
   b. Design air flow.
   c. Actual air flow.
   d. Design return air flow.
   e. Actual return air flow.
   f. Design outside air flow.
   g. Actual outside air flow.
   h. Design outside/return air ratio.
   i. Actual outside/return air ratio.
8. Exhaust Fan Data
   a. Location.
   b. Manufacturer.
   c. Model number.
   d. Serial number.
   e. Air flow, specified and actual.
   f. Total static pressure (total external), specified and actual.
   g. Inlet pressure.
   h. Discharge pressure.
   i. Sheave Make/Size/Bore.
   j. Number of Belts/Make/Size.
   k. Fan RPM.
9. Duct Traverse
   a. System zone/branch.
   b. Duct size.
   c. Area.
   d. Design velocity.
   e. Design air flow.
   f. Test velocity.
   g. Test air flow.
   h. Duct static pressure.

10. Air Distribution Test Sheet
    a. Air terminal number.
    b. Room number/location.
    c. Design air flow.
    d. Test (final) air flow.
    e. Percent of design air flow.

END OF SECTION

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SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes HVAC Insulation for equipment, piping and ductwork.

B. Related Sections:
   1. Section 23 05 00 - Common Work Results for HVAC:
      a. Hanger sizes for insulated pipes.
      b. Pipe identification.
      c. Extended valve stems for insulated valves.
      d. General material and installation requirements.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C165 - "Test Method for Measuring Compressive Properties of Thermal Insulations."
   2. C450 Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
   3. C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   4. C552 – Specification for Cellular Glass Thermal Insulation.
   5. C585 – Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   6. C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   7. E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   8. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   9. C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
   10. C533 - "Specification for Calcium Silicate Block and Pipe Thermal Insulation"
   11. C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   12. C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   13. C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   14. C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   15. C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
   16. C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   17. C1639 – Standard Specification for Fabrication of Cellular Glass Piping and Tubing Insulation.
   18. D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   19. E96 - Standard Test Methods for Water Vapor Transmission of Materials.

20. E2231 - Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics.

B. Sheet Metal and Air Conditioning Contractors (SMACNA):
   1. HVAC Duct Construction Standard - Metal and Flexible.

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

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

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Refer to Section 013300 for submittal procedures.

B. Product Data: Product description, thermal characteristics, ASTM standards compliance.
   1. List specific materials for each service, and location.

1.05 QUALITY ASSURANCE

A. Certify insulation for maximum flame spread index of 25 and maximum smoke developed index of 50 when tested in accordance with ASTM E84, UL-723, and NFPA 255.
   1. Follow mounting procedures of ASTM E2231.
   2. Provide accessories, such as adhesives, mastics, cement, tapes and glass cloth to retain the indicated index rating of the assembly.

B. Manufacture pipe insulation inner and outer diameters in accordance with ASTM C585.

C. Manufacture factory fabricated fitting covers in accordance with ASTM C450.

1.06 QUALIFICATIONS

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

B. Applicator: Company specializing in performing Work of this section with minimum 3 years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemicals, and damage by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   3. Johns Manville.
   4. Owens Corning.

B. Acceptable Manufacturers for Closed Cell Elastomeric Insulation Products:
   1. Aeroflex. Aerocell.
   2. Armacell, LLC. Armaflex.
   3. Nomaco; FlexTherm.

C. Acceptable Manufacturers for Insulation Saddles and Protection Shields:
   1. Anvil (Grinnell).
   2. B-Line - Coopers.
   3. Carpenter and Patterson.
   4. PHD Manufacturing.

D. Acceptable Manufacturers for Insulation Fitting Covers:
   1. Insulated Pipe Shields, LLC (Aluminum).
   2. Johns Manville (Zeston).
   3. Proto.
   4. Speedline.
   5. ITW Insulations Systems (Aluminum).

2.02 PIPE INSULATION

A. TYPE P-2: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
   1. Thermal Conductivity: 0.27 at 75 degrees F.
   2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.
   3. Refer to special insert requirements below.

2.03 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
   1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Fitting Covers:
   1. Rated 25/50 for flame spread and smoke developed, tested in accordance with ASTM E84.
   2. Match adjacent PVC jacket thickness where applicable, 20 mil minimum thickness.

3. 30 mil thickness for outdoor applications and indoor applications within 6 feet of the floor.
4. White.

C. Aluminum Fitting Covers:
1. Fabricated from 1100 aluminum alloy, two piece assembly.
2. 0.032-inch thickness, 2-1/2 inch size and larger.

D. PVC Plastic Pipe Jacket:
1. Material compounds in accordance with ASTM D1784. White.
2. 20 mil sheet material, 30 mil minimum thickness for outdoor applications.
3. Pressure sensitive color matching vinyl tape joints for hot systems.
4. Solvent weld seams for outdoor use and systems operating below ambient temperatures.

E. Aluminum jacket:
1. Type T-3003 H-14 sheet.
2. 0.016 inch minimum thickness, smooth or embossed pattern.
3. Secured with 1/2-inch wide 0.020-inch thick type 304 stainless steel bands.

2.04 INSULATION ACCESSORIES

A. Adhesives and mastic: Compatible with insulation and jacket materials.
1. Adhesive for cellular glass: Pittseal Cw.
2. Mastic for cellular glass: Pittcote 404 coating.

B. Vapor Retarder Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.

C. Piping 1-1/2 Inches Diameter and Smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.

2.05 SHEET METAL BLANK OFFS

A. Wall louvers:
1. Double wall anodized or galvanized sheet metal panels.
2. Insulated with 2 inch thick, 3-pound density glass fiber insulation.
3. Duct gage in accordance with SMACNA HVAC Duct Construction Standards for 1/2 inch pressure classification; no cross-breaking.
4. Surfaces visible through the louver: Painted or anodized black.

2.06 DUCTWORK INSULATION

A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied FSK jacket meeting ASTM C1136, Type II.
1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Maximum Operating Temperature: 250 degrees F.
3. Density: 0.75 pound per cubic foot.

B. Type D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied jacket meeting ASTM C1136, Type II:
   1. Thermal Conductivity: 0.24 at 75 degrees F.
   2. Density: 3.0 pound per cubic foot.

C. TYPE D-3: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
   1. Thermal Conductivity: 0.24 at 75 degrees F.
   2. Density: 1.5 pound per cubic foot.
   3. Maximum Operating Temperature: 250 degrees F.
   4. Maximum Air Velocity: 6,000 feet per minute.

2.07 DUCTWORK INSULATION JACKETS (FIELD APPLIED)

A. Aluminum Duct Jacket:
   1. ASTM B209.
   2. Thickness: 0.016 inch thick sheet.
   3. Finish: Smooth or diamond pattern.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Vapor Retarder AP Jacket:
   1. White kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Water Vapor Permeance: ASTM E96; 0.02 perms.
   3. Secure with pressure sensitive tape.

A. FLEXIBLE SELF-ADHESIVE CLADDING
   1. Manufacturers and trade names:
      a. Polyguard – Alumaguard.
      b. VentureClad - 1577CW.
   2. Description:
      a. Thickness: 5.5 to 6 mil.
      b. Density: 0.3 pounds per square foot.
      c. Water Vapor Permeability (ASTM E96): 0.00 perms.
      d. Puncture Resistance (ASTM D 1000): 35.4 pounds.
      e. Tear Strength (ASTM D 624): 8.5 pounds.

2.08 INSULATION SHIELDS, SADDLES AND INSERTS

A. Insulation protection shields at hangers:
   1. Galvanized steel, minimum length: 12 inches.
   2. MSS SP-69, Type 40.
   3. Thickness:
      a. 5.7 inch diameter and smaller: 18 gage galvanized steel.
      b. 5.7 inch to 11 inch diameter: 16 gage galvanized steel.
      c. Larger than 11 inch diameter: 14 gage galvanized steel.

B. Pipe Saddles for Pipes 4 inch and larger:
   1. Exposed and non-plenum locations: Wood insulation saddle, hard maple. Inserts length: not less than insulation shield length, matching thickness and contour of adjoining insulation.

2. Plenum locations and where roll hangers are used: Carbon steel saddle with glass fiber or calcium silicate insert shaped to match pipe and saddle contours.

C. Closed Cell Elastomeric Insulation Insert:
1. Polyurethane insert to fully surround pipe.
2. Thickness to match pipe insulation.
3. Tyco PUN series or Tyco KS series; or equivalent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordinate sleeved openings with pipe and duct installers prior to setting sleeves to ensure adequate openings for insulation through floor and wall penetrations.

B. Verify piping, equipment, and ductwork has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION - GLASS FIBER PIPE INSULATION AND JACKET

A. Pipe and cylindrical fittings:
1. Verify that insulation is correct size to snugly fit around specific piping.
2. Apply insulation to clean piping.
3. Apply mastic to piping to temporarily secure insulation to pipes when jacket is not permanently affixed to outside of insulation system.
4. Seal exposed ends of insulation with a full coat of mastic.

B. Fittings:
1. Apply pre-cut insulation to fittings to provide a snug fit.
2. Insulate other fittings with 3/4 lb. density fiberglass blanket compressed to the same thickness as adjacent pipe insulation.
   a. Secure fitting insulation with fiberglass tape or 18 gauge stainless steel wire.
   b. Finish with a smooth coat of mineral fiber cement.
   c. After the cement is dry, finish with 4 oz. canvas adhered with permanent adhesive.

C. Jacket and fitting covers:
1. Seal jackets and end laps with mastic applied to 2 surfaces or with self-sealing type lap system.
2. Secure fitting covers by stapling and taping the ends to the adjacent pipe insulation.
3. For piping systems required to have a vapor barrier, seal seam edges with vapor barrier adhesive and wrap ends with vapor barrier tape overlapping the adjacent jacket.

3.03 INSTALLATION – ELASTOMERIC FOAM

A. Pipe and Fittings:
1. Slip insulation over pipe before assembly.
2. Insulate fittings with matching insulation.
3. Insulate at hangers with polyurethane inserts.
4. Paint insulation exposed to weather with alkydchorinated - rubber paint.

3.04 INSTALLATION - PIPING

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of 1 hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than 1 hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Insulation jacket protection shields:
   1. Install galvanized steel shield between pipe hanger and insulation jacket.
   2. Piping Supported by Roller Type Pipe Hangers:
      a. Install galvanized steel shield between roller and inserts.

E. Saddles and Inserts For piping 3" and larger:
   1. Tack weld or otherwise secure saddle to bottom of piping.
   2. Install insert to completely fill the void between the pipe and the saddle.
      a. Insert Configuration: Thickness and contour matching pipe and interior of saddle.

F. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping.
   2. Miter joints at elbows for copper piping systems with sweat fittings.
   3. Seal seams and butt joints with manufacturer's recommended adhesive.
   4. When application requires multiple layers, apply with joints staggered.
   5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces less than 8 feet above finished floor: Finish with PVC jacket and fitting covers or aluminum jacket and aluminum fitting covers.

H. Aluminum jacket:
   1. Provide minimum 2-inch lap at longitudinal and tangential seams.
   2. Secure jacket with two metal bands per section.
   3. For systems requiring a vapor barrier, seal joints with vapor barrier mastic.

I. Refer to insulation schedule for applicable types and thicknesses.

3.05 INSTALLATION - DUCTWORK

A. Duct dimensions indicated on Drawings are free area dimensions.

B. Insulated ductwork conveying air below ambient temperature:
   1. Provide insulation with vapor retarder jackets.
   2. Finish with tape and vapor retarder jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire damper sleeves and flexible connections.

C. Insulated ductwork conveying air above ambient temperature:
   1. Provide with or without vapor retarder jacket, but provide insulation jacket.
   2. Insulate fittings and joints. Bevel and seal exposed ends of insulation.

D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 8 feet above finished floor): Finish with aluminum jacket.
   1. Jacket entire duct if bottom is within 8 feet of floor.

E. External Glass Fiber Duct Insulation:
   1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
   2. Secure insulation without vapor retarder with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
   5. Taper and seal insulation around access doors and damper operators to allow operation without interference.

F. External Elastomeric Duct Insulation:
   1. Adhere to clean oil-free surfaces with full coverage of adhesive.
   2. Seal seams and butt joints with manufacturer's recommended adhesive.
   3. When application requires multiple layers, apply with joints staggered.
   4. Insulate standing metal duct seams with insulation of like material and thickness as adjacent duct surface. Apply adhesive at joints with flat duct surfaces.
   5. Lift ductwork off trapeze hangers and insert spacers.

G. Insert high density spacers of equal thickness as insulation at trapeze hanger locations.

H. Prepare duct insulation for finish painting. Refer to Section 09 91 00.

I. Apply insulation in accordance with the manufacturer's published recommendations.

J. Exterior Duct Insulation (Rigid):
   1. Apply with edges tightly butted and impaled over welded pins and secured with clips. Place pins to hold insulation securely, but not over 18 inches on center. Seal joints with FSK tape.
   2. Apply roll type aluminum corner bead at corners. Apply canvas or glass fabric as finish over FSK embedding the fabric in a coat of adhesive. Apply a finish brush coat of adhesive over fabric.

K. Outside Air, Combustion Air and Exhaust Air Duct Insulation:
   1. Apply insulation to extend to and contact wall or roof deck.
      a. Secure insulation jacket to metal with pressure sensitive vapor barrier tape leaving no voids at edges.
   2. Seal butt joints with 3 inches wide joint sealing tape and seal corner joints with 4-inch wide tape. Seal pin clip locations with tape patches.

L. Exposed Air-Conditioned Supply and Return Duct Insulation:
   1. Apply insulation to supply and return air ducts exposed in non-air-conditioned mechanical rooms and unfinished spaces.
   2. Secure insulation to metal with welded pins and mechanical fasteners on not over 18-inch centers leaving no voids at edges. Seal butt joints with 3 inches wide joint sealing tape and seal corner joints with 4-inch wide tape. Seal over pin clips with tape patches.

M. Concealed Air-Conditioned Supply and Return Duct Insulation:
   1. Apply insulation to supply and return air ducts.
   2. Secure insulation to metal with strips of insulation adhesive leaving no voids at edges. Further secure the bottom side insulation on ducts over 24 inches wide with welded pins and mechanical fasteners on not over 18-inch centers. Lap joints 2 inches, seal with lap adhesive and staple 6 inches on center. Seal over staples and fasteners with matching tape patch.

3.06 PAINTING

A. Prepare duct insulation for finish painting. Refer to Section 09 91 00.

B. Prepare exposed, unfinished duct jacket, fittings, supports, and accessories ready for finish painting.
   1. Acrylic Finish: Two finish coats over a primer that is compatible with material and finish coat paint. Color: Final color as selected by Architect.

3.07 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches	JACKET REQUIREMENT
Condensate Piping from Cooling Coils	P-2	All sizes	0.5	None
Refrigerant Suction	P-2	3/4 inch and smaller	0.5	PVC (Exterior only)
Refrigerant Suction	P-2	1 inch and larger	1.0	PVC (Exterior only)

(VB) Requires vapor barrier jacket and sealed joints.

B. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION AND JACKET TYPE	INSULATION THICKNESS** (inches)
Outside Air Intake	D-2, FSK	2.0
Supply Air Ducts conveying air-conditioned air	D-2, FSK	1.0
Return Air Ducts (lined) conveying air-conditioned air	D-3	1.0
Return Air Ducts (lined) within 10 feet of air handler	D-3	1.0
Exhaust Air Ducts within 10 feet of exterior openings (concealed)	D-1, FSK	1.5*
Exhaust Air Ducts within 10 feet of exterior openings, exposed to view	D-2, FSK	1.5
Transfer Air Ducts (lined)	D-3	1.0
Ductwork routed outside building envelope	D-2, Self adhesive cladding	2.0

* Uncompressed thickness.
**R-value of interior lining can be used to offset required thickness of exterior duct insulation.

END OF SECTION

SECTION 23 08 00

COMMISSIONING FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. HVAC commissioning description.
2. HVAC contractor responsibilities related to commissioning.

B. Related Sections:
1. Section 23 05 00 – Common Work Results for HVAC: Administrative requirements.
2. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC: For requirements and procedures concerning testing, adjusting, and balancing of mechanical systems.
3. Section 23 09 00 - Instrumentation and Control for HVAC: Submittal and training requirements.
4. Section 23 09 93 - Sequences of Operation: sequences to be verified and tested by the commissioning authority.
5. Section 23 33 00 - Air Duct Accessories: Product requirements for ductwork test holes.

1.02 REFERENCES

A. Associated Air Balance Council (AABC):
1. AABC Commissioning Guideline.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
1. Guideline 1 - The HVAC Commissioning Process.

C. National Environmental Balancing Bureau (NEBB):
1. Procedural Standards for Building Systems Commissioning.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 COMMISSIONING DESCRIPTION

A. The HVAC Commissioning Authority will perform the following tasks:
1. Review submittals for constructability and conformance with the design intent.
2. Expand upon the manufacturers start-up checklists to include coordination items and work sequencing concerns.
3. Observe construction to confirm compliance with the requirements of the contract documents and the design intent.
4. Witness HVAC equipment startup.
5. Perform verification checks of systems and controls.
6. Create test procedures to verify functionality of controls and equipment and to confirm installation is in compliance with the design intent.
7. Witness HVAC equipment functional performance testing.

8. Witness testing and balancing work or confirm system balancing by spot-checking and TAB contractor demonstrations.

1.05 COMMISSIONING OBLIGATIONS OF THE INSTALLING CONTRACTOR

A. The installing contractor will perform the following tasks:
   1. Provide copies of HVAC equipment installation manuals to the Commissioning Authority with equipment submittals or at least prior to equipment installation.
   2. Provide copies of HVAC product specific start-up checklists to the Commissioning Authority with equipment submittals or at least prior to equipment installation.
   3. Demonstrate compliance with the requirements of the Contract Documents to the satisfaction of the Commissioning Authority.
   4. Perform equipment start-up and fill out the start-up checklists as developed by the Commissioning Authority.
   5. Demonstrate system operation and control sequences as directed by the Commissioning Authority to ensure compliance with Contract requirements.
   6. Perform HVAC equipment functional performance testing.
   7. Perform testing and balancing work and confirm system balancing by demonstrating balanced airflows as directed in spot-checking a sample of air inlets and outlets.
   8. Complete and endorse functional performance test checklists provided by Commissioning Authority to assure equipment and systems are fully operational and ready for functional performance testing.
   9. Provide equipment, materials, and labor necessary to correct deficiencies found during commissioning process to fulfill contract and warranty requirements.
   10. Provide operation and maintenance information and record drawings to Commissioning Authority for review verification and organization, prior to distribution.
   11. Provide assistance to Commissioning Authority to develop, edit, and document system operation descriptions.
   12. Provide training for systems specified in this Section with coordination by Commissioning Authority.

B. Equipment and Systems to Be Commissioned:
   1. Ductwork.
   2. Variable frequency drives.
   3. Gas-fired heaters.
   4. Air handling units.
   5. Split system air cooled condensing units.
   6. Fans.
   7. Testing, Adjusting and Balancing work.
   8. HVAC Controls, control software and operator interface.

1.06 COMMISSIONING SUBMITTALS

A. Section 01 91 00: Requirements for commissioning submittals.

B. Draft Forms: Submit draft of system verification forms and functional performance test checklist.

C. Test Reports: Indicate data on system verification form for each piece of equipment and system as specified.

D. Field Reports: Indicate deficiencies preventing completion of equipment or system verification checks equipment or system to achieve specified performance.

1.07 CLOSEOUT SUBMITTALS

A. Section 01 70 00: Requirements for submittals.

B. Project Record Documents: Record revisions to equipment and system documentation necessitated by commissioning.

C. Operation and Maintenance Data: Submit revisions to operation and maintenance manuals when necessary revisions are discovered during commissioning.

1.08 COMMISSIONING RESPONSIBILITIES

A. Equipment or System Installer Responsibilities:
   1. Attend commissioning meetings.
   2. Ensure temperature controls installer performs assigned commissioning responsibilities as specified below.
   3. Ensure testing, adjusting, and balancing agency performs assigned commissioning responsibilities as specified.
   4. Provide instructions and demonstrations for Owner's personnel.
   5. Ensure subcontractors perform assigned commissioning responsibilities.
   6. Ensure participation of equipment manufacturers in appropriate startup, testing, and training activities when required by individual equipment specifications.
   7. Develop startup and initial checkout plan using manufacturer's startup procedures and functional performance checklists for equipment and systems to be commissioned.
   8. During verification check and startup process, execute HVAC related portions of checklists for equipment and systems to be commissioned.
   9. Perform and document completed startup and system operational checkout procedures, providing copy to Commissioning Authority.
   10. Provide manufacturer's representatives to execute starting of equipment. Ensure representatives are available and present during agreed upon schedules and are in attendance for duration to complete tests, adjustments and problem-solving.
   11. Coordinate with equipment manufacturers to determine specific requirements to maintain validity of warranties.
   12. Provide personnel to assist Commissioning Authority during equipment or system verification checks and functional performance tests.
   13. Prior to functional performance tests, review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during tests.
   14. Prior to startup, inspect, check, and verify correct and complete installation of equipment and system components for verification checks included in commissioning plan. When deficient or incomplete work is discovered, ensure corrective action is taken and re-check until equipment or system is ready for startup.
   15. Provide factory supervised startup services for equipment and systems specified. Coordinate work with manufacturer and Commissioning Authority.
   16. Perform verification checks and startup on equipment and systems as specified.
   17. Assist Commissioning Authority in performing functional performance tests on equipment and systems as specified.
   18. Perform operation and maintenance training sessions scheduled by Commissioning Authority.
   19. Conduct HVAC system orientation and inspection.

B. Temperature Controls Installer Commissioning Responsibilities:
   1. Attend commissioning meetings.
   2. Review design for ability of systems to be controlled including the following:
      a. Confirm proper hardware requirements exists to perform functional performance testing.
      b. Confirm proper safeties and interlocks are included in design.
      c. Confirm proper sizing of system control valves and actuators and control valve operation will result capacity control identified in Contract Documents.
      d. Confirm proper sizing of system control dampers and actuators and damper operation will result in proper damper positioning.
      e. Confirm sensors selected are within device ranges.
      f. Review sequences of operation and obtain clarification from Architect/Engineer.
      g. Indicate delineation of control between packaged controls and building automation system, listing BAS monitor points and BAS adjustable control points.
      h. Provide written sequences of operation for packaged controlled equipment. Equipment manufacturers' stock sequences may be included, when accompanied by additional narrative to reflect Project conditions.
   3. Inspect, check, and confirm proper operation and performance of control hardware and software provided in other HVAC sections.
   4. Submit proposed procedures for performing automatic temperature control system point-to-point checks to Commissioning Authority and Architect/Engineer.
   5. Inspect check and confirm correct installation and operation of automatic temperature control system input and output device operation through point-to-point checks.
   6. Perform training sessions to instruct Owner's personnel in hardware operation, software operation, programming, and application in accordance with commissioning plan and requirements of Section 23 09 00.
   7. Demonstrate system performance and operation to Commissioning Authority during functional performance tests including each mode of operation.
   8. Provide control system technician to assist during Commissioning Authority verification check and functional performance testing.
   9. Provide control system technician to assist testing, adjusting, and balancing agency during performance of testing, adjusting, and balancing work.
   10. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

C. Testing, Adjusting, and Balancing Agency Commissioning Responsibilities:
   1. Attend commissioning meetings.
   2. Participate in verification of testing, adjusting, and balancing report for verification or diagnostic purposes. Repeat sample of 20 percent of measurements identified in testing, adjusting, and balancing specification and as selected by Commissioning Authority.
   3. Assist in performing operation and maintenance training sessions scheduled by Commissioning Authority.

1.09 COMMISSIONING MEETINGS

A. Attend initial commissioning meeting and progress commissioning meetings as required by Commissioning Authority.

1.10 SCHEDULING

A. Prepare schedule indicating anticipated start dates for the following:
   1. Piping system pressure testing.
   2. Piping system flushing and cleaning.
   3. Ductwork cleaning.
   4. Ductwork pressure testing.
   5. Equipment and system startups.
   6. Automatic temperature control system checkout.
   7. Testing, adjusting, and balancing.
   8. HVAC system orientation and inspections.
   9. Operation and maintenance manual submittals.
   10. Training sessions.

B. Schedule seasonal tests of equipment and systems during peak weather conditions to observe full-load performance.

C. Schedule occupancy sensitive tests of equipment and systems during conditions of both minimum and maximum occupancy or use.

1.11 COORDINATION

A. Notify Commissioning Authority minimum of four weeks in advance of the following:
   1. Scheduled equipment and system startups.
   2. Scheduled automatic temperature control system checkout.
   3. Scheduled start of testing, adjusting, and balancing work.

B. Coordinate programming of automatic temperature control system with construction and commissioning schedules.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install additional balancing dampers, balancing valves, access doors, test ports, and pressure and temperature taps required by Commissioning Authority.

B. Place HVAC systems and equipment into full operation and continue operation during each working day of commissioning.

C. Install replacement sheaves and belts to obtain system performance, as requested by Commissioning Authority.

D. Install test holes in ductwork and plenums as requested by Commissioning Authority for taking air measurements.

E. Prior to start of functional performance test, install replacement filters in equipment.

3.02 COMMISSIONING

A. Seasonal Sensitive Functional Performance Tests:
   1. Test heating equipment at winter design temperatures.
   2. Test cooling equipment at summer design temperatures.
   3. Participate in testing delayed beyond Final Completion to test performance at peak seasonal conditions.

B. Participate in initial and alternate peak season test of systems required to demonstrate performance.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Control Devices
      a. Control panel enclosures and controllers.
      b. Humidity sensors.
      c. Thermostats and temperature sensors.
      d. Electronic damper actuators.
      e. Duct Smoke Detectors.
   2. Device communication wiring.

B. Related Sections:
   1. Section 23 09 93 - Sequence of Operations for HVAC.
   2. Section 23 33 00 - Air Duct Accessories.
   3. Division 26- Electrical.

1.02 SYSTEM DESCRIPTION

A. The Contractor shall design and provide a complete, electrically supervised, non-coded, control system as indicated.

1.03 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   1. 62 - Ventilation for Acceptable Indoor Air Quality.

B. National Electrical Manufacturers Association (NEMA):
   1. DC 3 - Residential Controls - Electrical Wall Mounted Room Thermostats.
   2. 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. National Fire Protection Association (NFPA):
   1. 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.04 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.05 SUBMITTALS

A. Section 01 33 00: Submittal Procedures.

B. Shop Drawings:
   1. System configuration drawings showing controller connections to peripheral devices, unitary devices, sensors and switches.

2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Written sequence of operation. Coordinate submittals with information in Section 23 09 93.

C. Product Data: Submit description and engineering data for each control system component.
1. Environmental limits for storage and operation.
2. Operational (output) range.
3. Input requirements.
4. Power consumption and requirements.

D. Manufacturer's Installation Instructions: Submit installation requirements for each control component.

1.06 CLOSEOUT SUBMITTALS

A. Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.

B. Operation and Maintenance Data:
1. Refer to Section 01 78 23 Operation and Maintenance Manuals.
a. Model numbers and serial numbers of control devices.
b. Testing and diagnostic procedures for each type of control device.
c. Interconnection wiring diagrams with numbered system components and devices.
d. Approved shop drawings and product data.
e. Warranties.
2. Submit inspection period, cleaning methods, recommended cleaning materials.
3. Calibration records, calibration tolerances and adjustment procedures.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum of 5-years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum of 5 years' experience.

1.09 DELIVERY, STORAGE, AND HANDLING

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

B. Accept controls on site in original factory packaging Inspect for damage.

1.10 COORDINATION

A. Section 01 31 00: Requirements for coordination.

B. Coordinate location of thermostats, temperature sensors, humidity/dew point sensors, and other exposed control sensors with plans and room details before installation.

C. Coordinate supply of conditioned electrical circuits for control units.

1.11 WARRANTY

A. Section 01 78 36: Product Warranties.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of control system for 1 year from Date of Substantial Completion.

B. Perform work without removing units from service during building normal occupied hours.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
1. Alerton Technologies, Inc.
2. American Automatrix.
3. Andover Controls Corporation.
4. Belimo.
5. Delta Controls, Inc.
6. Honeywell.
7. Invensys.
8. Johnson Controls.
9. KMC.
10. Siemens.
11. Trane.
12. Veris Industries.

2.02 CONTROL PANELS

A. Local Control Panels: Unitized cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.
1. Fabricate panels of 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Panel-Mounted Equipment: Temperature and humidity controllers, relays, and automatic switches; except safety devices. Mount devices with adjustments accessible through front of panel.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gauges.

2.03 CONTROLLERS

A. Economizer controller; Basis of Design: Johnson Controls, model AD-DME400-0:
   1. Pre-programmed electric controller with modulating output signal for damper positioning.
      a. M9204, 12 pin stepper motor actuator control.
   2. Analog inputs for humidity/dew point sensors for outside air and return air.
   3. Analog inputs for temperature sensors for outside air, return air and discharge air.
   4. Potentiometers for setting:
      a. Discharge (supply) air temperature setting.
      b. Minimum ventilation position.
      c. Economizer lockout setting.
   5. Provide transformer for 24 VAC controller power requirements.

2.04 THERMOSTATS

A. Thermostat:
   1. Line voltage On/Off thermostats: bi-metal actuated contacts or bellows actuated snap switch, U.L. Listed, locking metal cover, and visible thermometer.
      a. Rated for current draw of controlled device.
      b. Adjustable.
   2. Low voltage with transformer: control range suitable for the specific application.
      a. Factory calibrated.
      b. Provide correct steps/stages to accomplish the specified sequences.

2.05 TEMPERATURE SENSORS

A. Thermistor temperature sensors as follows:
   1. Accuracy: Plus or minus 0.5 degree F at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   4. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
   5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
   6. Room Sensors: Match room thermostats, locking cover.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

B. Resistance Temperature Detectors: Platinum.
   1. Accuracy: Plus or minus 0.2 percent at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   4. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
   5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
   6. Room Sensors: Match room thermostats, locking cover.
   7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

2.06 ELECTRIC OPERATORS

A. Furnish operators for motor operated dampers not furnished under other Sections.

B. Operators shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or 2-position action as specified.

C. When so specified in the sequence of operation or where more than 2 actuators are to be operated in sequence to each other, provide position feedback positive positioners with adjustable start point and operating range.

2.07 DAMPER ACTUATORS

A. Manufacturers:
   1. Belimo.
   2. Honeywell.
   3. Johnson.
   4. Other manufacturers listed in Article 2.01 A.

B. Proportional, modulating or 2-position damper actuator, electronic, direct coupled type, U.L. Listed. Spring return or non-spring return as specified or required by the sequence of control. Non-spring return actuators have reversing switch and gear disengagement button on cover.

C. Electronically protected from overload at all angles of rotation.

D. Wherever possible, locate actuators out-of-the airstream.

E. Power: 10 VA at 24vac or 8W at 24vdc.
   1. Provide 120V transformers.

F. Torque: Size for minimum 150 percent of required duty.

G. Duty Cycle: rated for 60,000 full stroke cycles at rated torque.

H. Accessories:
   1. Damper linkage.
   2. Field selectable rotational, spring return direction, field adjustable zero and span.

2.08 DAMPER ACTUATORS (2 POSITION)

A. Two-position damper actuator, electronic, direct coupled type, U.L. Listed. Spring return or non-spring return as specified or required by the sequence of control. Non-spring return actuators have reversing switch and gear disengagement button on cover.

B. Electronically protected from overload at all angles of rotation.

C. Wherever possible, locate actuators out-of-the airstream.

D. Power: 120 VAC, 10 W. [10 VA at 24vac or 8W at 24vdc.].

E. Torque: Size for minimum 150 percent of required duty.

F. Duty Cycle: rated for 60,000 full stroke cycles at rated torque.

G. Accessories:
   1. Damper linkage.
   2. Field selectable rotational, spring return direction, field adjustable zero and span.

2.09 GAS DETECTION AND CONTROL PANEL:

A. General: Unitary gas detection and control system for CO and NOx. Panel, gas sensors/transmitters, horn, and strobe to be provided by single manufacturer.

B. Panel: Lockable metal cabinet. LED status display indication shall include: common warning, alarm, and system fault. Inputs to accept remote gas sensors. Outputs to operate fans/dampers. Control logic shall include time delay for warning (fan start). Power input 120V/60Hz.

C. Gas Sensor: Electro-chemical type, with life no less than 5 years CO and 2 years NOx.

D. Alarm: Horn and strobe with silencing button.

E. Test Kit: provide manufacturer's test and test gas to allow for start-up, commissioning, and scheduled calibrations during warranty period.

F. Basis of Design: Toxalert GVU

2.10 RELAYS AND SWITCHES

A. Furnish relays and switches required for the successful operation of the system. Include suitable indicating plates. Include positive positioning devices on operators where sequencing is specified.

2.11 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Perform wiring necessary for the temperature control system unless specifically indicated otherwise.

B. Provide conduit, electrical wiring and junction boxes in accordance with Division 26 and in accordance with conduit types and electrical classifications as shown on the Electrical Drawings.

C. Install HVAC control circuitry within its own conduit systems provided under this Section. Do not install HVAC control circuitry within conduit systems that are shown on the Electrical Drawings.

D. Electrical Characteristics: In accordance with Division 26.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 31 00: Coordination and project conditions.

B. Verify that conditioned power is available to control units.

C. Verify location of thermostats and humidistats and other exposed control sensors with Drawings before installation.

D. Verify building systems to be controlled are ready to operate.

3.02 INSTALLATION

A. Install thermostats, space temperature sensors, after locations are coordinated with other Work.

B. Install thermostats, 48 inches above floor. Align with light switches. Install room temperature and humidity sensors 60 inches above the floor. Align with light switches. Do not install temperature sensors directly above dimmers.

C. Mount thermostats located on cold walls on an insulated backplate. Seal penetrations through wall airtight.

D. Refer to Division 26 for installation of smoke and heat detectors.

E. Connect and configure equipment to achieve sequence of operation specified.

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Label visible sensors as to function and controlled device. Conceal labels behind device cover.

H. Install labels and nameplates to identify control components according to Section 23 05 00.

I. Install control panels adjacent to associated equipment on walls or freestanding supports. Install engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates for control panel on cabinet face. Label with equipment or system designation.

J. Install conduit and electrical wiring in accordance with Division 26.

3.03 FIELD QUALITY CONTROL

A. Provide commissioning report indicating that each point has been tested for proper wiring termination and functionality.

B. Testing and Adjusting:
   1. Test control functionality at the device and system levels prior to Owner training.
   2. Calibrate and adjust control settings to achieve stable output signals.

C. Replace damaged or malfunctioning controls.

3.04 DEMONSTRATION

A. Demonstrate room temperature and humidity sensor calibration to the satisfaction of the Engineer.

B. Demonstrate control sequences to the Owner and engineer.

3.05 TRAINING

A. Train Owner's maintenance personnel to adjust, operate, and maintain control systems and components, including:
   1. Adjusting equipment modes.
   2. Step-by-step procedures associated with function key commands and day-to-day usage.
   3. Include a minimum of 2 hours dedicated instructor time on-site.
   4. Review data in maintenance manuals.
   5. Schedule training with Owner, with seven days' advance notice.

3.06 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within 1 year of date of Substantial Completion, provide up to 2 Project site visits, when requested by Owner for the following:
   1. Adjust and calibrate components identified by the Owner as out of calibration.

3.07 EQUIPMENT

A. Provide insulated backplate where thermostats and temperature sensors are on exterior walls.

B. Seal thermostat subbase and sensor backs to prevent airflow from wall cavity to the space.

C. Furnish motor operated dampers that are not furnished with louvers, gravity vents and fans. Refer to those sections for dampers to be provided with equipment.

D. Label thermostats and sensors to identify controlled device and initial temperature setting.

3.08 SEQUENCE OF OPERATIONS

A. Refer to Section 23 09 93: Sequence of Operations.

END OF SECTION

SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Abbreviations used in this section.
2. Operational modes.
3. Adjustable variables and global settings.
4. Monitoring and trend logs.
5. Sequence of operation for:
   a. Automatic Control Valves.
   b. Automatic Control Dampers.
   c. HVAC Fans.
   d. Fuel Fired Heaters.
   e. Air Cooled Condensing Units.
   f. Air Handling Units.
   g. Duct Heating Coils.
   h. Unit Heaters.

B. Related Sections - Control equipment:
1. Section 23 09 00 - Instrumentation and Control for HVAC.

1.02 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 CONTROL SYSTEM DESCRIPTION

A. The Contractor shall design and provide a complete, electrically supervised, non-coded, control system as indicated.

1.04 DEFINITIONS

A. “Throttling range": used herein to establish a general responsiveness for P-I and PID control.
1. Tune the P-I and PID settings to respond similar to proportional control with the specified throttling range.

1.05 ABBREVIATIONS

A. For this Section, a number followed by an "F" means temperature in degrees Fahrenheit.

B. AHU - air handling unit (includes energy recovery units and roof mounted air conditioning units).

C. CO2 - carbon dioxide.

D. DAT - discharge air temperature (usually supply duct temperature).

E. LAT - leaving air temperature (usually after passing through heating or cooling coil).

F. MA/MAT - mixed air / mixed air temperature (leaving filter section).

G. NOx - oxides of nitrogen.

H. OA/OAT - outside (ambient) air / outside air temperature.

I. P-I - proportional and integral control algorithm, controls to setting with zero offset.

J. PID - proportional, integral and derivative control algorithm; controls to setting with zero offset including a response time component.

K. PPM - parts per million.

L. % rh - percent relative humidity.

M. RA/RAT - return air / return air temperature.

N. rh - relative humidity.

O. SA/SAT - supply air / supply air temperature.

P. VFD - Electronic motor speed controller, modulating output.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 CONTROL VALVE SEQUENCES

A. Gas Appliance Control Valves:
   1. Solenoid and modulating gas valves are controlled by the appliance they serve.

3.02 CONTROL DAMPER SEQUENCES

A. Control Dampers: 23 33 00 see HVAC FANS and FAN COIL control damper and associated equipment sequences.

3.03 HVAC FANS:

A. Maintenance Bay Exhaust Fans (EF-B1, EF-B2, EF-B3, EF-B4)
   1. See MAKEUP AIR UNIT sequences.

B. Toilet Exhaust Fan (EF-B5,)
   1. Manual wall switch starts/stops fan.

3.04 FAN COIL UNITS

A. Breakroom and Toilet (AHU-B1, CU-B1)
   1. Occupied Mode
      a. Fan runs continuously.
      b. Outside air damper opens to minimum position (25 percent as set by balancer). Position is reset by economizer cycle.
      c. Heating mode: Outside damper at minimum position, duct coil modulates to maintain space temperature.
         1) Maintain zone temperature by modulating through P-I control loop.
         2) Throttling range: 4 degrees; 100 percent at 2 degrees below setting.
      d. Economizer: outside damper modulates to maintain space temperature.
      e. Cooling: outside damper at minimum position, condenser activates unit when zone temperature exceeds zone temperature setting. Deactivates when zone temperature drops below zone temperature setting.
   2. Unoccupied Mode
      a. Fan cycles on call for heating or cooling.
      b. Heating/cooling/economizer function as described in Occupied Mode.
         1) Outside air damper is closed, except for economizer cycle.

3.05 MAKEUP AIR UNITS (MAU-B1, EF-B1, EF-B2, EF-B3, EF-B4)

A. Input: CO/NOx Gas Detector, Manual switch (On/Off/Auto)

B. Sequence:
   1. Normal (AUTO): Fan off, MAU off, dampers closed.
   2. Gas Detection (AUTO):
      a. EFs on, dampers open.
      b. MAU fan on, damper open, burner modulates to provide tempered air, discharge temperature 65 degrees F (adj). See 23 74 23 "Packaged Outdoor Heating Only Makeup-Air Units" for additional packaged controls.
   3. ON: see Gas Detection.

3.06 UNIT HEATERS.

A. Local t'stat cycles heater to maintain setpoint. Initial setpoint of 50 degrees F (adj) for spaces not normally occupied.

B. Packaged controls start/stop blower, operate gas valve, and provide safeties.

END OF SECTION

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SECTION 23 11 23

FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Natural gas piping above grade.
2. Unions and flanges.
3. Valves.
4. Pipe hangers and supports.
5. Natural gas pressure regulators.

B. Related Sections:
1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
2. Section 08 31 13 - Access Doors and Frames: Access doors for concealed valves and accessories.
3. Section 09 91 00 - Painting and Coating: Product requirements for painting for placement by this section.
4. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Piping materials for gas piping systems.
5. Section 23 05 23 - General-Duty Valves for HVAC Piping: Valves for gas piping systems.
6. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
7. Section 23 05 53 - Identification for Mechanical Piping and Equipment: Product requirements for valve and pipe identification for placement by this section.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
1. Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.

B. American Society of Mechanical Engineers (ASME):
1. B16.3 - Malleable Iron Threaded Fittings.
2. B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
4. B16.44 - Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems Up to 5 psig (sizes 1/2 - 2).
5. B31.9 - Building Services Piping.

C. ASTM International (ASTM):
1. A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

3. B88 - Standard Specification for Seamless Copper Water Tube.

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
   1. SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

E. National Fire Protection Association (NFPA):
   1. 54 - National Fuel Gas Code.

1.03 SYSTEM DESCRIPTION

A. Where more than 1 piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide pipe hangers and supports in accordance with ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89 and State of Minnesota Standards.

C. Use plug, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.04 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.05 SUBMITTALS

A. Section 01 33 00: Submittal procedures.

B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
   4. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
      a. Natural gas pressure regulators.

1.06 CLOSEOUT SUBMITTALS

A. See Section 01 70 00.

B. Project Record Documents: Record actual locations of valves, piping system, and system components.

C. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists, and exploded assembly views.

1.07 QUALITY ASSURANCE

A. Perform natural gas work in accordance with NFPA 54.

B. Perform Work in accordance with applicable code and local gas company requirements.

C. Perform Work in accordance with authority having jurisdiction for support attachments to building structure.

D. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

E. Perform Work in accordance with State of Wisconsin standard.

1.08 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this Section with minimum 3 years experience.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 60 00.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.10 ENVIRONMENTAL REQUIREMENTS

A. See Section 01 60 00.

B. Do not install underground piping when bedding is wet or frozen.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 COORDINATION

A. See Section 01 30 00.

1.13 WARRANTY

A. See Section 01 70 00.

B. Furnish 5-year manufacturer warranty for valves, excluding packing.

1.14 EXTRA MATERIALS

A. See Section 01 70 00.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Type E, Grade B, Schedule 40 black:
   1. Fittings: ASTM A234/A234M forged steel welding type.
   2. Joints: ASME B31.9, welded.
   3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10-mil polyethylene tape.

B. Polyethylene Pipe:
   1. Pipe: ASTM D 2513, SDR 11
   2. Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
   3. Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   4. Anodeless Service-Line Risers: Factory fabricated and leak tested.
   5. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
      a. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
      b. Aboveground Portion: PE transition fitting.
      c. Outlet shall be threaded or flanged or suitable for welded connection.
      d. Tracer wire connection.
      e. Ultraviolet shield.
      f. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Type E, Grade B, Schedule 40 black:
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
   2. Joints: Threaded for pipe 2 inches and smaller.
   3. Joints: Welded for pipe 2-1/2 inches and larger.
   4. Galvanized pipe not allowed.

2.03 REGULATOR VENT PIPING, ABOVE GRADE

A. Indoors: Sch. 40 steel pipe and fittings

B. Outdoors: PVC pipe, tubing, and fittings, UL 651.

2.04 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Galvanized Steel Piping: Screwed galvanized malleable iron ground joint union, brass iron seat.

2. Black Steel Piping: Class 150, screwed malleable black iron ground union, brass to iron seat.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Galvanized Steel Piping: Flanged, threaded, galvanized cast iron union, gasket and carbon steel bolts.
2. Black Steel Piping: Class 150, welded neck forged black steel or slip-on flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.05 BALL VALVES

A. Manufacturers:
1. Apollo.
2. Crane Valve, North America.
3. Hammond Valve.
4. Kitz.
5. Milwaukee Valve Company.
6. Nibco, Inc.
7. Stockham Valves & Fittings.
8. Watts.

B. Upstream of meter: Furnish shutoff valves complying with ASME B16.33.

C. Inside building: Furnish shutoff valves complying with ASME B16.44 or ANSI Z21.15.

2.06 PLUG VALVES

A. Manufacturers:
1. Flow Control Equipment, Inc.
2. Homestead Valve.
3. Milliken.

B. Upstream of meter: Furnish shutoff valves complying with ASME B16.33.

C. Inside building: Furnish shutoff valves complying with ASME B16.44 or ANSI Z21.15.

2.07 NATURAL GAS PRESSURE REGULATORS

A. Manufacturers:
1. Fischer.
2. Maxitrol.

B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body:
1. Comply with ANSI Z21.80.
2. Temperatures: Minus 20 degrees F to 150 degrees F.
3. Body: Steel casting.
4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.
5. Disk, diaphragm, and O-Ring: Nitrile.
6. Maximum Inlet Pressure: 150 psig.
7. Furnish sizes 2 inches and smaller with threaded ends.

2.08 FLEXIBLE APPLIANCE CONNECTORS

A. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.

B. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.

C. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.

D. Corrugated stainless-steel tubing with polymer coating.

E. Operating-Pressure Rating: 0.5 psig (14 inch wc).

F. End Fittings: Zinc-coated steel.

G. Threaded Ends: Comply with ASME B1.20.1.

H. Maximum Length: 72 inches.

2.09 HANGERS AND SUPPORTS

A. See Section 23 05 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. See Section 01 30 00.

B. Verify excavations are to required grade, dry, and not over-excavated.

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.

3.03 INSTALLATION - UNDERGROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54 and IFGC.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 23 00 "Excavation and Fill" for excavating, trenching, and backfilling.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:
   1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
   3. Replace pipe having damaged PE coating with new pipe.

3.04 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Refer to Section 23 05 00 for general pipe installation requirements.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Install gas pressure regulator with independent vent full size opening on regulator and terminate outdoors.

E. Install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.

F. Provide connection to new gas service. Make all arrangements with Gas Utility for installation of new gas meter and service to building. Gas service distribution piping to have initial minimum pressure of 2 psi. Provide regulators on each branch serving appliances designed for lower inlet pressures.

3.05 PAINTING

A. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

B. Refer to Section 09 91 00.

C. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint.
   1. Finish Coat Material: Exterior/Interior, flat, latex.
   2. Color: Final color as selected by Architect [interior Yellow interior, exterior Flat Black]. Vary first and second coats to allow visual inspection of the completed Work.

3.06 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00.

B. Where gas appliance will be damaged by test pressure, disconnect appliance and cap piping during pressure test. Reconnect appliance after pressure test and leak test connection.

C. Where gas appliance is designed for operating pressures equal to or greater than piping test pressure, provide gas valve to isolate appliance or equipment from gas test pressure.

D. Pressure test natural gas piping in accordance with NFPA 54.

E. Inspect, test, and purge gas piping in accordance with applicable codes, local gas company requirements, and State of Minnesota standards.

F. Where new branch piping is extended from existing system, pressure test new branch piping only. Leak test joint between new and existing piping with noncorrosive leak detection fluid or other approved method.

G. When pressure tests do not meet specified requirements, remove defective work, replace, and retest.

H. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.
   1. Where leakage is detected, shut off gas supply until necessary repairs are complete.

I. Do not place appliances in service until leak testing and repairs are complete.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Pipe hangers and supports.
4. Refrigerant specialties.

B. Related Sections:
1. Section 07 84 00 - Firestopping: Product requirements for firestopping for placement by this section.
2. Section 23 05 00 – Common Work Results for HVAC: Product and installation requirements:
   a. Administrative requirements.
   b. Pipe hangers and supports, sleeves and accessories for placement by this section.
   c. General piping installation requirements.
   d. Pipe labeling and identification requirements.
3. Section 23 05 00 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
4. Section 23 07 00 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
5. Section 23 62 00 - Packaged Compressor and Condenser Units: Connections to outdoor equipment.
6. Section 23 73 00 - Indoor Central Station Air Handling Units: Connections to indoor equipment.
7. Section 23 81 26 – Split-System Air-Conditioners: Connections to indoor and outdoor equipment.
8. Division 26 – Electrical: Execution requirements for electric connections specified by this section.

1.02 REFERENCES

A. Air-Conditioning, Heating & Refrigeration Institute (AHRI):
1. ANSI/AHRI Standard 495 – Standard for Performance Rating of Refrigerant Liquid Receivers.
2. ANSI/AHRI 710 – Performance Rating of Liquid-Line Driers.
3. 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
1. 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers (ASME):
1. B31.5 - Refrigeration Piping.

D. ASTM International (ASTM):
   1. B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

E. American Welding Society (AWS):
   1. A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. D1.1 - Structural Welding Code - Steel.

F. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:
   1. SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

G. Underwriters Laboratories Inc. (UL):
   1. 429 - Electrically Operated Valves.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide unions, or couplings at locations requiring servicing. Install unions or couplings downstream of valves and at equipment connections.

C. Provide pipe hangers and supports in accordance with ASME B31.5, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

D. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.05 SUBMITTALS

A. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Valves: manufacturers catalog data with valve data and ratings for each service.
   3. Refrigerant Specialties: Submit manufacturers catalog data including capacity, component sizes, rough-in requirements, and service sizes for the following:
      a. Refrigerant filter-driers.
      b. Refrigerant expansion valves.
      c. Electronic expansion valves.

B. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

1.06 CLOSEOUT SUBMITTALS

A. Section 01 77 00: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for replacing filter media.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.02 UNIONS, FLANGES, AND COUPLINGS

A. 2 inches and Smaller:
   1. Copper Pipe: Bronze, soldered joints.

2.03 PIPE HANGERS AND SUPPORTS

A. Refer to Section 22 05 00.

2.04 REFRIGERATION SPECIALTIES

A. Provide specialties associated with operational control and servicing of refrigeration circuits and systems.
   1. Filter-driers and service valves: as recommended by condensing unit manufacturer.
   2. Thermal expansion valves - selected for evaporator coil tonnage.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify pipe size with refrigeration equipment supplier.

B. Ream pipe and tube ends. Remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment with unions.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.02 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Install refrigeration piping as indicated on Drawings and specified in Section 23 05 00.
   1. Sleeve pipe passing through partitions, walls and floors.
   2. Install pipe identification.
   3. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
   4. Provide access where valves and fittings are not exposed.
   5. Install valves with stems upright or horizontal.

B. Install refrigerant piping in accordance with ASME B31.5.

C. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping.

D. Slope horizontal piping 0.40 percent in direction of flow.

E. Flood refrigerant piping system with nitrogen when brazing.

F. Insulate suction piping and equipment; refer to Section 23 07 00.

G. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

H. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

I. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

J. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

K. Provide electrical connection to solenoid valves. Refer to Division 26 for wiring requirements.

L. Fully charge completed system with refrigerant after testing.

M. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test refrigeration system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using electronic leak detector.

C. Repair leaks.

D. Retest until no leaks are detected.

END OF SECTION

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SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Duct Materials.
2. Insulated flexible ducts.
3. Single wall spiral round ducts.
4. Ductwork fabrication.
5. Hangers and Supports.

B. Related Sections:
1. Section 09 91 00 - Painting and Coating: Product requirements for painting for placement by this section.
2. Section 23 05 00 – Common Work Results for HVAC:
   a. Administrative procedures.
   b. Identification and labeling requirements.
3. Section 23 07 00 – HVAC Insulation: Duct insulation requirements.
4. Section 23 33 00 – Air Duct Accessories: Connections to ductwork and accessories.

1.02 REFERENCES

A. ASTM International (ASTM):
1. A276 - Standard Specification for Stainless Steel Bars and Shapes.
2. A480 - Specification for General Requirements for Flat-Rolled Stainless And Heat-Resisting Steel Plate, Sheet and Strip.
3. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
5. B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
6. D1784 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
7. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Underwriters Laboratories Inc. (UL):
1. 181 - Factory-Made Air Ducts and Connectors.
2. 723 - Tests for Surface Burning Characteristics of Building Materials.

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. HVAC Air Duct Leakage Test Manual.
2. HVAC Duct Construction Standards - Metal and Flexible; Third Edition – 2005.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 PERFORMANCE REQUIREMENTS

A. Duct configurations resulting in higher friction or increased sound level are not permitted.

B. Insulated flexible ducts: Flame spread/smoke developed ratings not exceeding 25/50 (UL 723) when tested in accordance with ASTM E84.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards – Metal and Flexible.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Store PVC materials in shaded areas, away from direct sunlight.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

PART 2 PRODUCTS

2.01 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M for extension of existing systems.

B. Type 321 or 316 Stainless steel. ASTM A276.

C. Aluminum: 3003 alloy H 14 temper in accordance with ASTM B209.

D. PVC:
   1. Acceptable Manufacturers: Harrison, Harvel, Mapco, U.S. Plastic Corp.
   2. Construction: ASTM D1784, Cell Class 12454-B; 0.172 inch minimum wall thickness.
   3. Fittings: Solvent welded, PVC.

E. Fasteners: Cadmium plated rivets, bolts, or sheet metal screws for new duct systems.

F. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.02 INSULATED FLEXIBLE DUCTS

A. Manufacturers:
   1. Flexmaster, Model Type 5M.

2. Thermaflex, Model M-KE.

B. Product Description: Polymer film supported by helical-wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
1. Rated as Class 1 Air Duct.
2. Pressure Rating: 4 inches w.g. positive and 0.5 inches w.g. negative.
3. Maximum Velocity: 4000 fpm.
4. Temperature Range: -20 degrees F to 175 degrees F.
5. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.03 SPIRAL DUCT

A. G-90 galvanized steel, SMACNA lock seam standard RL-1:
1. Size 3 inch through 12 inch: 26 gauge.
2. Size 14 inch through 24 inch: 24 gauge.
3. Size 26 inch through 42 inch: 22 gauge; Flange end reinforcing over 24 inch - Class A.
4. Sizes over 42 inch: 20 gauge with flange end reinforcing - Class C.

B. Lock formed spiral seams, rated for leakage class 3.

2.04 DUCTWORK FABRICATION

A. Fabricate and support ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Construct to 1.0 inch pressure classification unless otherwise indicated to use higher classification.

B. Construct T's, bends, and elbows with centerline radius equal to the duct width. Where not possible and where rectangular elbows are used, provide turning vanes.

C. Transition duct sizes gradually:
1. Divergence: not to exceed 15 degrees where possible; maximum 30 degrees.
2. Convergence: not to exceed 30 degrees where possible; maximum 45 degrees.

D. Provide 45-degree lateral wye takeoffs with balancing dampers. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections with balancing dampers.

E. Seal joints between duct sections and duct seams.
1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 30 00.

B. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION

A. Duct Sealing:
   1. Supply Air Ducts: Class B: Transverse and longitudinal joints, up to 3-inch water gauge.
      Exceptions: Exposed ductwork in conditioned area served by the duct. No sealing required.
   2. Return Ducts: No sealing required.
      Exceptions: Ducts located in unconditioned spaces such as attics. Class C.
   3. Outside Air Ducts: Class C: Transverse joints, up to 2-inch water gauge.
   4. Exhaust Ducts: Class C: Transverse joints, up to 2-inch water gauge.
   5. Combustion Air Ducts: Class B: No sealing required.

B. Pressure Classification: In accordance with SMACNA HVAC Construction Standards - Standard and Standard VAV construction requirements.

C. Provide manual balancing dampers at branch duct connections to the trunk duct and provide balancing dampers on trunk ducts serving a single inlet or outlet.

D. Protect installed ductwork from construction dust by installing temporary closures of metal or taped polyethylene on open ends of ductwork.

E. Wipe construction dust and debris from duct interior immediately prior to installation.

F. Install duct hangers and supports in accordance with Section 23 05 00.
   1. Cable supports are only acceptable were ductwork is concealed or in mechanical rooms.

G. Use double nuts and lock washers on threaded rod supports.

H. Connect flexible ducts to metal ducts with adhesive and draw bands.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Connect diffuser boots to low pressure ducts with 5 feet minimum length of flexible duct.

B. Connect air outlets and inlets directly to sheet metal ductwork.

C. Provide 2 inch wide flexible connectors at equipment inlets and outlets.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports. Do not use cable hangers unless approved by architect.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 INSTALLATION - SLEEVES

A. Set sleeves in position in forms. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through wet floors 1 inch above finished floor level. Caulk sleeves.

D. Where ductwork penetrates floor, ceiling, or wall, close off space between duct and adjacent work with stuffing or firestopping insulation and caulk airtight.

3.06 CLEANING

A. Refer to Section 01 70 00.

3.07 PAINTING

A. Paint visible portion of ductwork behind air outlets and inlets matte black.

B. Refer to Section 09 91 00.

C. Prepare exposed, unfinished duct, fittings, supports, and accessories ready for finish painting.
   1. Acrylic Finish: Two finish coats over a primer that is compatible with material and finish coat paint.
   2. Color: Final color as selected by Architect.

3.08 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply and Return	Steel, galvanized
Relief, Toilet Exhaust and Transfer	Steel, galvanized
Outside Air, General Exhaust	Steel, galvanized
Combustion Air	Steel, galvanized
Shower Exhaust	Aluminum

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Motorized dampers.
2. Back-draft dampers.
3. Duct access doors.
4. Volume control dampers.
5. Flexible duct connections.

B. Related Sections:
1. Section 23 09 00 – Instrumentation and Control for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.
2. Section 23 31 00 – HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.
3. Section 26 27 26 – Wiring Devices: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this Section.

1.02 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA):
1. 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International (ASTM):
1. E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association (NFPA):
1. 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
2. 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors (SMACNA):
1. HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc. (UL):
1. 555 - Standard for Safety for Fire Dampers.
2. 555C - Standard for Safety for Ceiling Dampers.
3. 555S - Standard for Safety for Smoke Dampers.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data: For fire dampers submit the following:
   1. UL ratings, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.

C. Manufacturer's Installation Instructions: Submit for Fire Dampers.

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

1.05 CLOSEOUT SUBMITTALS

A. Refer to Section 01 70 00.

B. Project Record Documents: Record actual locations of access doors.

C. Operation and Maintenance Data: Submit for motorized dampers and fire dampers.

1.06 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

1.07 QUALIFICATIONS

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

1.08 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 60 00.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.09 COORDINATION

A. Refer to Section 01 30 00.

B. Coordinate Work where appropriate with building control Work and fire alarm system installation.

PART 2 PRODUCTS

2.01 MOTORIZED DAMPERS

A. Manufacturers:
   1. Arrow.
   2. Cesco.
   3. Greenheck.
   4. Pottorff.
   5. Ruskin.
   6. Titus.
   7. United Enertech.
   8. Or approved equal.

B. Description:
   1. Frames: 6 inch wide 16 gauge.
   2. Blades: Maximum spacing 6 inches, 16 gauge, 48 inches maximum length.
   3. Linkage: 12 gauge plated steel brackets riveted to the blades with aluminum rod locked pivots.
   4. Bearings: Oilite bronze.
   5. Axles: Extendable from motor actuator attachment.
   6. Seals: Blade and jamb of polyurethane.
   7. Motors: Heavy duty 24 volt with spring return.
   8. Dampers shall be suitable for velocities up to 2000 FPM and Class 2 [Class 1], low leakage construction.
   9. Dampers shall be louver size, wall opening size, roof opening size or duct size as scheduled on Drawings.

C. Outside air/exhaust dampers to outside are to be Class 1 [Class 1A], low leak type: No more than 8 CFM/S.F. leakage at 4 inches w.c. static pressure, with operator exerting 6 inch - lbs. of torque.

D. Furnish and install Belimo, or approved equal, 24V electric actuators with spring return for each damper above of ample output for actuation and shut-off:
   1. Each damper shall be normally fully closed and shall fully open whenever associated fan is energized.

E. Power and control wiring shall be provided by Section 23 09 00.

2.02 BACKDRAFT DAMPERS

A. Manufacturers:
   1. Arrow.
   2. Cesco.
   3. Greenheck.
   4. Pottorff.
   5. Ruskin.
   6. Titus.
   7. United Enertech.
   8. Or approved equal.

B. Description:
   1. Multi-blade, parallel-action; start-to-open (STO) at 0.01 inch water gauge static pressure.
   2. Galvanized steel or extruded aluminum frame.
   3. Blades:
      a. Maximum 6 inch width.
      b. With felt or flexible vinyl sealed edges.
      c. Linked together in rattle-free manner with 90-degree stop.
      d. Steel ball bearings and axles.

C. Basis of Design:
   1. Greenheck WD-100 series for horizontal mounting under relief gravity hood.
   2. Greenheck WD-400 series for vertical mounting (STO at 0.026-inch w.g. pressure).

2.03 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

2.04 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Single Blade Dampers:
   1. Material: Same gauge as duct to 24 inches size in both dimensions, and 2 gauges heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
   4. Fabricate for duct sizes up to 6 inches by 30 inches.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 inches by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

D. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

E. Quadrants:
   1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches furnish regulator at both ends.

F. Remote Damper Operators:
   1. Cable Remote system designed for remote manual damper adjustment.
   2. Tubing: Aluminum.
   3. Cable: Stainless steel:
   4. Wall Mounting Box: Recessed.

5. Provide where finishes will prevent access to quadrants regulators.

2.05 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Metal-Edged Connectors: Flame-retardant or noncombustible fabrics. Comply with UL 181, Class 1. Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips galvanized sheet steel or aluminum sheets. Provide metal compatible with connected ducts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 30 00.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installations are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.02 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Install back-draft dampers on gravity relief hoods.

C. Access Doors: Install access doors at the following locations:
1. Before and after each duct mounted coil.
2. At each fire damper.
3. Before and after each automatic control damper.

D. Access Door Sizes: Install minimum 8 by 8 inch size for hand access, 18 by 18 inch size for shoulder access. Review locations prior to fabrication.
1. Mark access doors for fire dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE DAMPER.

3.03 DEMONSTRATION

A. Refer to Section 01 70 00.

END OF SECTION

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SECTION 23 34 00

HVAC FANS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Upblast centrifugal roof fans.
2. Cabinet fans

B. Related Sections:
1. Section 09 91 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
2. Section 23 00 00 – Common Work Results for HVAC.
3. Section 26 27 26 – Wiring Devices.

1.02 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA):
1. 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
2. 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

B. Underwriters Laboratories Inc. (UL):
1. 705 - Power Ventilators.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.

1.05 CLOSEOUT SUBMITTALS

A. Refer to Section 01 70 00.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this Section with minimum 3-years experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 60 00.

B. Protect motors, shafts, and bearings from weather and construction dust.

PART 2 PRODUCTS

2.01 UPBLAST CENTRIFUGAL ROOF FANS (PRV'S)

A. Manufacturers:
1. Loren Cook Company.
2. Penn Ventilator.
3. Acme Engineering and Manufacturing Corp.
4. Greenheck Corp.
5. Twin City Fan.

B. PRV: UL 705 listed, roof mounted, upblast fan.

C. Bolted and welded construction utilizing corrosion resistant fasteners.

D. Provide aluminum structural components constructed of 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

E. Motor: Permanently lubricated sealed ball bearings.

F. Provide NEMA 4X disconnect within PRV enclosure.

G. Furnish 14-inch insulated roof curb.

H. Damper (Greenheck Model VCD-23):
1. 5 inch by 1 inch, 16-gauge galvanized steel hat channel frame.
2. Galvanized steel axles.
3. 3V style 16-gauge galvanized steel blades with vinyl blade seals.
4. Synthetic (non-metallic) bearings.
5. 120 VAC, 60 Hertz, motor operated, two position; Power open and spring return to close.
6. Actuator and linkage located out of the airstream.

2.02 INLINE FANS

A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
   3. Companion Flanges: For inlet and outlet duct connections.
   4. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
   5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

F. Vibration Isolators:
   1. Type: Elastomeric hangers.
   2. Static Deflection: 1 inch (25 mm).

2.03 CABINET FANS (BATH FAN)

A. Housing: Steel, lined with acoustical insulation.

B. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

C. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

D. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

E. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
   3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
   4. Motion Sensor: Motion detector with adjustable shutoff timer.
   5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
   6. Filter: Washable aluminum to fit between fan and grille.
   7. Isolation: Rubber-in-shear vibration isolators.
   8. Manufacturer's standard roof jack or wall cap, and transition fittings. Finish color per Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof curbs are installed as instructed by manufacturer.

3.02 PREPARATION

A. Coordinate roof curb flashing and installation with Architect and Roofing Contractor.

B. Refer to drawings for curb installation detail.

3.03 INSTALLATION

A. Install dampers on inlet to roof exhaust fans.

B. Install motor operated dampers [within] below roof curb of roof exhaust fans.

3.04 DEMONSTRATION

A. Refer to Section 01 70 00.

B. Demonstrate fan operation and maintenance procedures.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Diffusers.
2. Registers
3. Grilles.
4. Wire Mesh Grille

B. Related Sections:
1. Section 09 91 00 - Painting.
2. Section 23 05 00 – Common Work Results for HVAC.
3. Section 23 09 00 – Instrumentation and Control for HVAC: Power to VAV diffusers.

1.02 REFERENCES

A. Air Movement and Control Association International, Inc. (AMCA):
1. 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
1. 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors (SMACNA):
1. HVAC Duct Construction Standard - Metal and Flexible.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and NC rating ant design flow.

C. Catalog data indicating scheduled performance.

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

1.05 QUALITY ASSURANCE

A. Air Outlets:
1. Outlets to be selected to provide throw and distribution required for their respective location without objectionable drafts.
2. Maximum pressure drop through outlet to be 0.10 inches of water.

3. Unless otherwise noted, outlets to be selected on the basis of maintaining a maximum sound level of NC 30.

B. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

1.06 QUALIFICATIONS

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

PART 2 PRODUCTS

2.01 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers:
1. Anemostat Air Products.
2. E. H Price Company.
3. Krueger.
4. Nailor Industries, Inc.
5. Titus.
6. Tuttle and Bailey.

B. Type: Square, stamped, diffuser to discharge air in 360-degree pattern with sector baffles where indicated.

C. Frame: Surface mount type. In plaster ceilings, furnish plaster frame and ceiling frame.

D. Fabrication: Aluminum with off white, baked enamel or powder coat finish.

E. Accessories: Radial opposed-blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.02 SUPPLY REGISTERS/GRILLES

A. Manufacturers:
1. Anemostat Air Products.
2. E.H. Price Company.
3. Krueger.
4. Nailor Industries, Inc.
5. Titus.
6. Tuttle and Bailey.

B. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with double deflection.

C. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D. Fabrication:
1. Steel with 20 gauge minimum frames and 22 gauge minimum blades, with off white factory baked enamel finish.
2. Provide aluminum registers and grilles for use in showers, laundry rooms and other damp areas. Off white factory baked enamel or powder coat finish.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face. Provide aluminum dampers where they are serving aluminum grilles.

2.03 TRANSFER AND RETURN REGISTERS/GRILLES

A. Manufacturers:
   1. Anemostat Air Products.
   2. E.H. Price Company.
   3. Krueger.
   4. Nailor Industries, Inc.
   5. Titus.
   6. Tuttle and Bailey.

B. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, horizontal face.

C. Frame: 1-1/4 inch margin with countersunk screw mounting.

D. Fabrication:
   1. Steel with 20 gauge minimum frames and 22 gauge minimum blades, with off white factory baked enamel finish.
   2. Provide aluminum registers and grilles for use in showers, laundry rooms and other damp areas. Off white factory baked enamel or powder coat finish.

2.04 WIRE MESH GRILLE

A. Fabricate grille with 2 by 2 mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 40 mm (1-1/2 inch) margin.

B. Use grilles where shown in unfinished areas such as mechanical rooms and maintenance area exhaust.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 30 00.

3.02 INSTALLATION

A. Paint visible portion of ductwork behind air outlets and inlets matte black.

B. Install diffusers to ductwork with airtight connection.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

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SECTION 23 62 00

PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Air Cooled Condensing Units.

B. Related Sections:
   1. Section 23 09 93 - Sequence of Operations for HVAC Controls: Start-stop sequences.
   2. Section 23 23 00 - Refrigeration Piping: Requirements for refrigerant piping connecting to equipment specified by this section.

1.02 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. Air-Conditioning and Refrigeration Institute:
   1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
   2. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
   2. ASHRAE 20 - Method of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
   3. ASHRAE 23 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units.
   4. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:
   1. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 DEFINITIONS

A. Coefficient of Performance (COP) - cooling: The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

B. Integrated Part-Load Value (IPLV): A single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment.

1.05 SUBMITTALS

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

B. Product Data: Submit rated capacities, weights, accessories, electrical nameplate data and wiring diagrams.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Field Reports: Submit start-up report indicating results of testing, dehydration, and starting of machine.

1.06 CLOSEOUT SUBMITTALS

A. Section 01 77 00 Contract Closeout: Closeout procedures.

B. Operation and Maintenance Data: Submit maintenance instructions, parts lists, description of controls and accessories.

1.07 QUALITY ASSURANCE

A. Performance Ratings: Coefficient of Performance (COP) and Integrated Part-Load Value (IPLV) not less than prescribed by ASHRAE 90.1.

B. Construction and Ratings: In accordance with ARI 210/240. Testing in accordance with ASHRAE 20.

C. Performance Ratings: Energy Efficiency Ratio (EER) not less than prescribed by ASHRAE 90.1 when tested in accordance with ARI 210/240.

1.08 WARRANTY

A. Section 01 77 00 - Contract Closeout: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for compressors.

PART 2 PRODUCTS

2.01 AIR COOLED CONDENSING UNITS

A. Manufacturers:
1. Aaon.
2. Carrier.
3. McQuay.
4. Trane.
5. York.

B. Description:
   1. Packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, refrigerant compressor(s), condensing coil(s) and fan(s), integral refrigerant piping, fan guards, mounting skids and controls. Provide discharge and liquid connection valves.
   2. House components in galvanized steel panels with weather resistant, baked enamel finish.
   3. Mount starters, disconnects, and controls in weatherproof panel with full opening access doors. Furnish mechanical interlock to disconnect power when door is opened.
   4. Furnish removable access doors or panels with quick fasteners.
   5. Label components including pipe stub outs, refrigeration system components and electrical and controls components.
   6. Provide laminated color-coded wiring diagram inside the control compartment door.

C. Construction:
   1. Unit shall be completely factory assembled, piped, wired and shipped in one section.
   2. Designed for outdoor application.
   3. Condenser coils: Mechanically protected from physical damage by painted galvanized steel louvers (wire grille) covering the full area of the coil.
   4. Access to condenser coils, condenser fans, compressors, and electrical and controls components: Hinged access doors with quarter turn, zinc cast, lockable handles.
   5. Paint finish: Capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
   6. Lockable hinged access doors provide access to the compressors.
   7. Include forklift slots in unit base.

D. Electrical:
   1. Provided with standard power block for connecting power to the unit.
   2. Control circuit transformer and wiring: Provides 24 VAC control voltage from the line voltage provided to the unit.
   3. Equip each compressor with a 5 minute off, delay timer to prevent compressor short cycling.

E. Refrigeration System:
   1. Compressors:
      a. Scroll type with thermal overload protection and crankcase heater.
      b. Mounted in an isolated service compartment which can be accessed without affecting unit operation.
      c. Isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators.
      d. Include a 10-100% variable capacity scroll compressor on the lead circuit.
         1) For Manufacturer's lacking this capability, provide hot gas bypass piping and controls to allow stable operating performance at low and part load conditions.
   2. Each refrigeration circuit:
      a. Equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low-pressure sides, and service valves for liquid and suction connections.
      b. Provide liquid line filter driers.
   3. Include a factory holding charge of R-410A refrigerant and oil.

F. Airside economizer limits system operation to outside temperatures above 50 degrees F.

PART 3 EXECUTION

3.01 UNIT INSTALLATION

A. Placement:
   1. Follow manufacturer's recommendations for rigging, protecting, lifting and placing condensing units when received on site.

B. Electrical: Locate wiring diagram for Division 26 contractor to follow for making connections.

C. Ground Mounted: Install ground mounted units on concrete pad at least 3-1/2 inches high and 6 inches wider than unit.

3.02 PIPING INSTALLATION

A. Install refrigerant suction piping from evaporator coil to compressor inlet.

B. Install compressor hot gas discharge piping to suction piping located at evaporator coil. Provide back-pressure regulator and modulating hot gas control valve to maintain stable refrigerant flow conditions.

C. Install liquid line between condenser coil and direct expansion evaporator coil. Provide liquid line solenoid valve and thermal expansion valve. Extend remote bulb sensor for TXV to suction piping and mount as recommended by condensing unit manufacturer. [Locate bulb upstream of hot gas connection].

D. Refrigerant piping:
   1. Finished field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line and insulated suction line.
      a. Provide insulated hot gas bypass line, valves and control for systems lacking variable speed compressor.

3.03 EQUIPMENT START-UP

A. Perform system checks in accordance with Commissioning Authority and manufacturer's published start-up procedures prior to start-up.

B. Charge piping system to capacity after refrigerant piping has been leak tested.

C. Operate system though various conditions to insure controls and safety features are functioning properly.

3.04 TRAINING

A. Provide Owner with 4 hours minimum factory training for the condensing unit:
   1. Include the following topics:
      a. Safety features and lockout controls.
      b. Normal operating conditions and limits.
      c. Start-up and shut-down procedures.
      d. Coil and other component cleaning.

e. Sight glass conditions and other indicators.

2. Obtain certification from Owners personnel that training has occurred.

3.05 PROJECT CLOSEOUT

A. Furnish Owner with Operation and Maintenance manuals describing system operation and contact information for installing Contractor.

B. Provide Owner with five year warranty for compressors.

END OF SECTION

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SECTION 23 74 23

PACKAGED, OUTDOOR, HEATING-ONLY MAKEUP AIR UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Direct-fired make-up air unit.
2. Integral controls.

B. Related Sections:
1. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation applying to units in this section.
2. Section 23 11 23 - Facility Natural-Gas Piping: Natural gas piping connections.
3. Section 23 33 00 - Air Duct Accessories: Flexible connections.
4. Division 26 - Electrical: Electrical connection to units.

1.02 REFERENCES

A. Air-Conditioning Heating, and Refrigeration Institute:
1. AHRI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
3. AHRI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

B. Air Movement and Control Association International, Inc.:
1. AMCA 210 – Laboratory Methods of Testing Fans for Ratings.
2. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
2. ASHRAE 62 - Ventilation for Acceptable Indoor Air Quality.
3. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASTM International:
1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

E. International Code Council, Inc.
1. ICC – International Fuel Gas Code (IFGC) - 2006 Edition.

F. National Fire Protection Association:
1. NFPA 54 - National Fuel Gas Code.
2. NFPA 58 - Liquefied Petroleum Gas Code.
3. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
4. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

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

B. Product Data:
   1. Airflow and Heating capacities.
   2. Dimensions.
   3. Weights.
   4. Rough-in connections and connection requirements.
   5. Duct connections.
   6. Electrical requirements with electrical characteristics and connection requirements.
   7. Controls.
   8. Accessories.

C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

D. Manufacturer’s Field Reports: Submit start-up report for each unit.

1.05 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of controls installed remotely from units.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.06 QUALITY ASSURANCE

A. Cooling Capacity: Rate in accordance with AHRI 210/240 or AHRI 340/360.

B. Sound Rating: In accordance with AHRI 270.

C. Insulation and adhesives: Meet requirements of NFPA 90A.

D. Outside Air Damper Leakage: Test in accordance with AMCA 500.

1.07 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years’ experience.

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Accept units on site. Inspect for damage.

1.09 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of roof curbs with roof structure, roof deck and roof membrane installation.

C. Coordinate wiring of controls with Division 26 Contractor.

PART 2 PRODUCTS

2.01 DIRECT FIRED MAKEUP AIR UNITS

A. Manufacturers:
1. AbolutAire.
2. Captive Aire.
3. Concepts and Designs, Inc.
4. Climate By Design, Inc. (CDI).
5. FloAire.
6. Greenheck.
7. Industrial Commercial Equipment.
8. Reznor.
9. Rupp.
10. The Trane Company.
11. Western ICE [not for MCES].

B. Product Description: Self-contained, packaged, factory assembled and wired, including:
1. Cabinet.
2. Supply fan.
3. Gas-fired heating section.
4. Air filters.
5. Controls.
6. Accessories.

C. Configuration:
1. Downflow or horizontal air delivery.
2. Indoor installation.

D. Roof Mounting Curb: 14 inch high, galvanized steel, channel frame with gaskets, nailer strips. Full perimeter type for mounting under entire unit.

E. Cabinet:
1. Designed for outdoor installation with weatherproof construction.
2. Panels: Constructed of G90 galvanized steel with baked enamel finish meeting salt spray test in accordance with ASTM B117.
3. Furnish gasket, hinged access doors.

4. Insulation: one inch thick aluminum foil faced glass fiber with edges protected from erosion.

F. Supply Fan:
1. Double width, double inlet, forward curved centrifugal type, high efficiency motor.
2. Motor permanently lubricated with built-in thermal overload protection.
3. V-belt drive with matched set belts, rated for 125 percent of motor horse power.
4. L-100,000 bearings.
5. Shaft design for maximum operations speed not to exceed 75 percent of its first critical speed.
6. Tested in accordance with AMCA 210.

G. Gas Burner:
1. Fuel: Natural gas.
2. Gas Burner: cast aluminum burner with pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device. Require unit fan operation before allowing gas valve to open.

H. Air Filters: 2 inch thick 25 to 30 percent efficiency based on ASHRAE 52.1.

I. Mixed Air Casing:
1. Outside Air Damper Leakage: Maximum 3.0 cfm per square foot at 1.0 inches wg pressure differential. Automatic, two position. Interlocked to open when supply fan starts. Furnish rain hood with screen.

J. Controls:
1. Furnish terminal strip on unit for connection of operating controls to remote panel.
2. Status Panel: Furnish remote panel containing the following status indications:
   a. Heating mode.
   b. Heating failure.
   c. Dirty filters.
3. Control and Status Panel: Furnish remote panel containing the following control and status indications:
   a. Heating mode.
   b. Heating failure.
   c. Dirty filters.
   d. Fan only operation.
   e. Remote thermostat temperature set point.

K. Accessories:
1. Convenience Outlet: Factory installed, 115-volt, 15 amp, GFCI type, internally mounted.
2. Roof Curb Adaptor Package: Furnish duct support hardware to adapt unit to existing roof curb.

L. Capacity: As indicated on Drawing Schedules.

2.02 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: As indicated on Drawing Schedules.

B. Disconnect Switch: As indicated on Drawing Schedules.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify roof curbs are installed and dimensions are as shown on shop drawings and instructed by manufacturer.

3.02 PREPARATION

A. Furnish roof curbs to Division 7 contractor for installation.

3.03 INSTALLATION

A. Roof Curb:
   1. Assemble roof curb.
   2. Install roof curb level.
   3. Coordinate curb installation and flashing with Division 7 requirements.
   4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
   5. Install gasket material between unit base and roof curb.

B. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.

C. Install components furnished loose for field mounting.

D. Install electrical devices furnished loose for field mounting.

E. Install control wiring between unit and field installed accessories.

3.04 INSTALLATION - NATURAL GAS HEATING SECTION

A. Connect natural gas piping in accordance with IFGC.

B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.

C. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 23.
   1. Shutoff valve.
   2. Dirt leg.
   3. Pressure regulator.

D. Install natural gas piping accessories above roof.

3.05 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Requirements for manufacturer's field services.

B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.06 CLEANING

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

B. Vacuum clean coils and inside of unit cabinet.

C. Install new throwaway filters in units at Substantial Completion.

3.07 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate unit operation and maintenance.

END OF SECTION

SECTION 23 82 39

UNIT HEATERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Gas fired unit heaters

B. Related Sections:
   1. Division 26 - Equipment Wiring Connections.

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute (ARI):
   1. 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors (SMACNA):
   1. - HVAC Duct Construction Standard - Metal and Flexible.

1.03 PRICE AND PAYMENT PROCEDURES

A. All Work and Costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.04 SUBMITTALS

A. Refer to Section 01 33 00.

B. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

1.05 CLOSEOUT SUBMITTALS

A. Refer to Section 01 70 00.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.06 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this Section with minimum 3-years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 60 00.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.01 GAS FIRED UNIT HEATERS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for [natural] [propane] gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Indoor, separated combustion, power vented.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
   1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
   2. Discharge Louvers: Independently adjustable, horizontal blades.

E. Accessories:
   1. Four-point suspension kit.
   2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
   3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

F. Heat Exchanger: Aluminized steel.

G. Burner Material: Aluminized steel with stainless-steel inserts.

H. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
   1. Gas Control Valve: Single stage.
   2. Ignition: Electronically controlled electric spark with flame sensor.
   3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
   4. Vent Flow Verification: Differential pressure switch to verify open vent.
   5. Control transformer.
   6. High Limit: Thermal switch or fuse to stop burner.

I. Wall-Mounted Thermostat:
   1. Single stage.
   2. Fan on-off-automatic switch.
   3. 24-V ac.
   4. 50 to 90 deg F (10 to 32 deg C) operating range.

J. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 30 00.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

E. Verify ductwork is ready for installation.

F. Verify concealed blocking and supports are in place and connections are correctly located.

3.02 INSTALLATION

A. General Requirements
   1. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.
   2. Protection: Install finished cabinet units with protective covers during remainder of construction.
   3. Unit Heaters: Hang from building structure, with pipe hangers anchored to building, not from piping. Mount as high as possible to maintain greatest headroom unless otherwise indicated.
   4. Cabinet Unit Heaters: Install at locations as indicated on Drawings. Coordinate to assure correct recess size for recessed units.

B. Fuel fired Unit Heaters
   1. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

2. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
3. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
4. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.
5. Vent Connections: Comply with Section 235123 - Gas Vents.
6. Ground equipment according to Division 26 - Grounding and Bonding for Electrical Systems.
7. Connect wiring according to Division 26 - Low-Voltage Electrical Power Conductors and Cables.

3.03 CLEANING

A. Refer to Section 01 70 00.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

D. Install new filters.

END OF SECTION

SECTION 26 05 05

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. References used in electrical and control Specifications.
2. Regulatory requirements for electrical construction.
3. Requirements of equipment and materials.
4. Workmanship.
5. Selective demolition.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item, **Site Electrical**.
2. Work described under the following Divisions shall be considered incidental to this item:
a. Division 26 – Electric

1.03 REFERENCES

A. ANSI - American National Standards Institute
1. C2 - National Electrical Safety Code.
2. C62.41-IEEE - Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. EPA-Environmental Protection Agency

C. ICEA - Insulated Cable Engineers Association
1. S-95-658 - Thermoplastic-Insulated Wire and Cable.
2. S-65-375 - Rubber-Insulated Wire and Cable.

D. IEEE - Institute of Electrical and Electronic Engineers
1. 112 - Standard Test Procedure for Polyphase Induction Motors and Generators.
2. 519 - Recommended Practices and Requirements for Harmonic Control In Electric Power Systems.

E. LPI - Lightning Protection Institute
1. LPI175 - Lightning Protection System Installation Standard.

F. DILHR- Wisconsin Department of Industry, Labor and Human Relations.

G. NECA - National Electrical Contractors Association
1. NECA 1 - Standard Practices for Good Workmanship In Electrical Contracting.

H. NEMA - National Electrical Manufacturers Association
1. TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

2. MG 1 - Motors and Generators.
3. PB 2 - Deadfront Distribution Switchboards.
4. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2,000 Volts AC or 750 Volts DC.
5. 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
6. WC 5 - (See ICEA S-95-658).
7. WC 7 - (See ICEA S-95-658).

I. NFPA - National Fire Protection Association
   1. NFPA 70 - National Electrical Code.

J. OSHA - Occupational Safety and Health Administration
   1. 29 CFR 1910 - Occupational Safety and Health Standards.

K. UL - Underwriters Laboratories, Inc.
   1. UL-6 - Rigid Metal Conduit.
   2. UL-83 - Thermoplastic - Insulated Wires and Cables.
   3. UL-96 - Lightning Protection Components.
   4. UL-360 - Liquid-Tight Flexible Steel Conduit.
   5. UL-467 - Electrical Grounding and Bonding Equipment.
   6. UL 486D - Insulated Wire Connector Systems for Underground Use or In Damp or Wet Locations.
   7. UL-508 - Industrial Control Equipment.
   8. UL-651 - Schedule 40 and 80 Rigid PVC Conduit.
   9. UL-797 - Electrical Metallic Tubing.
   10. UL-810 - Capacitors.
   11. UL-891 - Dead-Front Switchboards.
   12. UL-913 - Intrinsically Safe Apparatus and Associated Apparatus for Use In Class I, II, and III, Division 1, Hazardous (Classified) Locations.
   13. UL-935 - Fluorescent-Lamp Ballasts.
   14. UL-1008 - Transfer Switch Equipment.
   15. UL-1012 - Power Units Other Than Class 2.
   16. UL-1029 - High-Intensity-Discharge Lamp Ballasts.
   17. UL-1277 - Electrical Power and Control Tray Cables With Optional Optical Fiber Members.
   18. UL-1449 - Surge Protection Devices.
   19. UL-1479 - Fire Tests of Through-Penetration Firestops.
   20. UL-1572 - High Intensity Discharge Lighting Fixtures.

L. U.S. Department of Transportation - Federal Motor Carrier Safety Regulations.

1.04 REGULATORY REQUIREMENTS

A. All Work performed under this Contract shall conform to the latest editions of the National Electrical Code (NFPA70), the National Electrical Safety Code (ANSI C2), and The Wisconsin Administrative Code.

1.05 INSTRUCTIONS AND PARTS LITERATURE

A. Instruction and parts literature are generally packed with electrical equipment and devices. Contractor shall remove this literature from the packing container or equipment enclosure, identify the literature with the equipment to which it applies, and file the literature in loose-leaf binders with index tabs. Each binder shall have an index which lists

each piece of equipment and the literature which applies to it. An index tab shall be provided for each piece of equipment.

B. Contractor shall establish a procedure with the other trades for receiving, identifying, and filing literature for devices which are removed from their packaging and installed by other trades. Literature shall be provided as outlined above.

1.06 SUBMITTALS

A. Submittals for equipment provided by the Electrical Contractor shall bear a stamp or specific written certification from the Electrical Contractor, certifying the submittals have been reviewed.

B. Submit the following items consistent with Section 01 33 00. Refer to each Section under Division 26 for additional submittal requirements particular to that Section.

C. Shop Drawings and Manufacturer's Information:
   1. Product Data Sheets
      a. Product and component data sheets which describe all equipment and devices to be provided.
      b. Include all features specified.
      c. Provide dimensioned prints with weights.
      d. Highlight or otherwise accentuate on each data sheet the specified product features and product numbers.
   2. Composite Drawing
      a. Include power and control wiring for all systems and equipment.
      b. Show basic systems on composite drawing.
      c. Use terminal numbers on drawings and schematics.
      d. Use separate drawings to show details of sub-systems.
      e. Identify sub-system drawing interface points on composite drawing and sub-system drawings; terminal numbers of interface points shall be the same on both drawings.
      f. Revise or redraw manufacturer's standard drawings to meet above requirements.
   3. Record all Changes to Existing Systems
      a. Revise all wiring diagrams and schematic diagrams to show final installation:
         1) Includes all new and existing equipment diagrams.
   4. Programmable Systems
      a. Description of programmable system operation, including but not limited to input/output functions, control capabilities, configuration procedures, starting setpoints, etc.
      b. Preliminary graphic screens and reports.
         1) This submittal shall occur prior to shipment of the system.
   5. Manufacturers Installation Instructions
      a. Submit with shop drawings.
      b. Include with shipment.

D. Operating and Maintenance Manuals
   1. Include all the information provided with the shop drawings and manufacturer's information.
      a. Update and complete control system drawings and descriptions for all equipment.
      b. All documentation shall include modifications made which reflect the final installation.

2. Date the manuals with the day, month, and year they are provided to the Owner/Engineer.
3. Provide manufacturers' user manuals and installation instructions.
4. Provide 3 hard (paper) copies in a 3-ring binder. Provide a table of contents and each piece of equipment or sub-system shall be tabbed.
5. Provide 2 digital copies in a PDF format saved to a compact disk. The saved files shall be clearly identified and organized in a similar manner to the hard copies
   a. Data saved on the disks shall be accessible and neatly organized.
   b. Provide a table of contents which utilizes bookmarks. The bookmark shall take the reader to a specific page when the reader clicks on the desired title in the table of contents. A bookmark shall be provided for materials associated with each piece of equipment included in the O&M manual.
6. Record all Changes to Existing Systems
   a. Insert revised documents into the Owner's existing operation and maintenance manuals in place of original documents.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. All electrical and control equipment and materials shall be provided as specified in the Contract Documents.

B. All equipment and materials shall be new and shall bear the Underwriters Laboratories (UL) label if such products are listed by UL.

C. Where applicable, equipment and materials shall conform to ANSI, ICEA, IEEE, and NEMA Standards.

PART 3 EXECUTION

3.01 WORKMANSHIP

A. All Work shall be performed in a neat and workmanlike manner consistent with the high-quality standards of the electrical trade. "A neat and workmanlike manner" shall be as required by NFPA 70 and shall conform to NECA 1, Standard Practices for Good Workmanship in Electrical Contracting. Each electrician shall be knowledgeable and well-trained in the particular tasks to be performed.

3.02 EQUIPMENT MOUNTING

A. Unless noted otherwise, equipment which is not free-standing shall not be mounted on wood panels, but shall be attached to concrete or masonry walls, support channels, or building structural steel.

3.03 IDENTIFICATION

A. Nameplates shall be used to identify all field devices.

B. All nameplates shall be engraved phenolic nameplates attached with stainless steel screws or a permanent stamped brass tag.

3.04 RECEIVING AND STORING EQUIPMENT

A. All equipment shall be handled and stored in accordance with the manufacturer's instructions.

B. In general, equipment packaging is not designed to protect the contents for outdoor storage. As a minimum, Contractor shall store the equipment prior to installation in a clean, dry location free from excessive temperatures, humidity, or foreign materials normally encountered at a Site. If the storage facility is unheated, Contractor shall provide heating to protect equipment from condensation, which could cause components to corrode or to be otherwise damaged.

END OF SECTION

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SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. 600-volt wire and cable.
2. Variable frequency drive cable.
3. Specialty cable.
4. Ethernet cable.
5. PLC data highway cable.
6. Multi-conductor instrument cable.
7. Voice/data cable.
8. Retractable cords.
9. Terminals and connectors.
10. Direct burial cable.
11. Telephone terminal cabinets.
12. Installation.
13. Splices and terminations.
14. Identification.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the project and included in the Lump Sum Bid Item for the **Site Electrical**.

1.03 SUBMITTALS

A. Product data sheets shall be submitted for all wire and cable.

PART 2 PRODUCTS

2.01 600-VOLT WIRE AND CABLE

A. Feeder and Branch Circuit Wire
1. Stranded copper conductor, solid copper for lighting and convenience receptacle circuits only.
2. THWN insulated for conductor sizes #4 AWG and smaller.
3. XHHW or THWN insulation for conductor sizes #3 AWG and larger.

B. Control Wire
1. #14 AWG, 7 or 9 strand copper.
2. THWN or XHHW insulation.
3. Solid color.

C. Insulation of all wire shall conform to ICEA S-95-658, NFPA 70, and UL-83.

D. All Wire and Cable Shall Be
   1. New and coiled or on reels.
   2. Each coil and/or reel shall have a label with the manufacturer's name, trade name of wire, size of wire, and UL label.

E. Branch circuit wiring for lighting above suspended ceilings may utilize a modular wiring system with the following features:
   1. Metal-clad cable per NFPA 70 Article 330 with THWN or THHN insulated #12 AWG copper conductors, including a ground wire.
   2. Pin and socket contacts with positive latching of connections.
   3. Safety keying to prevent mismatching of components.
   4. UL listed.
   5. Dualite EZ-FLEX, Lithonia Reloc System 840, or approved equal.

2.02 SPECIALTY CABLE

A. Cable for the vehicle detection loops shall be #14 AWG stranded copper conductor with THHN 600-volt insulation in-sleeved in a continuous length of 0.31 inch thick PVC tubing; Sarasota "Electro-Loop Wire," or approved equal.

B. Fire Alarm System Cable
   1. 2-conductor #18 awg solid copper with 300-volt PVC insulation and overall PVC jacket which meets the requirements of NFPA 70 Article 760; Belden 9571, or as recommended by manufacturer.
   2. 2-conductor #14 awg solid copper with 300-volt PVC insulation and overall PVC jacket which meets the requirements of NFPA 70 Article 760; Belden 9580, or as recommended by manufacturer.

2.03 ETHERNET CABLE

A. Unshielded twisted pair, 4 pairs.

B. #24 AWG solid bare copper conductor.

C. Color coded fluorinated ethylene proplylene insulation.

D. ANSI/TIA/EIA-Category 5E.

E. Type CMP.

F. Hitachi Cable 39419-008, or equal.

2.04 MULTI-CONDUCTOR INSTRUMENT CABLE

A. 2-conductor, 3-conductor, or 4-conductor #16 shielded.

B. Stranded tinned copper conductors.

C. Polyethylene color-coded insulation.

D. Aluminum foil shield and drain wire.

E. Overall PVC or neoprene jacket which is resistant to oil, ozone, moisture, and sunlight.

F. General Cable Corp. VNTC Series, or equal.

G. Special instrument and signal cable shall be provided with the equipment which requires them.

2.05 TELEPHONE CABLE

A. For Interconnection Between Buildings
   1. Manufactured to RUS Specification PE-89.
   2. #22 AWG solid soft copper wires.
   3. Thermoplastic compound insulation color-coded per telephone industry standards.

B. Cable Assembly Shall Have
   1. The number of pairs shown on the Drawings.
   2. Twisted pairs with varying lengths of lay to minimize crosstalk.
   3. Interstices filled with a petrolatum-polyethylene compound.
   4. The complete assembly wrapped with a non-hygroscopic core tape.
   5. Shielding
      a. For underground duct applications, 0.005-inch copper tape applied longitudinally over the core tape with an overlap, corrugated to increase flexibility.
      b. For direct burial, 0.008-inch aluminum tape applied longitudinally over the core tape with an overlap, corrugated to increase flexibility.
   6. A high molecular weight polyethylene outer jacket which is highly resistant to abrasion, moisture, weather, and environmental cracking.
   7. Anixter Type PE-89, Belden Type PE-89, General Cable, or approved equal.

C. Cable for Individual Outlets Shall Be
   1. 4 or 6 conductor telephone station cable (as required by telephone system).
   2. #22 AWG solid annealed copper conductor.
   3. Color coded polyethylene insulation and PVC jacket.
   4. Alpha, Belden, or equal.

2.06 VOICE/DATA CABLE

A. Telephone and Network Cable shall be
   1. Unshielded twisted pair, 4 pairs.
   2. #24 AWG solid bare copper conductor.
   3. Color coded fluorinated ethylene proplylene insulation.
   4. ANSI/TIA/EIA-Category 5E.
   5. Type CMP.
   6. Hitachi Cable 39419-008, or equal.

2.07 COILING CORDS

A. 2 feet in length with 10 foot extended length.

B. #18 AWG stranded copper with color-coded rubber insulation.

C. Type SJO overall jacket, black neoprene.

D. Alpha 660/2, Belden 9476, or equal.

2.08 RETRACTABLE CORDED REELS

A. 40-foot retracting utility cord reel.

B. 14 AWG 3-conductor cable.

C. Rigid ceiling mount.

D. Provide a 15-amp receptacle at end of cord.

E. 11-amp rating at 125 volts.

F. UL recognized.

G. Steel housing with a yellow finish.

H. Automatic spring retraction.

I. Ratchet lock that can be disengaged for a constant tension.

J. External spring tension adjustment.

K. Adjustable ball stop on the cord. Verify with Owner ball stop location.

L. 18-inch primary cord length minimum with receptacle included.

M. Woodhead 943, or approved equal.

2.09 TERMINALS AND CONNECTORS

A. Tool compressed terminals and connectors shall be made of 1 piece seamless highly conductive copper with a uniform tin-plate coating to minimize corrosion; Burndy, 3M, or equal.

B. Step-down adapters shall be copper compression type; Greaves PT-R Series, or equal.

C. Electrical spring connectors shall be 3M “Scotchlok” or “Ranger,” Ideal “Wing-Nut,” or equal.

D. Fork Terminals
   1. Vinyl or nylon self-insulated locking type.
   2. Terminal insulation that supports wire insulation.
   3. Thomas & Betts Type FL, Burndy Type TP-LF, Panduit Type PNF, 3M Type MNG, or equal.

E. Electrical Tape:
   UL Listed.
   Weather resistant.
   Moisture resistant vinyl.
   Rated for the voltage system which it is applied.
   Temperature rating suitable for the application on which it is applied.

F. Motor Connection Kit:
   1. UL Listed.
   2. Qualified to ANSI standards.
   3. Rated to withstand 1000V.
   4. For use on in-line or stub motor lead splices.
   5. Resistant to abrasion.
   6. Installed per manufacturer's recommendations.

G. Waterproof kits shall be utilized for all outdoor below-grade splices and connections; Raychem Type CRSM, 3M 82-BF1, or approved equal.

H. Waterproof kits shall be utilized for all outdoor below-grade splices and connections as follows:
   1. Heavy wall, heat shrinkable with interior coating of hot melt adhesive – sealant. Tubing shall be chemically cross linked, thermally stabilized polyolefin.
   2. UL listed (UL-486D).
   3. Manufacturer: 3M – ITCSN, or equal.

2.10 WIRE COLOR CODING

A. Contractor may use color coding at his discretion, except for the following colors, which shall be used only as designated below for both power and control circuits
   1. Control Circuits
      a. Dark Blue - Direct current circuits.
      b. Light Blue - Intrinsically safe conductors.
      c. Green - Grounding conductor.
      d. White - Neutral conductor.
   2. Power Circuits (Use solid colors through Size No. 8 AWG. Use black conductors with tape color identification No. 6 AWG and larger)

	Voltage	120/240	208Y/120	480Y/277
a.	Phase A	Black	Black	Brown
b.	Phase B	Red	Red	Orange
c.	Phase C		Blue	Yellow
d.	Neutral	White	White	Gray
e.	Ground	Green	Green	Green

2.11 DIRECT BURIAL CABLE

A. 600-volt 3 conductor cable (2 #6, 1 #6G).

B. Conductors shall be class B stranded bare copper per ASTM B3 and B8.

C. Insulation shall be polyvinyl chloride (PVC), nylon armored per UL-83 for Type THHN/THWN.

D. Overall jacket shall be sunlight resistant polyvinyl chloride (PVC) per UL-1277.

E. Tested per UL requirements for Type TC cable having THWN or THHN conductors. Cables shall be listed for direct burial and meet the IEEE 383, UL-1277, and ICEA 210,000 BTU/HR Flame tests.

F. Temperature rating of 90 degrees C.

G. Anixter 3G-0603, or equal.

2.12 CONDUCTOR IDENTIFICATION

A. Imprinted labels
   1. UL Listed.
   2. Machine typed in blank ink.

B. Label Sleeves
   1. Non-burning.
   2. Heat-shrinkable.
   3. Clear.
   4. UL Listed.

C. Self-Laminating
   1. Vinyl.
   2. Wrap around.
   3. Acrylic adhesive.
   4. Water and Oil Resistant.
   5. UL Listed.
   6. Machine typed in blank ink.

D. Manufacturers: Brady, 3M, Raychem TMS or Thomas & Betts E-Z Code.

2.13 CONDUCTOR PULLING COMPOUND

A. Rated for use with the conductor insulation and conduit material.

B. Non-conductive.

C. Non-cementing.

D. Dry to a fine lubricating powder or a thin film which does not harden in conduit.

E. UL Listed.

F. Rated for repeated exposure to high heat or freezing temperatures.

PART 3 EXECUTION

3.01 INSTALLATION

A. All wire shall be installed in the specified raceways.

B. Wire pulling shall be performed through the system in such a manner as to not exceed the maximum tensile strength of the cable being pulled as allowed by the NFPA 70 and/or cable manufacturer. All handling and installation of wire and cables shall be done by competent and skilled workmen who shall use methods which will prevent damage to the wire and cable.

C. Pulling compound shall be approved by the cable manufacturer.

D. Adequate measures shall be employed to determine that the raceways are free of foreign material and moisture before pulling wire or cable.

E. Any conductor used for equipment grounding purposes shall be green in color, unless it is bare. Conductors with white or green covering shall not be used to indicate other than neutral or grounding. This limitation applies to all power and control circuits.

F. Conductors shall be without splice from termination to termination, unless indicated otherwise on the Drawings.

G. Conductors for ac and dc circuits shall be installed in separate conduits.

H. A minimum of 10 percent but not less than 4-spare conductors shall be provided in control circuit runs between control panels and from the motor control centers to control panels.

I. or each power operated overhead door wiring shall be provided from the leading-edge emergency stop mechanism back to the motor controller. A junction box shall be mounted halfway to the top of the door on the appropriate side. This shall be for the connection of the retractable cord, which is specified above.

3.02 SPLICES AND TERMINATIONS

A. All splices, taps, and terminations shall be made with tool compressed connectors. Contractor shall provide all wire connectors, lugs, and terminals, unless indicated otherwise.

B. Bolted compression lugs furnished as an integral part of the equipment shall be used to terminate the conductors to that equipment.

C. Motor leads shall be connected with tool-compressed ring terminals which are bolted together, insulated with varnished cambric tape, and protected with an over-wrap electrical tape, or protected with an approved motor connection kit.
Electrical spring connectors may be used to connect motor leads to #12 or #10 AWG branch circuit conductors.

D. Electrical spring connectors shall be used for splices and taps in lighting and 120-volt receptacle circuits.

E. All control wiring shall be terminated to terminal strips at both ends with fork terminals. Spare wires in control panels shall be terminated to spare terminals. Spare wires in motor control centers shall be coiled by respective conduit, labeled, and shall be long enough to reach the compartment furthest from conduit.

F. Every bolt, lug, and screw termination shall be tightened with a torque wrench or torque screwdriver to the torque values specified in UL Standards and/or as specified by the device manufacturer.

G. Terminal cabinets installed indoors shall have NEMA 12 enclosures.

3.03 IDENTIFICATION

A. Control circuits may be color-coded using available colors, except gray and green. They shall be identified at each terminal with a label. Imprinted labels shall be protected by a heat shrinkable sleeve.

B. Each control circuit shall be identified at both ends with the same number; wire number shall be the same as the wire number shown on the Equipment Drawings. Spare conductors shall be identified with a single letter at both ends.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Grounding Electrode System.

B. System and Equipment Grounding.

C. Installation.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for the **Site Electrical**.

PART 2 PRODUCTS

2.01 WIRE

A. Class B stranded copper; either bare or with green insulation.

B. Size shall be as specified herein and as indicated in the Contract Documents.

2.02 GROUND RODS

A. Grounding Electrode System:
1. 5/8 inch by 10-feet copperweld.

B. Luminare Concrete Bases:
1. 3/4 inch by 15-feet copperweld, unless noted otherwise.

2.03 WALL-MOUNTED GROUND BUSS BAR

A. Copper plate

B. Manufacturer predrilled holes, minimum of 16.

C. Wall mounting brackets with buss isolators.

D. Buss bar shall be approved by Owner's voice/data service provider(s). Contractor shall coordinate equipment with the service provider and provide quantity of holes and accessory equipment as required by the service provider.

E. Manufacturer: Hutton, Alltec, or equal.

2.04 CONNECTORS AND TERMINATORS

A. Tool-compressed connectors and lugs which are UL listed (UL-467).
   1. Manufacturer: Burndy “Hyground”, Thomas & Betts “Blackburn” Series, or equal.

B. Bar taps for connection to bus bars which are UL listed (UL-467).
   1. Manufacturer: Burndy, Thomas & Betts “Blackburn” Series, or equal.

C. Exothermic welding components.
   1. Manufacturer: Continental Industries “Thermoweld”, Erico Products “Cadweld,” or equal.

D. Ground clamps shall be UL listed (UL-E10661) cast high strength corrosion resistant copper alloy.
   1. Manufacturer: Burndy, Thomas & Betts “Blackburn” Series, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Power Company will provide grounding electrodes at the transformer and make the connections from the grounding electrode to the transformer neutral.

B. The Power Company's transformer neutral shall be connected to the service entrance switchboard ground bus with the grounded (neutral) conductors provided with the service entrance phase conductors.

C. Contractor shall provide a grounding electrode system as required per NFPA 70 and as indicated the Contract Documents.

D. The grounding bushings on conduits entering distribution equipment shall be connected to the ground bus in accordance with the requirements of NFPA 70.

E. Raceways provided for grounding electrode conductors shall be rigid nonmetallic.

F. An equipment grounding conductor shall be installed with each circuit, included but not limited to feeder circuits, motor circuits, lighting circuits, and control circuits. Conductor shall be connected to the equipment ground bus or to the enclosure if there is no ground bus.

G. Separately derived systems shall be grounded in accordance with NFPA 70.

3.02 SPECIAL REQUIREMENTS

A. Flow meters shall be grounded in accordance with the manufacturer's instructions.

B. Contractor shall determine if there are any other special grounding requirements for equipment furnished on this Project and shall provide grounding as recommended by the manufacturer.

3.03 SPLICES AND TERMINATIONS

A. In general, splices and terminations of the grounding electrode system shall be brazed, shall be exothermic welded, or shall be made with tool-compressed fittings.

B. Connections to bus bars or equipment enclosures shall be made with tool-compressed lugs which are bolted to the equipment or with bar taps.

C. Connections to ground rods shall be exothermic welded. Provide adapter sleeves as required for #6 AWG conductors or smaller.

D. Connections to copper water piping shall be made with ground clamps.

END OF SECTION

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SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Conduit.
2. Conduit fittings.
3. Underground warning tape.
4. Pull and junction boxes.
5. Fire stop material.

B. Related Sections
1. Section 07 84 00 – Firestopping.
2. Section 33 05 05 – Trenching and Backfilling.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the project and included in the Lump Sum Bid Item for the **Site Electrical**.

1.03 SUBMITTALS

A. Submit the following items consistent with Section 01 33 00:
1. Product data sheets for each type of conduit.
2. If the Contractor elects to use HPDE conduit, provide the manufacturer's recommend procedures, instructions, materials and equipment for splicing/coupling the conduit.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT

A. Steel
1. Galvanized inside and outside.
2. NFPA 70, Article 344.
3. UL Listed.

2.02 RIGID METAL CONDUIT FITTINGS

A. Threaded couplings and fittings only; no set screw, gland type, or split fittings.

B. Grounding type insulated bushings; O-Z/Gedney Type BLG, or equal.

C. Insulated bushings; Midwest Electrical Mfg. Co., O-Z/Gedney Type B, or equal.

D. Sealing locknuts; Midwest Electrical Mfg. Co., RACO, or equal.

E. Expansion Fittings
   1. 4-inches conduit movement.
   2. External bonding jumper.

F. Pull Fittings (C, LB, etc.): Clamp type, stamped covers with gaskets and stainless-steel screws and clamps.

G. Conduit Hubs
   1. Full contact type with sealing "O" ring.
   2. Myers "Scru-tite," or equal.

H. Material: Fittings, hubs, etc. shall be galvanized steel for galvanized steel conduit and copper free aluminum for aluminum conduit.

I. Corrosion Resistant Coatings:
   1. Pretreatment:
      a. Carboline Carbocrylilc 120 (for both steel and aluminum conduit), or equal.
   2. Coating:
      a. Carboline Bitumastic 300M.
      b. 3M Scotchrap Pipe Primer and wrapped with 3M Scotchrap Corrosion Protection Tape.

2.03 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. EPC-40-PVC and EPC-80-PVC.

B. Sunlight resistant.

C. NEMA TC2.

D. NFPA 70, Article 352.

E. UL Listed.

F. Manufacturer: Carlon, CertainTeed, or equal.

2.04 HIGH DENSITY POLYETHYLENE CONDUIT (HDPE)

A. Meets requirements of NFPA70.

B. Thermoplastic polymer material.

C. Smooth interior and smooth exterior wall.

D. UL listed.

E. NEMA –TC-7.

F. Manufacturer: Carlon or equal.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Galvanized exterior.

B. Corrosion resistant, lubricating interior coating.

C. Galvanized or Zinc Plated Finish Steel Fittings
   1. Set screw, concrete-tight type, except raintight/concrete-tight gland compression type in wet locations.
   2. Insulated throat connectors.
   3. Appleton, Midwest Electric, O-Z/Gedney, or equal.

D. NFPA 70, Article 358.

E. UL Listed.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Galvanized steel core.

B. Built-in continuous copper ground in 1/2 inch through 1-1/4 inches.

C. PVC jacket.

D. NFPA 70, Article 350.

E. UL listed.

F. Manufacturer: Amer-Tite Type UL, Anamet Anaconda Sealtite Type U.A., Electri-Flex Liquatite Type L.A., or equal.

G. Connectors
   1. Grounding ferrule and insulated throat.
   2. Manufacturer: Appleton STB, Crouse-Hinds LTB, Midwest Electric LTB, or equal.

H. Grounding liquid tight connectors:
   1. Grounding ferrule and insulated throat.
   2. Ground lug cast as integral part of iron gland nut.
   3. Manufacturer: Appleton, Efcor Brand, O-Z/Gedney, or equal.

2.07 FLEXIBLE METAL CONDUIT

A. Aluminum or galvanized steel.

B. NFPA 70, Article 348.

C. UL listed.

2.08 COPPER MC (METAL CLAD) CABLE

A. Cable shall be UL listed Type MC.

B. Suitable for operation at 600 volts.

C. Rated 90 degrees C.

D. Conductors shall be THWN Stranded.

E. Aluminum interlocked armor.

F. Insulated ground.

2.09 UNDERGROUND WARNING TAPE

A. 6 inches wide, 4-mil polyethylene film.

B. Vivid, opaque, long-lasting red color with bold, black letters.

C. Lettering
   1. Top line – "...CAUTION CAUTION CAUTION..."
   2. Bottom line – "...ELECTRIC LINE BURIED BELOW..."

D. Seton Name Plate Corp. No. 210 ELE, EMED Co. Stock No. UT27737-6, or equal.

2.10 PULL AND JUNCTION BOXES

A. Covers attached with hinges and stainless-steel screws located within 1/2 inch of each corner opposite the hinges and spaced not more than 12 inches apart.

B. Neoprene gasketed covers.

C. Sized per NFPA 70 with enough capacity to add to each side at least 2 conduits of the same size as the largest conduit entering the box.

D. Square cornered masonry type boxes, 2-1/2 inches minimum depth, shall be used for all flush switches and receptacles in glazed tile, face brick, and unfinished block walls.

E. Weatherproof die-cast aluminum boxes with threaded outlets for all surface mounted outlets; Bell (Raco), or approved equal.

F. Galvanized fittings and boxes for EMT conduit.

2.11 FIRE RETARDANT MATERIAL

A. Fire stop foam.

B. Fire stop sealant.

C. 3-hour fire rating.

D. UL Classified per UL-1479.

E. Chase Technology Corp., Dow Corning, General Electric, 3M, or equal.

2.12 DUCT SEALING COMPOUND

A. Soft, fibrous, slightly tacky, non-hardening, and easily applied by hand at all working temperatures.

B. Clean and non-staining.

C. J.M. Clipper Corp. Duxseal, O-Z/Gedney DUX, or equal.

2.13 CONDUIT CLAMPS

A. Conduit clamps for rigid metal conduit shall be malleable iron, 1-hole clamp with malleable iron clamp backs; Crouse-Hinds MW500 Series, Raco 1303/1324, Appleton CL75M/600M, or equal.

2.14 HANDHOLES

A. Precast concrete box and cover or fiber reinforced polyester box and polymer concrete cover.

B. Covers suitable for heavy traffic loading and with a minimum of 2 stainless steel bolts to secure them to the box.

C. Sized as Required Per Code, Minimum Size: 13 inches wide, 24 inches long, and 36 inches deep.

D. Molin Concrete Products, CDR Systems Corp., Quazite "Composite," or approved equal.

2.15 CABLE FITTINGS

A. Aluminum or stainless-steel threaded body and gland nut.

B. Neoprene bushing.

C. Stainless steel wire mesh grip.

D. Crouse-Hinds CGB with RPE wire mesh grip, Killems CG, or equal.

2.16 CONDUIT SEALS

A. Conduit seals shall be provided wherever conduits penetrate exterior concrete walls below grade, or cross hazardous location boundaries
   1. For conduits less than 60 inches below grade; OZ/Gedney Type FSK, or equal.
   2. For conduits more than 60 inches below grade; OZ/Gedney Type WSK, or equal.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION

A. Conduit size shall be as shown on the Drawings or as required by the NFPA 70 with a minimum size of 3/4 inch, except that 1/2 inch may be used to connect to devices which have a knock-out or fitting for only 1/2-inch conduit. All raceways shall be installed in

accordance with NECA 1, Standard Practices for Good Workmanship in Electrical Contracting, and as specified herein.

B. Pull boxes or fittings shall be installed as Site and pulling requirements dictate.

C. All raceways shall be EMT, except where noted otherwise
   1. All raceways shall be installed concealed in walls, below floor slabs, or above suspended ceilings where possible.
   2. Conduits in Maintenance bay, and the mech/elec room may be surface mounted and exposed.
   3. Conduit in the maintenance bay below 8 feet above the floor shall be considered to be subject to physical damage and shall be rigid metal conduit.

D. Conduits or groups of conduits shall run parallel to or perpendicular to building lines. Grouped conduits shall be supported at proper intervals with trapeze or bracket type hangers constructed of galvanized Unistrut, Power-Strut, or equal. All hangers, fasteners, nuts, etc. shall be galvanized steel or stainless steel. Support fasteners shall be preset inserts, beam clamps, expansion shields, or gun-driven studs.

E. Conduit and Penetration Sealing
   1. Any conduit run which goes through an exterior building wall or between rooms of more than 30 degrees F difference in temperature shall be sealed internally with duct sealing compound at the point where they leave the room.
   2. All penetrations thru fire rated walls shall be sealed according to NFPA 70, Article 300.21.

F. No raceways, fittings, outlets, junction boxes, or pull boxes shall be attached to grating; they shall be connected to supports which are attached to structural members.

G. All pull and outlet boxes shall be set plumb. Boxes for concealed wiring shall be flush with the finished surface. All boxes shall be UL listed for the location in which they are installed.

H. Expansion fittings shall be installed at building expansion joints and where the length of straight run requires it.

I. All conduits shall be kept dry and free of water or debris with pipe plugs or caps.

J. Conduit and boxes shall not be attached to or suspended from equipment or mechanical ductwork. Where box or conduit must be mounted below ductwork, provide a structural channel support which is suspended from the ceiling or bracketed from a wall. Attachments to equipment shall be directly to the electrical devices associated with it.

K. Conduit terminations to terminal boxes, cabinets, and enclosures shall have double locknuts and insulated bushings. External locknuts shall be sealing locknuts.

L. All conduits which enter major equipment, such as the service entrance switchboard and motor control centers, shall have grounding type insulating bushings.

M. Conduit terminations to outdoor or below ground NEMA 3R, 4, and 4X terminal boxes, pull boxes, cabinets, and enclosures shall use full contact hubs.

N. Liquidtight flexible metal conduit shall be used to connect from the rigid conduit system to equipment and devices if a rigid connection is improper or impractical.
   1. Liquidtight flexible metal conduit 1-1/2 inches and larger shall have an external bonding jumper sized in accordance with NFPA 70.
   2. Grounding liquidtight connectors may be used in lieu of the grounding clamp on the conduit.

O. Underground conduit runs shall have a minimum cover of 2 feet, and shall be rigid nonmetallic conduit, unless noted otherwise
   1. Conduit shall be sloped to drain to handholes or pull boxes.
   2. Rigid metal conduit shall be used for the vertical elbow and riser out of the ground.
   3. Rigid metal conduit installed underground or in contact with concrete shall have a corrosion resistant coating or covering.
   4. HPDE conduit may be used for underground conduit runs longer than 50 feet.

P. Contractor shall do all trenching for underground conduit with a minimum size trench. 3 inches of sand shall be placed below and above buried conduit in trench. All fill material shall be placed in 12-inch lifts and compacted to 90-Percent Standard Proctor Density. Underground warning tape shall be laid in the trench approximately 9 inches below the surface. Excavating, backfilling, and grading shall comply with Division 31.

Q. A nylon pull cord shall be installed in each empty conduit.

R. Only raceway types which are specified in this section shall be used.

S. The roadway, sidewalk, or grade beneath which conduit is routed shall be restored to its original or better condition.

T. Provide cable fittings and wire mesh grip for cable entry into conduit.

U. Cable tray shall be installed in accordance with manufacturer's instructions and applicable NEMA Load Classification.

V. Wireways shall be installed in accordance with manufacturer's instructions and NFPA 70, Article 386.

W. All spices performed on the HDPE conduit shall use equipment and procedures recommended by the manufacturer and which meet NFPA 70.

3.02 COPPER MC (METAL CLAD) CABLE

A. Copper MC (Metal Clad) Cable shall be allowed as follows:
   1. Fixture whips.
   2. Receptacle wiring in walls. All ceiling wiring shall be in a rigid conduit system.

3.03 OPENINGS

A. Contractor shall review the size and location of all openings to be sure they meet the requirements of the equipment that is furnished and/or installed as a part of this Contract. Contractor shall be responsible for providing all required openings necessary for a complete installation. All required openings are not shown on the Drawings.

B. All openings shall be filled with an approved sealant, caulking, or grout after the conduit or cable installation is complete.

3.04 HANDHOLE INSTALLATION

A. All handholes shall have a drain opening in bottom. Excavating for handholes shall be dug at least 24 inches deeper than the depth of the bottom of the handhole and the area below the handhole shall be filled with pea gravel.

B. Handhole covers shall be bolted in place when Work is complete.

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. All equipment checks, adjustments, tests, and system energization shall be performed as specified below. If any test specified will void the warranty of any equipment to be tested, the Engineer shall be notified and further instructions received before proceeding with the test.
   2. The following items shall be tested
      a. Grounding system resistance.
      b. Motors.
      c. Receptacle outlets.
      d. Control circuits and systems.
   3. When the Work is complete, a final inspection will be made and the Contractor shall demonstrate that all equipment and systems conform to the Drawings and Specifications.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 QUALIFICATION OF PERSONNEL

A. All personnel responsible for testing and commissioning equipment as a part of this Project shall be specially trained for the tasks they are to perform.

B. Personnel operating test equipment shall have had previous training and experience in using the equipment and shall be thoroughly familiar with the equipment capabilities and limitations.

C. All tests shall be made by or under the direct supervision of service personnel who are factory-trained in the application and operation of the device being tested.

D. Evidence of the experience of test personnel in the form of certificates of training or other acceptable documentation shall be made available upon request of the Engineer.

E. The Engineer reserves the right to require the Contractor to provide different test personnel if those performing the tests do not demonstrate competency in their work.

1.04 SCHEDULING AND REPORTING

A. All tests shall be scheduled 48 hours in advance with the Engineer and shall be conducted in his presence or the presence of his representative. Test results shall be tabulated neatly and legibly on the test forms, which are included at the end of this Section and which are

available from the Engineer. Any other report forms shall be submitted for approval at least 4 weeks before tests are made. Test reports shall include the pertinent readings or observations, a description of the method used, and a list of the equipment employed.

B. If the materials or equipment fail under test, the test reports shall include the following:
   1. Pertinent readings or observations made up to the point of failure.
   2. Any abnormal readings.
   3. Any data which might indicate the cause of failure.
   4. The cause of the failure, if determined.
   5. Corrective measures taken.

C. In all cases of test failure, the Contractor shall demonstrate that the corrective measures proposed are adequate before making any repairs, adjustments, or replacements.

D. 6 copies of all test reports shall be submitted to the Engineer within 24 hours after completion of the test. In addition, 1 complete set of test reports shall be included in each Operation and Maintenance Manual.

1.05 TESTING EQUIPMENT

A. Testing equipment used for a given test shall be recommended by the manufacturer for that particular test and shall be approved by the Engineer.

B. Insulation resistance tests shall be made with a line operated, 1,000-volt D.C. megohmmeter; James G. Biddle "Major Megger," Associated Research, Inc. "Meg-Check," or approved equal.

C. Ground resistance measurements shall be made with a 3 terminal, null balance instrument that has an accuracy of +/- 2 percent of full scale reading of selected range, and which provides direct reading down to 0.5 ohm; AEMC Model 3640, AVO (Megger) Catalog No. DET62D, or approved equal. Approved Alternates are the AEMC Model 3711 and the AMPROBE Catalog No. AMPDGC1000 clamp-on ground testers.

D. Voltage and current measurements shall be made with a true RMS instrument, which has an accuracy of ± 1 percent of full scale. Scale shall be selected so that the reading is not less than one-half scale.

E. All test equipment shall be provided by the Contractor.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSPECTION

A. All equipment shall be given a thorough visual inspection by the installer to detect insofar as possible any loose or erroneous connections, damaged components, the presence of foreign objects or materials, poor workmanship, incorrect rating of protective devices, or other abnormal conditions.

B. Every bolted or screwed connection or terminal with a torque rating shall have a torque wrench or torque screwdriver applied to assure tightness before any equipment is energized. This shall apply to both factory made an field made connections and terminations. Any problem or damage resulting from a faulty connection or termination shall be the responsibility of the Contractor.

C. Covers shall be installed on all pull boxes, junction boxes, and raceway fittings before the final inspection.

3.02 GROUND RESISTANCE MEASUREMENTS

A. The resistance of each ground rod shall be measured with a 3-terminal connection. Another measurement shall be made after all ground connections are made.

3.03 RECEPTACLE TESTS

A. After the system is energized, each receptacle shall be checked with a receptacle tester to verify proper connection of the hot, neutral, and grounding conductors.

3.04 COMMISSIONING

A. Contractor shall demonstrate to the satisfaction of the Engineer that all control and alarm systems are functioning as specified. This shall include but is not limited to motor control circuits, heating controls, and level alarms. Contractor shall make all adjustments necessary to obtain the proper operation of the above systems. This shall include but is not limited to adjusting limit switches and level controls; providing the necessary type and quantity of device, relay, and starter contacts; changing wire connections to device contacts; and calibrating signal devices.

END OF SECTION

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GROUND RESISTANCE TEST REPORT

GENERAL	Project:	Project Number:	Date:
	Contractor:	Inspector:	Tested By:
	Equipment Name:	Location:	
	Manufactured By:	Serial Number:	
	Auxiliary Device:	Manufacture Check:	
EQUIPMENT	Test Method _3-Terminal Connection	 _Other (Specify)	
	Potential Electrode Type: Distance:	Current Electrode Type: Distance:	
	Measured Resistance Ohms:		
TEST SET	Manufacturer:	Type:	
REMARKS	Acceptance Criteria (Spec. Standard)		

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SECTION 26 22 00

LOW VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Lighting transformers.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Site Electrical**.

1.03 SUBMITTALS

A. Provide product data sheets, complete descriptive materials, and dimensions.

PART 2 PRODUCTS

2.01 TRANSFORMERS

A. Indoor dry type for wall mounting.

B. 480 volts, 60 Hz, 3 phase or single-phase primary as required with a minimum of four 2-1/2 degree fully rated taps; 2 above and 2 below normal.

C. 208Y/120 volts, 3 phase, 4 wire or 120/240 volts, single phase, 3-wire secondary as noted on the Drawings.

D. KVA rating as shown on the Drawings.

E. 220 degrees C insulation system

F. Cutler-Hammer, General Electric, Square D, Sola/Hevi-Duty, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Transformers shall be installed where shown on the Drawings.

B. Contractor shall provide all supporting channel, fasteners, anchors, and connectors required for installation. All fasteners, anchors, and mounting hardware shall be galvanized steel. All supporting channels shall be aluminum or galvanized steel.

END OF SECTION

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SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Equipment Ratings.
2. Meter Socket.
3. Current Transformer Enclosure.
4. Installation.
5. Testing and Commissioning.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Site Electrical**.

1.03 SUBMITTALS

A. Drawings submitted for approval of the main switchboard and the service connection and metering cabinet shall include the following information as applicable to each piece of equipment:
1. Detailed top, front, and end views.
2. Outline dimensions, including weights.
3. Isometric or equivalent single line bussing diagram showing sizes, material, plating, and rating of phase, neutral, and ground buses.
4. Electrical line diagrams and schematics.
5. Metering and other wiring diagrams.
6. Component device and material lists.
7. Time-current curves for the circuit breakers and fuses.
8. Nameplate entries and schedules.
9. Features and accessories furnished to meet Specification requirements.
10. Cable access and exit areas, termination spaces, pull boxes.

B. Operation and Maintenance Manuals shall be provided for each component. These manuals shall include but shall not be limited to the following:
1. All shop drawing submittal information updated to show as-built conditions.
2. Outline dimension prints, including weights.
3. List of spares recommended for stock.
4. Description of the operation, proper maintenance, and repair of all components.
5. Local sources of service and supply.

PART 2 PRODUCTS

2.01 EQUIPMENT RATINGS (APPLICABLE TO ALL PRODUCTS SPECIFIED HEREIN, UNLESS NOTED OTHERWISE)

A. Voltage: 480Y/277 volt, 3 phase, 4 wire, 60 Hz.

B. Amperage: 200 Amp.

C. Fault Current Available: 42,000 amps, RMS symmetrical fault at rated voltage.

2.02 METER SOCKET

A. Power Company approved meter socket.

2.03 CURRENT TRANSFORMER ENCLOSURE

A. NEMA 3R enclosure constructed of 14-gauge steel.

B. Hinged door with hasp and meter seal provisions.

C. Dimensions which comply with NFPA 70 and Power Company requirements.

D. ANSI 61 gray polyester powder coating finish inside and outside over phosphatized surfaces.

E. Copper landing pads as required to mount Power Company's current transformers to terminate a single service entrance cable per phase and to terminate 3 cables per phase on the load side sized as shown on the Drawings.

F. Neutral bar for service entrance cables, grounding electrode conductor, and load cables.

G. American Midwest Power, Inc., Electro-Mechanical Industries, Inc., States Electric Mfg. Co., or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install service entrance equipment as shown on the Drawings.

B. The neutral leads from the service transformer shall be connected to the service entrance panel ground bus.

C. Coordination of Work with the Utility
1. Connections shall be made to the utility transformer.
2. Contractor responsible for all coordination with the utility with regard to the service connection. This shall include providing all forms to the Owner that is required by the utility for the service connection.
3. Provide and install all conduit, wiring, grounding, meters, panels, electrical devices, etc. not installed by the power company and required for a complete service.
4. Install items furnished but not installed by the utility.

3.02 TESTING AND COMMISSIONING

A. A factory-trained service engineer shall inspect all components of the switchboard after it is installed and shall make all necessary corrections and parameter programming before the equipment is tested. All equipment shall then be tested in the presence of the Engineer and all operations proved satisfactory.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Panelboards.
2. Installation.
3. Identification.

B. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Site Electrical**.

1.02 SUBMITTALS

A. Data sheets shall be submitted which describe the panelboards, give electrical ratings, give dimensions, and list the breakers.

PART 2 PRODUCTS

2.01 PANELBOARDS

A. Hardware
1. Surface or flush mounted as indicated on the Drawings.
2. Door in door front, complete with trim, doors, flush chrome plated cylinder lock, catch, and directory with clear plastic cover.
3. 2 keys.
4. Copper bus which includes all current carrying parts such as phase buses, ground and neutral buses/bars, bus fingers, etc.
5. All spaces indicated shall have bus fully extended and drilled for the future installation of breakers.
6. Gray baked enamel finish.
7. Trim attached directly to the box with screws; trim clamps shall not be used.

B. Ratings
1. Panelboard rating, main breaker, and branch breakers as specified on the Drawings. **Branch mounted main breakers shall not be allowed.**
2. Service entrance ratings as required.
3. Thermal-magnetic, quick make, quick-break, switching rated plug on circuit breakers.
4. Circuit breaker rating and number of poles as specified on the Drawings.
5. Multi-pole breakers with a common trip.
6. Handle padlock attachments where required.
7. Ampere Interrupting Ratings: 42,000 RMS symmetrical for 277 or 480 volt breakers, 22,000 RMS symmetrical for 240 volts or under.

C. Surge Protection Device (SPD)
   1. LED status indication of individual phases.
   2. Direct bus bar connection.
   3. Maximum continuous operating voltage shall be 115 percent of nominal system operating voltage.
   4. UL-1449 Suppressed Voltage Rating
      a. 800 volts for 480Y/277-volt panelboards.
      b. 400 volts for 208Y/120-volt panelboards.
   5. Protection modes shall be L-L, L-N, L-G, N-G.
   6. Minimum rated surge current capacity
      a. 160kA per phase, 80kA per mode for 480Y/277-volt panelboards.
      b. 80kA per phase, 40kA per mode for 208Y/120-volt panelboards.
   7. 10 year replacement warranty minimum.
   8. UL-1449, third edition.
   9. SPD shall be same manufacturer as panelboard.

D. Manufacturer: Cutler-Hammer, Square D, Siemens, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Panelboards shall be located where shown on the Drawings with the top approximately 6 feet above the floor. Box shall be set plumb. Breaker assemblies shall be set plumb and in continuous contact with the panel trim piece.

B. Panelboard schedule designations are as follows:
   1. Blank: Not intended for use.
   2. Space: Contains necessary bus and hardware for future addition of breakers.
   3. Spare: Contains a complete breaker installed, size as shown on schedule.

C. Provide Surge Protection Device integral to panelboard where noted on the schedules.

D. Provide HACR, GFCI and AFCI rated breakers which meet the requirements of NFPA 70 where noted on the panelboard schedules.

3.02 IDENTIFICATION

A. All panelboards shall be identified with laminated plastic name plates which have 1/2 inch high white letters on a black background. Nameplates shall be attached with screws.

B. Circuit directory shall be neatly machine typed with the number of the circuit, description of the circuit, the area served, and the size of the protective device.

3.03 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Switches.
2. Door switch.
3. Convenience receptacles.
4. Hazardous location receptacles.
5. Range receptacles.
6. Generator receptacles.
7. Welding receptacles.
8. Wall plates.
9. Outlet boxes.

1.02 PRICE AND PAYMENT PROEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Site Electrical**.

1.03 QUALITY

A. All wiring devices shall be products of the same manufacturer, unless specifically noted otherwise.

1.04 SUBMITTALS

A. Product data sheets shall be submitted for all materials specified herein.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES

A. Switches:
1. Heavy-duty, specification grade.
2. Quiet, toggle type.
3. Side and back wired.
4. Rated 20 amperes under all loads, 1 HP at 120 volts, 2 HP at 240 volts.
5. Ivory color.
6. Single-pole, 2-pole, 3-way and/or 4-way as shown on the Drawings.
7. Manufacturer: Eagle 2221 Series, General Electric GE 5930 Series, Hubbell 1220 Series, Leviton 1200 Series, Pass & Seymour 20 AC Series, or equal.

B. Occupancy Sensors
1. Combination light level, infrared and ultrasonic.

2. Combination of infrared and ultrasonic shall turn lights on and either technology shall hold the lights on.
3. 30 second to 15-minute adjustable time delay to turn off lights.
4. Dense, wide angle coverage pattern.
5. UL listed, 120-volt power pack with 24 VDC secondary and isolated 15-amp dry contact output. Watt Stopper, or equal.
6. 120 volt, 15-amp slave pack for light level output.
7. Complete with all mounting hardware.
8. Single-pole, 2-pole, 3-way and/or 4-way as shown on the Drawings.
9. Manufacturer: Watt Stopper, Sensor Switch, or equal.

C. Weatherproof Motion Sensor
1. Light level selector to adjust activation.
2. Utilize passive infrared technology to detect motion.
3. 270-degree detection pattern, minimum.
4. Adjustable time delay.
5. Dense, wide angle coverage pattern.
6. UL listed.
7. Temperature rating of -40 to 130 degrees F.
8. Complete with all mounting hardware, power supplies and relay packs.
9. Manufacturer: Watt Stopper, Sensor Switch, or equal.

D. Photo Controls
1. Light level selector to adjust activation.
2. Time-delay activation and de-activation.
3. SPST contacts rated 15-amp tungsten or 8.3-amp ballast at 120 Vac.
4. 1/2-inch male thread for mounting.
5. Manufacturer: Intermatic K4100, Tork 2100, or equal.

2.02 CONVENIENCE RECEPTACLES

A. Duplex Receptacles
1. Specification grade, 3-wire grounding type, NEMA 5-20R.
2. Side wired.
3. Rated 20 amperes, 125 volts.
4. Ivory color.
5. Manufacturer: Eagle 5362, Hubbell 5362, Leviton 5362, or equal.

B. Ground fault circuit interrupter receptacles
1. Specification grade, 3-wire grounding type, NEMA 5-20R.
2. Side wired.
3. Rated 20 amperes, 125 volts.
4. Ivory color.
5. Manufacturer: Eagle 9569, Hubbell GF-5362, Leviton 7899, or equal.

2.03 WALL PLATES

A. All flush mounted switches and receptacles shall be provided with smooth, impact resistant thermoplastic or molded nylon ivory color wall plates
1. Manufacturer: Eagle “Super Spec,” Hubbell ‘P’ Series, Leviton 807XX Series, Pass & Seymour ‘RP’ Line, or equal.

B. Surface mounted switches and receptacles in FS or FD cast device boxes shall have a stamped aluminum cover
   1. Manufacturer: Appleton, or equal, or a gasketed, cast plate, Crouse-Hinds Feraloy, or equal.

C. Surface mounted switches in cast aluminum boxes shall have stainless steel coverplates with dimensions which match the box dimensions
   1. Manufacturer: "Sierra," or equal.

D. Weatherproof covers for switches shall be weatherproof gray cast aluminum lift cover plates
   1. Manufacturer: Hubbell 7420, or equal.

E. Weatherproof covers for receptacles shall be hinged, Specification grade, weatherproof while in use, cast aluminum, UL listed, gray, completely gasketed
   1. Manufacturer: TayMac, Red Dot, or equal.

F. Weatherproof covers for receptacles in chemical rooms shall have non-metallic double-lift coverplates
   1. Manufacturer: Carlon E98DHG, or equal.

G. Weatherproof covers for switches in chemical rooms shall have non-metallic toggle-switch coverplates
   1. Manufacturer: Carlon E98TSC, or equal.

H. Wall plates for switches or manual starters which serve exhaust fans shall be engraved "EXHAUST FAN" with 1/8 inch high black letters.

PART 3 EXECUTION

3.01 INSTALLATION

A. Switches and convenience outlets shall be provided where shown on the Drawings.

B. Switches shall be on the latch side of doors, located 4 feet above floor, unless noted otherwise. Note: Door swing shall be verified with door installer before installing switch outlet boxes.

C. Indicating lights shall be provided with switches where shown on the Drawings and manual motor starters. Switches or manual starters with indicating lights shall be installed in 2 gang or multiple gang boxes with 2 gang or multiple gang wall plates.

D. Receptacle outlets in finished area shall be mounted 18 inches above floor, unless noted otherwise.

E. Interior surface mounted receptacles shall be mounted at 1.5 feet above floor level, unless noted otherwise.

F. Exterior receptacles shall be mounted at 2 feet above grade level, unless noted otherwise.

G. Flush wall receptacles installed above counters or worktables shall be mounted with long dimension parallel to the floor. Contractor shall verify countertop heights before installing boxes for convenience receptacles.

H. All receptacle outlets shall be grounded to a separate grounding conductor that has green insulation.

I. All switches, convenience receptacles, telephone outlets, manual starters, etc. in the finished areas shall be flush mounted. Flush boxes shall fit flush with the final finished wall in every case. Install metal box extenders and bond to the box where necessary.

J. All boxes shall be plumb.

K. Multi-outlet assembles shall be mounted directly above the counter backsplashes.

L. Laboratory bench outlets shall be as specified in Part 2 - Products.

M. All receptacles on a GFCI breaker shall be identified with laminated plastic nameplates which read: "GFCI PROTECTED." Letters shall be 1/4 inch high white on a red background. Feed through type GFCI receptacles which feed non-GFCI type receptacles where shown as GFCI type receptacles on the Drawing are not allowed.

N. Where indicated on the Drawings as WP, switches and receptacles shall have weatherproof cover plates.

O. Receptacles in chemical rooms shall have non-metallic weatherproof coverplates.

P. Clock outlets shall be 7 feet above the floor.

Q. Wall mounted door opener control stations shall be mounted 4 feet above the floor.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Local disconnects.
   2. Corrosion inhibitors.

1.02 PRICE AND PAYMENT PROCUDES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Site Electrical**.

1.03 SUBMITTALS

A. Data sheets which describe the switches, give electrical ratings, and give dimensions.

PART 2 PRODUCTS

2.01 LOCAL DISCONNECTS

A. UL listed, heavy duty, 600 volts, 3-pole safety switches.

B. Fusible or non-fusible as shown on the Drawings.

C. Ampere and horsepower rating required for the connected load.

D. Quick-make, quick-break operating mechanism.

E. Provisions for padlocking in the open and closed positions.

F. NEMA 1 enclosure for indoor switches.

G. NEMA 3R enclosure for outdoor switches.

H. NEMA 4X enclosure for corrosive areas identified on the Drawings.

I. NEMA 7 and listed as "Raintight" for switches installed in Class 1, Division 1, or 2 hazardous locations.

J. Provide auxiliary contacts as follows:
   1. Auxiliary contact shall disconnect motor protection circuit when motors with integral motor protection devices are provided.
   2. Auxiliary contact shall disable the associated VFD from operating when the disconnect is in the open position.
   3. Provide auxiliary contacts where noted elsewhere on the Drawings.
   4. Provide auxiliary contacts where noted elsewhere in control descriptions.

K. Each fusible switches shall have 2 sets of fuses.

L. Cutler Hammer, General Electric, Siemens, Square D, or equal.

2.02 MANUAL TRANSFER SWITCH

A. 100 amp, 240 volts, 3 phase, double throw with neutral position.

B. Solid neutral.

C. Load make/break.

D. Continuous duty rated.

E. UL listed.

F. NEMA 1 enclosure.

G. Laminated plastic nameplates which identify normal power and generator positions.

H. General Electric, Square D, Westinghouse, or approved equal.

2.03 CORROSION INHIBITOR

A. Vapor phase corrosion inhibitor device shall be Crouse-Hinds CID 101, Hoffman A-HCI, Zerust VC2, or approved equal.

B. Capsule or device size shall be adequate to provide 1 year of protection for the enclosure in which it is installed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Disconnect switches shall be installed in a readily accessible location where indicated on the Drawings. Centerline of the switch shall be mounted 4 feet above the ground.

B. Each switch shall be identified with a laminated plastic nameplate.

C. All disconnect switches mounted outside shall contain a corrosion inhibitor device.

D. Disconnects for single-phase motors shall be manual motor starters or manual motor starting switches specified in Section 26 24 19.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Luminaires.
2. Lamps.
3. Control devices.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. All Work and costs of this Section shall be incidental to the Project and included in the Lump Sum Bid Item for **Site Electrical**.

1.03 SUBMITTALS

A. Product cut sheets with specified features highlighted for each luminaire.

B. Product photometric data for each luminaire which is not listed in the Contract Documents or which does not have prior approval.

C. Provide Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. See Drawings for fixture schedule.

2.02 CONTROL DEVICES

A. Photo Controls
1. Light level selector to adjust activation.
2. Time-delay activation and de-activation.
3. SPST contacts rated 15-amp tungsten or 8.3-amp ballast at 120 Vac.
4. 1/2-inch male thread for mounting.
5. Manufacturer: Intermatic K4100, Tork 2100, or equal.

B. Timeclock
1. Astronomic, Multi-purpose, 365 day with holiday and seasonal scheduling.
2. 4-channel.
3. Manual override capability.
4. LCD display.
5. Automatic daylight savings or standard time.
6. Automatic Leap Year correction.
7. SPDT contacts rated 10 amps 24-277VAC.

C. Relays
   1. 120 Vac, 60 Hz. general purpose plug-in type.
   2. Contacts rated 10 amps at 240 Vac.
   3. Dust cover and base with screw terminals.
   4. Manufacturer: Potter & Brumfield, Square D, Allen-Bradley, or equal.

D. Lighting Contactors
   1. 600-volt electrically held.
   2. NEMA 1 enclosure, or open type if mounted in enclosure with other components.
   3. Manufacturer: Cutler-Hammer, General Electric, Square D, or equal.

2.03 POLES

A. For Lighting Unit
   1. 30 foot tall, square straight steel.
   2. Paint which matches the luminaire.
   3. Base plate cover over bolts and base plate.
   4. Handhole with gasketed cover.

B. All pole installations shall be capable of withstanding the forces produced by 90-mph winds with a 1.3-gust factor and the total number of luminaires and additional equipment required per pole.

PART 3 EXECUTION

3.01 INSTALLATION

A. In general, luminaires shall be located where shown on the Drawings; however, Contractor shall check equipment locations and install luminaires so that piping, duct work, and other devices or equipment shall not interfere with the luminaire components or its performance.

B. All suspended luminaires shall be mounted using supports at both ends of the fixture.

C. Galvanized or stainless-steel bolts, nuts, washers, and screws shall be used for mounting luminaries or luminaire outlets.

D. Lenses, refractors, and glassware shall be clean and free from cracks or chips. All reflectors, shades, luminaire bodies, etc. shall be free from dents and scratches, thoroughly cleaned, and properly aligned before installation is accepted by the Owner. All exposed tags and labels other than UL and emergency ballast identifiers shall be removed.

E. All luminaries, other than troffers, shall be firmly supported by major structural members, by structural slab, or channels in the ceiling construction.

F. Type of ceilings shall be verified so proper mounting hardware is furnished with each luminaire.

G. Location of insulation above ceilings shall be verified where recessed fixtures are located. If insulation is present, Contractor shall install barrier to separate fixtures from insulation per manufacturer's recommendations.

H. Luminaires with fluorescent emergency lighting packs shall be switched as indicated on the Drawings. A separate unswitched conductor shall provide power to the emergency lighting pack.

I. Intermediate framing shall be provided between structural members to support both ends of fluorescent luminaires mounted below gypsum board ceilings.

J. Pole erection and mounting shall be done according to pole manufacturer's recommendations.

K. A concrete base shall be provided for each outdoor luminaire, unless noted otherwise. Base types shall be provided as detailed on the Drawings.

3.02 IDENTIFICATION

A. Lighting control components shall be identified by laminated plastic nameplates with 1/4-inch white lettering on a black background. Identify each lighting contactor based on the loads served. In addition, identify the lighting control timeclock as such.

END OF SECTION

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SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Removal and trimming of vegetation and trees, and stripping and stockpiling of sod and topsoil.

B. Related Sections
   1. Section 31 23 00 – Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measure and Payment
   1. A Bid Item has been provided for **Clearing and Grubbing**. Measurement will be by Lump Sum. Bidder shall visit site prior to bid form submittal to determine the extent of clearing and grubbing required.
      a. Payment will constitute compensation in full for all removal, disposal, and costs.
   2. Stripping and Stockpiling of Soil: This Work shall be considered incidental to other Work in the Contract.
   3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 201 – Clearing and Grubbing.
   2. 632 – Furnishing and Planting Plant Material.

1.04 DEFINITIONS

A. Brush: All bushes, shrubs, and other vegetation that can be cut with a brush scythe or mowing machine, including small, isolated trees having a diameter of 4-inches or less at a point 2-feet above the ground surface.

B. Clearing: Cutting, removing, and disposing of trees, shrubs, bushes, windfalls, and other vegetation in the designated areas.

C. Grubbing: Removing and disposing of stumps, roots, and other remains in the designated areas.

D. Tree Trimming/Pruning: Cutting broken, damaged, or obstructing branches and installing wound dressing.

1.05 QUALITY ASSURANCE

A. Burning
   1. Acquire Wisconsin Department of Natural Resources (WDNR) and all required State Permits.
   2. Conform to all local regulations.

1.06 SITE CONDITIONS

A. Work consists of removing trees generally along the easement lot lines designated for utilities.

B. The Drawings do not specifically show all trees to be removed or transplanted.

C. Protect specimen trees close to Work that are designated to remain but may be damaged by Work.

1.07 SEQUENCING AND SCHEDULING

A. Install temporary erosion control measures prior to Work of this Section.

B. Complete before or sufficiently ahead of on-going rough grading, excavation, backfill, and compacting for utilities.

PART 2 PRODUCTS

2.01 WOUND DRESSING

A. Asphalt base tree paint.

B. Other acceptable materials per Engineer's approval.

PART 3 EXECUTION

3.01 GENERAL

A. Review removals in the field with the Engineer prior to doing Work. Clearing limits will be clearly marked by the Engineer.

B. Assume multiple mobilizations for the Work of this Section.

C. Stockpile soil to eliminate contamination with other on-site materials.

3.02 CLEARING AND GRUBBING

A. Clearing Trees: Cut off, remove, and dispose of trees and brush in the areas designated as a clearing operation. When grubbing is not required, the point of cut off shall be 6 inches above the ground.

B. Clearing Brush: Cut even with the ground surface.

C. Grubbing: Remove brush, stumps, roots, and other remains to a minimum depth of 6 inches below subgrade for all proposed sections.

D. Backfill all depressions resulting from the grubbing operations in accordance with Section 31 23 00.

3.03 TRIMMING AND PRUNING

A. As directed by the Engineer, trim trees that are to be saved but interfere with the proposed construction. Paint all cuts with wound dressing.

3.04 STRIPPING

A. After clearing and grubbing have been completed, strip sod and topsoil to a line 2 feet outside of areas to be occupied by structures, walks, roadways, areas to be excavated or filled, and other areas shown.

B. Stockpile sufficient topsoil to re-spread at a uniform depth of 4-inches to all disturbed areas identified for seeding or sodding:
   1. Do not strip within the drip line (branch spread) of trees identified to remain.

3.05 DISPOSAL

A. Dispose of all cleared and grubbed material and debris outside the right-of-way at a location selected by the Contractor, except for trees and logs to be salvaged.

B. Disposal site should be a properly designated landfill area as determined by appropriate governmental agencies or lands under direct control of the Contractor.

C. Stripped materials not used for embankments shall be disposed of off Site, or where shown on the Drawings. Prior to deposition of stripped material, the disposal area shall be cleared of trees and brush. After disposal of stripped material, the embankment shall be graded, top soiled with salvaged soil, and seeded.

D. On Site burial of any debris is not permitted.

E. Burning
   1. If allowed by the Wisconsin Department of Natural Resources (WDNR), all timber, stumps, branches, brush, roots, and debris may be burned within Owner's Property.
   2. Conform to WDNR Regulations related to air pollution.

3.06 PROTECTION

A. Conduct operations so as not to damage surrounding private property.

B. Protect trees intended to be saved from injury or defacement during operations
   1. Restrict widths of utility trenches.
   2. Provide protective bracing, sheeting, or box to insure safe Work conditions as incidental to Contract.

C. Exercise care to keep salvaged material as clean as possible during operations.

D. Install temporary fencing at the construction limits and drip lines of trees to be protected prior to any construction activities in order to protect vegetation.

END OF SECTION

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Excavation and fill for roadways, railways, foundations, channels, ponds, and other areas.

B. Related Sections
1. Section 01 57 13 - Temporary Erosion and Sediment Control.
2. Section 02 41 13 - Selective Site Demolition.
3. Section 31 10 00 - Site Clearing.
4. Section 31 23 13 - Subgrade Preparation.
5. Section 32 92 00 - Turf and Grasses.
6. Section 33 05 05 - Trenching and Backfilling.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Bid Items have been provided for various excavation materials, borrow materials, and salvage materials. Measurement and payment shall be at the Bid Unit Price, according to the following:
   a. A Bid Item has been provided for **Excavation Common – Onsite Disposal**. Measurement will be according to Section 205.4 of the WisDOT Spec. Payment will include placing embankments and compacting suitable excavated material on Site, including general earth moving activities.
   b. A Bid Item has been provided for **Excavation Common – Offsite Disposal.** Measurement will be according to Section 205.4 of the WisDOT Spec. Payment will include costs of hauling and disposal at an acceptable location according to local regulations. Any common excavation determined to be unsuitable for on-Site use, shall be reviewed by Engineer's representative and agreed to be unsuitable for on-Site use, prior to hauling and disposing off site.
   c. A Bid Item has been provided for **Select Borrow**. Measurement will be by the ton of material as determined from weight tickets delivered to the Engineer. Payment will include all costs related to furnishing and installing the material complete in place as specified
      1) If the borrow material is being wasted or placed in excess compared to the proposed grading, the Owner reserves the right to deduct quantities that are in excess.
   d. A Bid Item has been provided for **Topsoil**. Measurement will be by the ton of material as determined from weight tickets delivered to the Engineer. All hauling, placement, blading, grading, shaping, and compacting of Topsoil shall be incidental to this Bid Item.
2. Topsoil striping and stockpiling shall be considered incidental to the common excavation work and included in the Total Base Bid. Note that stripped topsoil must be deemed free of contaminants, should the Contractor wish to reuse on site.

3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structures Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 205 – Roadway and Drainage Excavation.
   2. 206 – Excavation for Structures.
   3. 207 – Embankment.
   4. 208 – Borrow.
   5. 209 – Granular Backfill.
   6. 210 – Structure Backfill.
   7. 312 – Select Crushed Material.
   8. 625 – Topsoil and Salvaged Topsoil.

1.04 SUBMITTALS

A. Submit the following items consistent with Section 01 33 00:
   1. Gradation tests for borrow materials.
   2. Topsoil Borrow test indicating material content, organic content, and ph levels.

1.05 DEFINITIONS

A. The definitions of the different classifications of excavation and borrow material shall conform to WisDOT Spec. 205 and 208, or as modified herein.
   1. Grading Grade: Bottom of the fully excavated design section as shown on the Drawings.
   2. Excavation Common: Excavation above the grading grade that has not been classified as another form of excavation in this Section.

1.06 QUALITY ASSURANCE

A. Assist testing laboratory by excavating for density tests. Assist testing laboratory with obtaining material samples.

1.07 SEQUENCING AND SCHEDULING

A. Perform excavation as soon as possible after sewer and water construction.

B. Complete subgrade for streets, railways, driveways, walks, and parking lots immediately after trench backfill and compaction.

C. Complete finish grading of turf areas within 5 calendar days after backfill.

PART 2 PRODUCTS

2.01 MATERIALS

A. Embankment: Conform to WisDOT Spec. 207.

B. Select Borrow: Conform to WisDOT Spec. 208.
   1. Fill imported for structural support should be non-organic granular soils having a maximum 12 percent by weight passing the No. 200 Sieve, and a maximum particle size of 2 inches. Crushed stone (or other rocky materials) could be a suitable alternative, but the Engineer should be consulted to review gradation of any proposed alternative fill material.

C. Breaker Run: Conform to WisDOT Spec. 311.

D. Topsoil Material: Conform to WisDOT Spec 625.

PART 3 EXECUTION

3.01 GENERAL

A. Establish traffic control prior to excavations.

B. Establish the specified erosion control devices according to Section 01 57 13 prior to all excavations.

C. Notify utility companies of progress schedule so they can accomplish relocations, removals, and holding of lines.

D. Perform removals consistent with Section 02 41 13.

E. Strip topsoil consistent with Section 31 10 00.

3.02 PREPARATION OF EMBANKMENT

A. Conform to Section 31 23 13.
   1. Engineer's approval is required of all areas where preparation works has been performed prior to the placement of the embankment or fill material.

3.03 EXCAVATING OPERATIONS

A. Conform to WisDOT Spec. 205.3, or as modified herein.
   1. Excavation of unstable material below grade shall be done under the direction of the Engineer as the subsurface conditions are disclosed.
      a. An experienced soils technician or geotechnical engineer administered by the Contractor must perform observations during construction to determine actual required subcut depths, which could be more or less than anticipated.
      b. Resident Engineer or their employed soils technician or geotechnical Engineer may also perform quality assurance observations to determine potential subcut depths during construction.
   2. Remove muck excavation material so as to minimize disruption to the bottom of the excavation.
   3. Notify Engineer immediately of any large boulders or ledge rocks encountered so proper measurement or profile can be made for an agreed upon price.
   4. No solid rock will be allowed within 12-inches of the subgrade.
   5. Provide and maintain temporary drainage facilities until permanent facilities are completed.

6. After the excavation is complete and prior to backfilling operations, notify the Engineer 24-hours in advance so all excavation areas can be cross-sectioned to determine quantities.

3.04 PLACING EMBANKMENT MATERIALS

A. Conform to WisDOT Spec. 207.3.

3.05 COMPACTING EMBANKMENTS

A. Conform to WisDOT Spec. 207.3.6, or as modified herein.
   1. Fill placed to attain grade for foundation and/or slab support should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 98% of its maximum standard Proctor dry density (ASTM D698). Geotechnical reporting anticipates a lift thickness on the order of 6 to 8 inches may be appropriate, although this should be reviewed in the field at the time of construction.
   2. Special Compaction Methods required for embankment materials shall conform to the Specified Density Method with the testing location and rates being determined by the Engineer.
      a. It is the responsibility of the Contractor to provide compaction testing throughout the project. Rate of testing is not specified, but quality assurance testing will be performed by the Resident Engineer, as deemed necessary.
   3. Clayey or silty soil used as fill will need to be placed at a water content sufficient to attain compaction (near the "optimum water content" defined in ASTM D698). It is the Contractor's responsibility to moisture condition the soil (wet or dry) to a uniform condition. Some on Site soils will be wet (or could be dry) and the Contractor shall not claim that this is a changed condition.
   4. Backfilling of embankments shall be performed using on Site materials: If the Contractor is unable to meet the specified density requirements using that material due to excess moisture content, they shall immediately notify the Engineer of this condition.
   5. The Contractor shall recognize that inclement weather (sometimes heavy) occurs during the construction season and the Contractor shall be responsible for protecting the moisture condition of soils during the construction phase. Such protection measures include sloping of exposed surfaces to promote runoff (avoid ponding) and compacting exposed surfaces prior to rain events to minimize infiltration.

3.06 RAIL SPUR EMBANKMENT REQUIREMENTS

A. Fill placed to attain subgrade elevation for rail spur support shall be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 95 percent of its maximum standard Proctor dry density (ASTM D698). Clay fill shall be within 2 percent (+/-) of its optimum moisture content. Geotechnical reports anticipate a lift thickness on the order of 4 to 6 inches may be appropriate, although this should be reviewed in the field at the time of construction.
   1. Compaction required for embankment materials shall conform to the Special Compaction Method as dictated by the WisDOT Standard Specifications. Testing, rates, and locations shall be determined and provided by the Resident Engineer, as needed.

3.07 FINISHING OPERATIONS

A. Conform to WisDOT Spec. 205.3.14 or as modified herein.
   1. Finish grading of subgrade prior to placement of an aggregate base course shall conform to the following tolerances:
      a. Not vary by more than 0.05 feet above or below the prescribed elevation at any point where a measurement is made.
   2. Finish grading of subgrade prior to placement of a granular borrow shall conform to the following tolerances:
      a. Not vary by more than 0.10 feet above or below the prescribed elevation at any point where a measurement is made.
   3. Finish grading of granular borrow prior to placement of an aggregate base shall conform to the following tolerances:
      a. Not vary by more than 0.10 feet above or below the prescribed elevation at any point where a measurement is made.
   4. Grading of the soils beneath the proposed topsoil shall be reviewed and approved by the Engineer prior to the start of the topsoil placement.

3.08 OFFISTE DISPOSAL OF CONTAMINATED MATERIALS

A. Any necessary offsite disposal of contaminated materials shall be in accordance with the requirements of the approved Materials Management Plan for the site, as well as local and state regulatory requirements.

END OF SECTION

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SECTION 31 23 13

SUBGRADE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Grading, shaping, and compacting subgrade prior to placing a base or surface course.

B. Related Sections
   1. Section 31 23 00 - Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. No Bid Item has been provided for subgrade preparation. Subgrade preparation and all related Work shall be considered incidental to the Project and included in the appropriate Bid Item associated with the Work, except for the following:
      a. The Owner will only pay for Engineer-approved **Excavation Below Subgrade** (EBS) to correct problems beyond the Contractor's control. EBS work shall be paid for under the Contract Unit Price (no multiples) for Excavation Common and Select Borrow Bid Items.
      b. The Owner will pay separately for geotextile fabrics or geogrids under the Geosynthetic Soil Stabilization and Layer Separation Bid Items.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 205 – Roadway and Drainage Excavation.
   2. 211 – Preparing the Foundation.

1.04 SEQUENCING AND SCHEDULING

A. Subgrade preparation shall be performed prior to placement of the aggregate backfill material if excavation and rough grading of subgrade is not performed under this Contract.

B. Subgrade preparation shall be performed on the existing gravel base prior to placement of additional gravel base material.

C. Subgrade preparation shall be performed prior to placement of the concrete curb and gutter.

D. Complete subgrade for streets, railways, driveways, walks, and parking lots immediately after installation of pipe as part of trench backfill and compaction.

E. Subgrade preparation shall be performed prior to placement of the bituminous/aggregate base course.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 GENERAL

A. Subgrade preparations shall be performed to produce the required density, grade, and cross-section.

3.02 PREPARATION

A. Conform to WisDOT Spec. 211.3.

3.03 COMPACTION

A. Following removal of all organic soils and other unsuitable soils, the top 12 inches of the exposed subgrade shall be compacted to a minimum of 95% of its maximum modified Proctor dry density. Geotechnical reports anticipate moisture conditioning will be needed to meet this requirement. In addition to the surface compaction, each area shall be proof rolled with a fully loaded tandem-axle dump truck and observed for signs of poor performance by a geotechnical engineer or experienced soils technician, just prior to placing new fill. All soft areas should be dug out and corrected in accordance with Section 31 23 00, and as the Engineer directs.

B. Inspection of subgrade by test rolling as follows:
   1. The equipment used for test rolling shall be a Tandom Truck with a gross weight of 45,000 pounds.
   2. The roadbed will be considered unstable if yielding and rutting is greater than 1-1/2 inches.

C. Where clayey soils are present at subgrade elevation, the placement of geosynthetic separation fabric (WisDOT 645, Type SAS), shall be placed on top of the finished subgrade as shown on the Plans or as directed by the Engineer. The purpose of this fabric is to reduce the risk of migration of fines into the sub-ballast or access drive.

3.04 FINISH OPERATIONS

A. Subgrade tolerance shall conform to WisDOT Spec. 211 and 205.3.14, or as modified below.
   1. Not vary by more than 0.05-feet above or below the prescribed elevation at any 1 point where a measurement is made.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish and install all labor, equipment, material, and related services to dewater all applicable portions of the Project.

B. It is anticipated that dewatering will be necessary for construction of the Project.

C. Provide all necessary dewatering during construction of the entire Project.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included in the appropriate Bid Item associated with the Work.

1.03 SUBMITTALS

A. Submit dewatering plan for all applicable excavations.

B. Submit dewatering plan for any necessary dewatering of contaminated groundwater. Plan shall adhere requirements set forth in the approved Materials Management Plan.

C. Dewatering plans shall include at a minimum, the following:
   1. Equipment, equipment, methods, standby equipment and power supply.
   2. pollution control facilities.
   3. water treatment and discharge systems details.
   4. discharge locations to be utilized.
   5. means of monitoring groundwater levels and draw-down.
   6. construction details of dewatering wells.
   7. copies of permits, if applicable.
   8. schedule of installation and operation.
   9. changes in operation related to changes in the volume of surface water due to various storm events.
   10. procedures for monitoring forecast and weather related changes.

1.04 SITE CONDITIONS

A. Protect the Site and adjacent property to avoid any damage caused by dewatering and pumping.

B. All dewatering discharge shall be the responsibility of the Contractor.

C. Insure that no erosion occurs and that no contamination of the adjacent low areas occurs due to dewatering.

PART 2 PRODUCTS

2.01 DEWATERING EQUIPMENT

A. The choice of dewatering equipment shall be the responsibility of the Contractor.

B. Dewatering by pumping from sump pits will be acceptable if this method is able to keep the excavation dry.

C. If pumping from sump pits is not able to maintain a dry excavation, dewatering shall be accomplished by means of well points, vacuum well points, deep wells, or a combination of these methods.

D. Contractor shall remove from the Site all sand, silt, and debris accumulated during dewatering operations.

PART 3 EXECUTION

3.01 DEWATERING

A. All dewatering shall be carried out in accordance with an approved plan. Plan must be approved by the Engineer prior to any dewatering operations.

B. All dewatering shall be done to ensure that no erosion or pollution results.

C. Dewatering shall be of such magnitude necessary to ensure that all excavations are acceptable for the construction requirements.

D. The Contractor shall insure that the dewatering is operated continuously, 24 hours per day during the times necessary to construct the foundation and piping.

E. Upon completion of the operation, the areas shall be cleaned of all debris and equipment and shall be returned to original or better condition.

3.02 PERMITS

A. Obtain permits required for dewatering wells if utilized.
   1. The Contractor shall obtain a permit from the DNR Bureau of Water Supply, for dewatering wells which singly or in aggregate produce in excess of 100,000 gallons per day. Permits shall be obtained prior to installation of wells. Wells shall be constructed, operated, and closed in accordance with DNR requirements. The Contractor shall provide two copies of DNR permits for dewatering wells to the Engineer. Dewatering wells shall be constructed and operated so as to prevent removal of fines.

END OF SECTION

SECTION 31 32 19

GEOSYNTHETIC SOIL STABILIZATION AND LAYER SEPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Geotextiles used for subgrade separation, stabilization and reinforcement.

B. Related Sections
   1. Section 31 23 00 – Excavation and Fill.
   2. Section 31 23 13 – Subgrade Preparation.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Geotextile Fabric Type SAS**. Measurement will be based upon units of square yards of actual surface area covered by Geotextile Fabric. Payment at the Bid Unit Price shall include all materials, installation, and protection of installed Geotextile Fabric as specified. The required overlap joint or joint sewing shall be incidental to this fabric item with no direct payment being made.
   2. A Bid Item has been provided for **Geogrid Type SR**. Measurement will be based upon units of square yards of actual surface area covered by Geogrid. Payment at the Bid Unit Price shall include all materials, subgrade preparation, installation, and protection of installed Geogrid as specified. The required overlap joint shall be incidental to this item with no direct payment being made.
   3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 645 – Geosynthetics.

1.04 SUBMITTALS

A. Manufacturers Certificate of Compliance which includes the following information:
   1. Full product name by trademark and style number.
   2. Geotextile/Geogrid polymer type(s).
   3. Geotextile/Geogrid physical properties.

B. Samples of the Geotextile/Geogrid
   1. The geotextile machine direction shall be marked on each sample submitted for testing.

PART 2 PRODUCTS

2.01 GEOTEXTILE FABRIC

A. Conform to the requirements of WisDOT Spec. 645.2.2.2, Type SAS (Subgrade Aggregate Separation).

2.02 GEOGRID

A. Conform to the requirements of WisDOT Spec. 645.2.3.2, Type SR (Subgrade Reinforcement).

PART 3 PART 3 EXECUTION

3.01 PREPARATION

A. Excavation: Conform to Section 31 23 00.

B. Subgrade Preparation: Conform to the requirements of Section 31 23 13. Subgrade shall be toleranced and approved before geotextile or geogrid placement.

3.02 INSTALLATION

A. Conform to WisDOT Spec. 645.3 except as modified below.

B. Place geotextile immediately ahead of the covering operation
   1. No geotextiles shall be left exposed to sunlight during installation for a total of more than 7 calendar days.
   2. The geotextile shall be laid smooth without excessive wrinkles.
   3. The geotextile shall not be dragged through mud or over sharp objects which could damage the geotextile.

C. All adjoining sections of the geotextile shall be overlapped a minimum of 18 inches or sewn using mechanical machine.

D. Secure fabric in place by means of stone weights to prevent displacement.

E. If geotextile is torn or punctured, the damaged area shall be repaired or replaced
   1. The patch shall overlap the existing geotextile a minimum of 3 feet from the edge of any part of the damaged area.

3.03 FILL PLACEMENT

A. Only granular spreading methods that will not tear the fabric shall be used.

B. Granular borrow shall not be dropped on the fabric from a height greater than 3 feet
   1. Place a minimum of 8 inches of granular borrow on the geotextile prior to the movement of construction equipment. Carefully monitor turning movements.
   2. Tracked or wheeled equipment shall not be permitted to drive directly on the fabric.
   3. Any ruts occurring during construction shall be filled with additional granular borrow and compacted to the specified density.

C. Compaction of first lift above the geotextile shall be limited to routing of placement and spreading equipment only. No vibratory compaction will be allowed on the first lift.

END OF SECTION

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SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Requirements for aggregate base course on a prepared subgrade.

B. Related Sections
1. Section 31 23 13 - Subgrade Preparation.
2. Section 31 32 19 – Geosynthetic Soil Stabilization and Layer Separation.
3. Section 32 12 01 - Flexible Paving.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Base Aggregate Open-Graded**. Measurement will be by ton of material placed, as determined from weight tickets submitted to the Engineer. Deductions may be made for contaminated aggregate or unrecovered aggregate deposited outside of the plan limits. Payment by the ton shall include compensation for preparing the foundation; and for stockpiling, placing, shaping, compacting, and maintaining the base.
2. A Bid Item has been provided for **Base Aggregate Dense 3/4-Inch**. Measurement will be by ton of material placed, as determined from weight tickets submitted to the Engineer. Deductions may be made for contaminated aggregate or unrecovered aggregate deposited outside of the plan limits. Payment by the ton shall include compensation for preparing the foundation; and for stockpiling, placing, shaping, compacting, and maintaining the base.
3. A Bid Item has been provided for **Base Aggregate Dense 1 1/4-Inch**. Measurement will be by ton of material placed, as determined from weight tickets submitted to the Engineer. Deductions may be made for contaminated aggregate or unrecovered aggregate deposited outside of the plan limits. Payment by the ton shall include compensation for preparing the foundation; and for stockpiling, placing, shaping, compacting, and maintaining the base.
4. A Bid Item has been provided for **Breaker Run**. Measurement will be by ton of material placed, as determined from weight tickets submitted to the Engineer. Deductions may be made for contaminated aggregate or unrecovered aggregate deposited outside of the plan limits. Payment by the ton shall include compensation for preparing the foundation; and for stockpiling, placing, shaping, compacting, and maintaining the base. If the Contractor substitutes select crushed material allowed under WisDOT Spec 311.2, the Contractor will be paid for that material at the Breaker Run Unit Price.
5. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 301 – Base, Subbase, and Subgrade Aggregate.
   2. 305 – Dense-Graded Base.
   3. 310 – Open-Graded Base.
   4. 311 – Breaker Run.
   5. 312 – Select Crushed Material.

1.04 SUBMITTAL

A. Submit gradation report on sample of aggregate base to be used.

1.05 SEQUENCING AND SCHEDULING

A. Construct aggregate base only after all of the following have been completed:
   1. Subgrade has been corrected for instability problems and successfully passed a test rolling test performed by the Contractor and witnessed by the Engineer.
   2. Subgrade has been checked for conformance to line and grade tolerances (stringline).

PART 2 PRODUCTS

2.01 MATERIALS

C. Reiss Dock Company has aggregate material available for use from their Duluth Property. If Contractor so chooses, this material may be delivered to the site via the St. Louis Bay, by C. Reiss Dock Company. At such point, responsibility would be placed on the Contractor to crush material to the specified sizes for on-site use, and sieve analysis would be required prior to approval for use.

Bidders are encouraged to contact Christian Zuidmulder, regarding potential use of C. Reiss Dock Materials.

Christian Zuidmulder
Vice President of Operations
The C. Reiss Co.
Fox River Terminals.
Whitehaven Silica.
Office 920.436.7600 ext. 101
Cell 920.562.2982
christian.z@thecreiss.com

A. Base, Subbase, and Subgrade Aggregate: Conform to WisDOT Spec. 301.

B. Dense-Graded Base: Conform to WisDOT Spec. 305.

C. Open-Graded Base: Conform to WisDOT Spec. 310.

D. Breaker Run: Conform to WisDOT Spec. 311.

E. Select Crushed Material: Conform to WisDOT Spec. 312.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare the subgrade in accordance with Section 31 23 13.

B. Subgrade to be completed and approved by the Engineer prior to installation of aggregate base.

3.02 CONSTRUCTION REQUIREMENTS

A. Conform to WisDOT Spec. 301.3.
   1. Compaction shall be at least 95 percent of its maximum standard Proctor dry density.
   2. After the base course has been placed, compacted, and tested, it is the contractor's responsibility to maintain the base course in a suitable condition for paving.
   3. Each roadway area shall be proof rolled with a fully loaded tandem-axle dump truck and observed for signs of poor performance by a geotechnical engineer or experienced soils technician. All soft areas should be dug out and corrected in accordance with Section 31 23 00, and as directed by the Engineer.
      a. See Section 31 23 13 for Subgrade Preparation requirements.

3.03 FIELD QUALITY CONTROL

A. The Contractor shall have an independent testing laboratory sample the aggregate base materials, and perform QC gradation, fracture, liquid limit, and plasticity testing in accordance with each respective AASHTO test method as listed in WisDOT Spec 301.2.3 of each base aggregate size, source or classification, and type at the following frequencies:
   1. One stockpile test before placement including gradation, fracture, and plasticity.
   2. Conduct one gradation test per lot. One lot is defined as 3000 tons of material placed. The contractor may include partial quantities of less than or equal to 750 tons with the previous lot. For partial lots exceeding 750 tons, notify the engineer who will direct additional testing to represent that partial lot.
   3. One fracture test for each gradation test. When the fracture 4-point running average is above the lower warning limit, the testing frequency may be reduced to one fracture test per ten gradation tests or fraction thereof. The reduced test frequency applies only as long as the running average remains above the lower warning limit.
   4. One plasticity and liquid limit test for the first gradation test. Thereafter, perform one plasticity check, per ten gradation tests or fraction thereof. If the soil cannot be rolled into a 3 mm-diameter thread, then it is non-plastic (NP) and the complete test need not be performed; report the plasticity Index as NP. If the material can be rolled into a thread, then perform both complete tests to determine the liquid limit and the plasticity index.

B. Moisture/Density Tests: Contractor shall test as frequent as they feel necessary to meet specifications, but at a minimum of 1 test per 5 stations. Breaker Run and Base Aggregate Dense Open Graded excluded from Density testing.
   1. The owner will provide verification testing as necessary.

C. Line and Grade Tolerance: The final aggregate base surface will be checked for conformance to specified tolerances by the "stringline" method prior to approval to pave the surface. Grade shall be ± 0.03 feet of grade.

3.04 PROTECTION

A. Keep aggregate base free of ruts and irregularities.

B. Place water on aggregate base for dust control as required to eliminate nuisance conditions for adjacent properties.

END OF SECTION

SECTION 32 12 01

FLEXIBLE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Hot plant mixed asphalt-aggregate mixtures for wearing and non-wearing pavement courses.
2. Bituminous tack coat.

B. Related Sections
1. Section 32 11 23 - Aggregate Base Courses.
2. Section 33 05 05 – Trenching and Backfilling.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Method of Measurement and Payment shall conform to WisDOT Sections 455 and 460, except as modified herein:
2. A Bid Item has been provided for **Tack Coat**.
   a. Method of measurement shall be in accordance with WisDOT Spec. Section 455.4, except as modified below:
      1) Cleaning of all debris and dirt from the previous asphaltic surfaces prior to placement of Tack Coat is considered included.
      2) Measurement shall be by gallon effectively applied.
   b. Basis of payment shall be in accordance with WisDOT Section 455.5.
3. Bid Items have been provided for HMA Pavement.
   a. Method of measurement shall be in accordance with WisDOT Section 460.4, except as modified below:
      1) **HMA Pavement 3 MT 58-34 S**: Measurement will be by weight in tons with tickets furnished by the Contractor on a daily basis.
      2) **HMA Pavement 4 MT 58-34 S**: Measurement will be by weight in tons with tickets furnished by the Contractor on a daily basis.
      3) **HMA Pavement 3 MT 58-34 V**: Measurement will be by weight in tons with tickets furnished by the Contractor on a daily basis.
      4) Asphaltic Binder Material for Mixture: No separate measurement will be made for asphaltic binder material.
   b. Basis of payment shall be in accordance with WisDOT Section 460.5, except as modified below:
      1) Asphaltic Binder Material for Mixture: No explicit direct payment shall be made. Cost of asphaltic binder material will be incidental to the cost of the mixture.
      2) Asphaltic Curb: No explicit direct payment shall be made for creation of asphaltic curbs.
4. Preparation of Bituminous Non-Wearing: Measurement and Payment shall be considered incidental and shall include the following:
   a. Final clean up of the bituminous non-wearing course with a power pickup broom.
   b. Final adjustment of the structures located within pavement.

5. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 450 – General Requirements for Asphaltic Pavements.
   2. 455 – Asphaltic Materials.
   3. 460 – Hot Mix Asphalt Paving.
   4. 465 – Asphaltic Surface.

1.04 SUBMITTALS

A. Submit mixture design report to the Engineer. Conform to WisDOT Spec. 460.2.7.

B. Contractors shall submit mix design report for all projects, regardless of the size of the project.

C. Contractor shall submit Q/C results in accordance with WisDOT Spec. 460.2.8.

1.05 SEQUENCING AND SCHEDULING

A. Aggregate base and concrete curb and gutter, if applicable, to be completed and approved by the Engineer prior to placement of bituminous surfaces.

B. The Contractor shall provide a 48-hour notice for scheduling and noticing of the effected landowners/businesses, prior to paving operations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mixture Designation: Conform to WisDOT Section 460 – Table 460-2.

B. Aggregate Material: Conform to the gradation requirements of WisDOT Section 460.2.2, except as modified below:
   1. Binder Course: Nominal size of aggregate shall be 19.0 mm for all mixtures, unless otherwise approved by Engineer.
   2. Surface Course: Nominal size of aggregate shall be 12.5 mm for all mixtures, unless otherwise approved by Engineer.

C. Asphaltic Binder in Mixture: Conform to the requirements of WisDOT Section 455.2, except as modified below:
   1. Asphaltic binder in mixture shall be PG 58-34, unless otherwise approved by Engineer.

D. Asphaltic Materials for Tack Coat: Conform to WisDOT Section 455.2.5.

PART 3 EXECUTION

3.01 GENERAL

A. Conform to the requirements of WisDOT Spec 450.3.2.1, except as modified herein.

B. The Contractor to review the proposed paving sequence with the Engineer prior to placement of each bituminous course (lift).

C. The proposed sequence shall address the: longitudinal seams, compaction, traffic control, hauling routes, and placement of pavement markings, if necessary.

D. Preparation of Asphalt Binder Course
   1. Final clean up of the bituminous surface with the use of a power pickup broom and front-end loader.
   2. Adjust structures, if necessary

E. Joints: Where new construction meets existing bituminous surfacing, the existing surface shall be uniformly milled or saw-cut straight and bituminous tack coat applied prior to placement of each bituminous course (lift).
   1. For joint construction, an existing bituminous surface shall be considered to include any bituminous surface not paved on the same day as the new construction. The Owner may require milling or saw cutting on surfaces paved the same day, if, in the opinion of the Owner, the mix has cooled to a point where a new milled or sawed edge is necessary.
   2. Construct 2-foot wide (min.) ramp where new construction does not match existing construction (i.e. wearing course to non-wearing course).

3.02 RESTRICTIONS

A. Conform to WisDOT Section 450.3.2.1, except as modified herein.

B. All street surfaces checked and approved by the Engineer prior to paving.

C. Existing bituminous surfaces must be dry prior and during placement of any bituminous pavements.

D. Wearing course shall not be placed when the air temperature in the shade and away from artificial heat is 50 degrees F or less, unless otherwise approved by the Engineer.

E. Diesel fuel shall not be used to coat rubber tires or hand tools to prevent asphalt from sticking.

3.03 PREPARATION

A. Aggregate: Install aggregate base course conforming to Section 32 11 23 – Aggregate Base.

B. Hot Mix Asphalt:
   1. Apply tack at the rate of 0.05 gallon per square yard.
   2. Tack the full surface of in-place HMA pavement before paving.
   3. Tack full face of existing asphaltic transitions, including patches.

3.04 PAVEMENT DENSITY

A. Conform to the requirements of WisDOT Section 460.3.3 “Minimum Required Density,” except as modified:
   1. Measurement of pavement density shall be by nuclear density.

2. Required minimum compaction is 91.5 percent of the target maximum density. Target maximum density shall be determined each day by the Contractor using a Standard Rice Test. Contractor shall provide the target maximum density to the Engineer at the start of paving operations. Contractor shall verify degree of compaction and submit a report to the Engineer as to date paved, date tested, location, and degree of compaction.
3. All costs for the tests and report shall be included in the unit price bid.

B. Base patching shall conform to Section 450.3.2.6.2 – Ordinary Compaction.

3.05 THICKNESS REQUIREMENTS

A. Conform to WisDOT Spec. 460.3.2, except as modified herein:
1. After compaction, the thickness of each course shall be within 1/8 inch of the thickness shown on the Drawings.
2. The portion of any course constructed more than the maximum allowable of 1/8 inch will be excluded from pay quantities or may require removal and replacement at the direction of the Engineer.
3. The Engineer may require end of Project core samples for verification of pavement thickness and uniformity.

END OF SECTION

SECTION 32 13 14

CONCRETE WALKS, MEDIANS, AND DRIVEWAYS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Cast-in-place concrete walkways, medians, driveways, and valley gutters.

B. Related Sections
1. Section 31 23 00 - Excavation and Fill.
2. Section 31 23 13 - Subgrade Preparation.
3. Section 32 11 23 - Aggregate Base Courses.
4. Section 32 12 01 - Flexible Paving.
5. Section 32 16 13 – Concrete Curbs and Gutters.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Concrete Strip, 5-Feet Wide.** Measurement shall be on the basis of in-place square yard, accepted by the Engineer.
   a. Payment of the Bid Item shall include the following:
      1) Concrete materials.
      2) Subgrade and base preparation.
      3) Placement of materials.
      4) Finishing.
      5) Curing and protection.
   b. Excavation of the existing concrete panels for installation of new concrete shall be incidental to the Project and included in the Total Base Bid.
   c. Aggregate base beneath concrete shall be measured and compensated per Section 32 11 23.
2. A Bid Item has been provided for **Concrete Pavement, 8-Inch**. Measurement shall be on the basis of in-place square yard, accepted by the Engineer.
   a. Payment of the Bid Item shall include the following:
      1) Concrete materials.
      2) Sub grade and base preparation.
      3) Placement of materials.
      4) Finishing.
      5) Curing and protection.
      6) Reinforcement.
   b. Excavation of the existing concrete apron for installation of new concrete shall be incidental to the Project and included in the Total Base Bid.
   c. Aggregate base beneath concrete shall be measured and compensated per Section 32 11 23.
3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Society of Testing Materials (ASTM)
   1. C260 - Air-Entraining Admixtures for Concrete.

B. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
   1. 415 – Concrete Pavement.
   2. 416 – Concrete Pavement – Appurtenant Construction.
   3. 501 – Concrete.
   4. 505 – Steel Reinforcement.
   5. 601 – Concrete Curb and Gutter.

1.04 SUBMITTALS

A. Submit one 7-day and two 28-day concrete test results for all concrete pours in any given day.

B. Submit design mix for concrete that will be used on the Project at the preconstruction conference. If mix design is not available at the time of the preconstruction conference, submit mix design at least 15 days before commencement of concrete pavement installation.

1.05 SEQUENCING AND SCHEDULING

A. Construction of the concrete driveway apron shall begin no sooner than 24 hours after placement of the adjacent concrete curb and gutter with completion within 5 days of curb placement.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement WisDOT Spec. 501.2.1:
   1. ASTM C150, Type II.

B. Aggregates: Conform to WisDOT Spec. 501.2.5

C. Air-Entraining Admixtures WisDOT Spec. 501.2.2:
   1. Conforming To: ASTM C260 "Air-Entraining Admixture for Concrete."
   2. Not to be added to the concrete mixtures in the field without approval from Engineer.

D. Mix Designation and Classification for Concrete:
   1. Manual Placement: Grade A.
   2. Slip Form Placement: Grade A2.

E. Pre-Formed Joint Filler: Conform to WisDOT Spec. 415.2.3.

F. Curing Compound: Conform to WisDOT Spec. 415.2.4.

G. Pavement Joint Sealer
   1. Hot-Poured, for Concrete and Asphalt Pavements.

2. ASTM Designation: D3405.

H. Curing Compound: Conform to WisDOT Spec. 415.2.4.

2.02 DENSE GRADED BASE

A. Dense Graded Base shall be required below all concrete:
1. Conform to Section 32 11 23 - Aggregate Base.

2.03 DOWEL AND TIE BARS

A. Conform to WisDOT Spec. 505.

PART 3 EXECUTION

3.01 GENERAL

A. Provide copies of batch tickets for concrete mix at the time of material delivery.

B. Construct concrete driveways and valley gutters at the locations and elevations indicated on the Drawings.

C. Verify locations with Engineer in the field prior to construction.

D. The completed concrete work shall give the appearance of uniformity in surface contour and texture, and shall be accurately constructed to line and grade. The required joints, edges, and flow lines shall show neat workmanship.

E. Retempering of concrete which has partially hardened with or without additional materials or water is prohibited.

F. Concrete washout locations shall conform to the requirements of NDPES General Construction Storm Water Permit.

3.02 FOUNDATION PREPARATIONS

A. Placement of the aggregate base or granular material to support the concrete work shall conform to Section 32 11 23 and Section 31 23 13.

B. The foundation shall be approved by the Engineer prior to placement of concrete material.

3.03 FORMS

A. Conform to WisDOT Spec. 415.3.2.4.

3.04 JOINT CONSTRUCTION

A. Concrete Pavement
1. Longitudinal Joints: Conform to WisDOT Spec. 415.3.9.1.
2. Transverse Joints: Conform to WisDOT Spec. 415.3.9.2.

3.05 METAL REINFORCEMENT

A. Conform to WisDOT Spec. 505.

3.06 PLACING AND FINISHING

A. Concrete Pavement
   1. Conform to WisDOT Spec. 415.3.

3.07 CONCRETE CURING AND PROTECTION

A. Conform to WisDOT Spec. 415.3.12 and 415.3.16, except as modified herein:
   1. All surfaces shall be coated with membrane curing compound within 30 minutes after finishing at the specified rate.
   2. The membrane curing compound must contain a fugitive dye and be applied in 2 different directions perpendicular to each other.
   3. A second application of membrane curing compound shall be applied 4 to 8 hours after the first application at the specified rate.
   4. The freshly finished surface shall be protected, surfaces pitted by rain will be considered unacceptable.
   5. Removal and replacement of any curb section damaged by traffic, rain, cold weather, or other causes occurring prior to the 72-hour curing period or final acceptance shall the responsibility of the Contractor.

B. Mixing and Protection During Cold Weather: Comply with WisDOT Spec. 415.3.15 - Cold Weather Concreting:
   1. A curing material that has water resistance, strength, and insulation properties will be required.

3.08 BACKFILLING

A. Conform to WisDOT Spec. 602.3.2.7, except as modified herein:
   1. Perform backfilling to protect the concrete no sooner than 72 hours after placement of the concrete.

END OF SECTION

SECTION 32 16 13

CONCRETE CURBS AND GUTTERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Cast-in-place concrete curbs, and concrete curb and gutter.

B. Related Sections
   1. Section 32 11 23 – Aggregate Base Courses.
   2. Section 32 12 16 – Hot Mix Asphalt (HMA) Pavement.
   3. Section 32 13 13 – Concrete Paving.
   4. Section 32 13 14 – Concrete Walks, Medians, and Driveways.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A Bid Items has been provided for **Concrete Curb & Gutter**. Measurement of curb and gutter shall be by the lineal foot measured along the face of the curb at the gutter line, no matter the size and type. Payment shall include materials, preparation, formwork, placement, finishing, curing, protection, reinforcement, backfilling, and all related work. Measurement shall not include frames/castings that are located along the face of curb.
   2. No separate measurement or payment for modifications at curb ramps, transition sections, catch basins, manholes and radii.
   3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Society of Testing Materials (ASTM)
   1. C260 - Air-Entraining Admixtures for Concrete.

B. State of Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction" - latest Edition and all current Supplements (WisDOT Spec.):
   1. 415 – Concrete Pavement.
   2. 416 – Concrete Pavement – Appurtenant Construction.
   3. 501 – Concrete.

1.04 SUBMITTALS

A. Submit one (1) 7-day and two (2) 28-day concrete cylinder test results for all concrete pours in any given day. All costs for testing will be paid by Contractor.

B. Submit design mix for concrete that will be used on the Project at the preconstruction conference. If mix design is not available at the time of the preconstruction conference, submit mix design at least 15 days before commencement of curb and gutter installation.

1.05 SEQUENCING AND SCHEDULING

A. Install concrete curb and gutter after concrete pavement has been completed and approved. Minimum cure time of 72 hours is required prior to backfilling curb and gutter.

B. Concrete curb and gutter construction shall precede installation of hot mix asphalt pavement.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete to Conform to WisDOT Section 501: Concrete:
   1. Portland Cement:
      a. Type A air-entraining concrete produced by using Type II air-entraining Portland Cement.
   2. Air-Entraining Admixtures:
      a. Conforming To: ASTM C260 "Air-Entraining Admixture for Concrete."
      b. Not to be added to the concrete mixtures in the field without approval from Engineer.
   3. Mix Designation and Classification for Concrete Curb and Gutter:
      a. Manual Placement: Grade A.
      b. Slip Form Placement: Grade A2.

B. Pre-Formed Joint Filler: Conform to WisDOT Spec. 415.2.3.

C. Curing Compound: Conform to WisDOT Spec. 415.2.4.

PART 3 EXECUTION

3.01 GENERAL

A. Provide copies of batch tickets for concrete mix at the time of material delivery to Site.

B. Construct concrete curb and gutter at the locations and elevations indicated on the Drawings.

C. Construct the style or type of curb and gutter as shown on the Drawings.

D. Construct intersection curb radii and transitions sections to conform to the detail on the Drawings.

E. Construct transition sections at inlet structures to conform to the detail on the Drawings.

F. Construct concrete curb ramp depressions to conform to the detail on the Drawings.

G. Construct curb transitions for driveways to conform to the detail on the Drawings. Locations to be verified by Engineer at the time of construction.

H. The completed concrete work shall give the appearance of uniformity in surface contour and texture, and shall be accurately constructed to line and grade. The required joints, edges, and flow lines shall show neat workmanship.

I. Retempering of the concrete which has partially hardened with or without additional materials or water is prohibited.

J. Full curb and gutter panels shall be removed and replaced for all major cracks, breaks, or chips greater than 1/2 inch.

K. All handwork to streets, sidewalks, driveways, and curb and gutter, including around catch basins, shall be mechanically vibrated with absolutely no voids or honeycombing allowed.

3.02 FOUNDATION PREPARATIONS

A. Support on a compacted aggregate base
   1. Conform to typical sections as shown on the Drawings.
   2. Conform to Section 32 11 23.

3.03 FORMS

A. Conform to WisDOT Spec. 601.3.3.

3.04 JOINT CONSTRUCTION

A. Conform to WisDOT Spec. 601.3.6, except as modified herein:
   1. Maximum spacing of expansion joints for slip formed shall be 200 feet.
   2. Place expansion joints at the PC and PT of horizontal curves.
   3. Place expansion joints 3 feet from each side of drainage structures
   4. Control joints 10 foot intervals.
   5. All expansion joints and control joints shall be uniform and cleaned 1/4 inch to 3/8 inch in depth.
   6. All expansion and control joints shall be tooled along entire top and front face of curb and gutter.
   7. All control joints shall be knifed through entire depth.
   8. All expansion joints shall be vertical, tooled, clean and flush with felt, no voids accepted.

3.05 PLACING AND FINISHING

A. Conform to WisDOT Spec. 601.3.4 and 601.3.5, except as modified herein:
   1. The top surface of the curb and gutter shall have a brush finish at right angles to the curb line.

3.06 CONCRETE CURING AND PROTECTION

A. Conform to WisDOT Section 415.3.12.2 and 415.3.16, except as modified herein:
   1. All surfaces shall be coated with membrane curing compound within 30 minutes after finishing at the specified rate.
   2. The membrane curing compound must contain a fugitive dye and be applied in 2 different directions perpendicular to each other.
   3. A second application of membrane curing compound shall be applied 4 to 8 hours after the first application at the specified rate.
   4. The freshly finished surface shall be protected, surfaces pitted by rain will be considered unacceptable.

5. Removal and replacement of any curb section damaged by traffic, rain, cold weather, or other causes occurring prior to the 72-hour curing period or final acceptance shall the responsibility of the Contractor.

B. Mixing and Protection During Cold Weather: Comply with WisDOT Section 415.3.15 - Cold Weather Concreting:
   1. A curing material that has water resistance, strength, and insulation properties will be required.

3.07 BACKFILLING

A. Initial Backfilling:
   1. Follow the 72-hour curing period with completion within 6 days of original placement.
   2. After acceptance, the Contractor shall immediately backfill behind the curb to preclude any erosion or undermining.
   3. Tolerance within 0.3 feet to the top of curb elevation.

B. Final Grading:
   1. Following completion of private utility work by others.

C. Curb damaged during backfilling is the responsibility of the Contractor.

3.08 WORKMANSHIP

A. Conform to WisDOT Spec. 601.3, except as modified herein:
   1. Any deviation in the design curvature of concrete edges in excess of 3/8 of an inch, measured with a 10-foot straight edge, will be considered unacceptable.
   2. Acceptance of work by price reduction will not be allowed.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Pavement markings for control and guidance of traffic.

B. Related Sections
   1. Section 32 12 16 – HMA Pavement.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Pavement and Curb Markings shall be measured by the lineal foot on the basis of length actually applied. The following Bid Items shall apply:
      a. **Marking Stop Line Epoxy, 24-Inch.**
   2. Bid Items for pavement markings are provided. Payment of each Bid Item shall be compensation in full for all costs incidental thereto, including but not limited to surface preparation, traffic control measures, maintaining the Work, for providing all markings, and for replacing marking improperly constructed or that fails during the proving period, together with any other expenses incurred in completing the Work that are not specifically included for payment under the Contract Bid Items.
   3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. State of Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction" - latest edition including all current supplements (WisDOT):
   1. 646 – Pavement Markings.
   2. 647 – Special Pavement Markings.

1.04 SUBMITTALS

A. 1 copy of the chosen epoxy formulation.

B. Pavement Marking Contractor Qualifications/Certifications.

C. WisDOT Certification approvals.

1.05 SEQUENCING AND SCHEDULING

A. Conform to the requirements of WisDOT Specifications.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver paint and materials to the job side unopened, in manufacturer's containers legibly marked with the contents by color, batch number, date manufactured, and manufacturer's name and address. Do not use material more than one year old.

PART 2 PRODUCTS

2.01 MATERIALS

A. Epoxy
   1. Conform to WisDOT Approved Products List (APL).

2.02 EQUIPMENT

A. Use specified equipment, as stated in WisDOT Spec. 646.3.2.2 and 646.3.2.3.

PART 3 PART 3 EXECUTION

3.01 GENERAL

A. Prepare pavement for wet reflective epoxy per WisDOT Spec. 646.3.1.1.

B. The pavement marking crew shall include at least 1 technical expert knowledgeable in each of the following areas:
   1. Equipment operation.
   2. Application techniques.
   3. Traffic control.
   4. Safety regulations.

C. The filling of tanks, pouring of materials, or cleaning of equipment shall not be performed on unprotected pavement surfaces, unless adequate provisions are made to prevent spillage of material.

3.02 SCHEDULE

A. Pavement markings
   1. Place following completion of asphalt surface course:
      a. No sooner than 24 hours after placement of asphalt.
      b. Within 5 working days of completion of asphalt placement.

3.03 PREPARATION

A. Locations
   1. Pavement markings shall be installed to match existing markings or as directed by the City.

B. Street Surface
   1. Engineer may direct cleaning of surface as necessary immediately prior to marking application:
      a. Brushing with non-metallic rotary broom.
      b. Other cleaning method approved by Engineer.

c. Air blast following cleaning.
2. Surface must be dry.
3. Minimum surface temperature is 50 degrees F.

3.04 APPLICATION

A. Apply paint per WisDOT Spec. 646.3.1.2 over all pavement marking locations.

B. General
1. Tolerance
a. Width: A tolerance of 1/4 inch under or 1/4 inch over the specified width will be allowed for striping provided the variation is gradual and does not detract from the general appearance.
b. Alignment: Deviations from the control guide shall not exceed 2 inches.
c. Establishment of application tolerances shall not relieve the Contractor of his responsibility to comply as closely as practicable with the planned dimensions.
2. Conditions
a. Markings shall not be applied when wind or other conditions cause a film of dust to be deposited on the pavement surface after cleaning and before the marking material can be applied.
b. Except when used as a temporary marking, pavement markings shall only be applied in seasonable weather when air temperature is 50 degrees F or higher.

3.05 CORRECTION OF DEFECTS

A. All pavement markings not conforming to the requirements of the Specifications shall be removed and replaced, or otherwise repaired to the satisfaction of the Engineer.

B. Where yield computations show a deficiency in material usage of not more than 20 percent, Owner may require satisfactory repair or may accept the Work at a reduced Bid Unit Price that is in direct proportion to the percent of the deficiency.

C. Where yield computations show a deficiency in material usage in excess of 20 percent, Owner will require removal and replacement to the satisfaction of the Engineer, unless other means are approved by the Engineer.

D. If removal and replacement is required, at least 90 percent of the deficient line shall be removed.

E. Width of removal shall be 1 inch wider on all sides than the nominal width of the marking to be removed.

F. Removal of unacceptable Work shall be accomplished with suitable blasting or grinding equipment, unless other means are authorized by the Engineer. Asphalt street surfacing shall not be damaged by the removal operation.

END OF SECTION

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SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Chain link fencing.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Chain Link Fence, 6-feet**. Measurement and Payment for fence work shall be by the linear foot basis as listed on the Bid Form. Payment shall include all gates, accessories, and footings.
2. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. A392 - Zinc - Coated Steel Chain - Link Fence.
2. A491 - Aluminum - Coated Steel Chain - Link Fence Fabric.
3. A817 - Metallic - Coated Steel Wire for Chain - Link Fence Fabric and Marcelled Tension Wire.
4. A585 - Aluminum - Coated Steel Barbed Wire.
5. C94 - Ready Mix Concrete.

1.04 SUBMITTALS

A. Shop drawings consistent with Division 01, showing typical layout, elevation, and section drawings for fences and gates. Show installation details for all end, corner, and line posts.

PART 2 PRODUCTS

2.01 RAILS AND POSTS

A. In accordance with ASTM F1043, PVC shall be applied to the pipe and hardware by the fusion bonding process (thermally fused) and adhered to a primer that is thermally cured to the galvanized steel to produce a vinyl thickness of 10 to 14 mils.

B. Top Rails and Brace Rails
1. 1-5/8 inches O.D. standard pipe, 2.27 lb/ft or 1-5/8 inches by 1-1/4 inches roll form section with a minimum bending strength of 192 lbs.
2. Zinc coating of 2 oz./sq.ft. of surface.
3. Securely fastened as per manufacturer's recommendations.

C. Line Posts
   1. 2-1/2 inches O.D. standard pipe weighing not less than 3.65 lb/ft or 1-7/8 inches by 1-5/8 inches roll form section with a minimum theoretical bending strength of 201 lbs. under a 6-foot cantilever load.
   2. Zinc coating of 2 oz./sq.ft. of surface.
   3. Minimum Length: 6 feet above finished grade.

D. End, Corner, and Gate Posts
   1. 3 inches O.D., Schedule 40 pipe with a weight of 5.79 lb/ft, or 3-1/2 inches by 2-1/2 inches roll form shape of equal strength. Drive gate posts shall be 6-5/8 inches O.D., 18.97 lbs./ft.
   2. Zinc coating of 2 oz./sq.ft. of surface.
   3. Minimum Length: 6 feet above finished grade.

E. Bottom Tension Wire
   1. 7-gauge aluminum coated with minimum tensile strength of 80,000 psi.

2.02 MISCELLANEOUS

A. Ties
   1. 9-gauge aluminum wire at 2 feet on center on top and bottom rod and 12 inches on center posts.

B. Fittings
   1. Necessary fittings shall be of malleable iron hot dipped galvanized after fabrication.
   2. Provide caps on pipe posts and pipe gate stiles.

C. Concrete Mix
   1. Conform to ASTM C94 Portland Cement Concrete with maximum 3/4-inch aggregate having a minimum compressive strength of 3,000 psi at 28 days.

D. Gates
   1. Size and location as shown on Drawings.
   2. Gate shall have positive type latching devices with padlock provisions.
   3. Fabric: Same as required in Article 2.01 – Chain Link Fabric.
   4. Provide gate supports as recommended by the manufacturer.

E. Galvanizing
   1. All fencing components, including gates, posts, and all accessories, are to be hot dipped galvanized (2 oz./sq.ft. surface) or otherwise be corrosion resistant.

PART 3 EXECUTION

3.01 WORKMANSHIP

A. All posts shall be set true to line and grade as shown on the Drawings to provide a neat appearance.

B. All fabric shall be tightly stretched and neatly secured to posts and rails.

C. Fence shall be complete in every respect, including items recommended by the manufacturer for first quality construction.

3.02 POST SETTING

A. All end, corner, pull, and gate posts shall be set in concrete 12 inches diameter by 42 inches deep.

B. Line posts may be driven to a minimum depth of 5 feet or set in concrete 12 inches diameter by 42 inches deep.

C. Line posts shall be evenly spaced on maximum 10-foot centers.

D. End, corner, pull, and gate posts shall have braces with the same material as top rail and trussed to line posts with 3/8-inch rods and tighteners.

END OF SECTION

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SECTION 32 92 00

TURF AND GRASSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Restoration of construction area by installation of topsoil, seed, sod, soil amendments, mulch, and erosion control.

B. Related Sections
1. Section 01 57 13 - Temporary Erosion and Sediment Control.
2. Section 31 23 00 - Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Seed, Fertilizer, and Mulch**. Measurement will be by the square yard. Payment at the Contract Bid Unit Price will include the following:
   a. Seed: Payment will be considered full compensation for providing, handling, and storing all seed; for providing the required culture and inoculating seed as specified; and for preparing the seed bed, sowing, covering and firming the seed. No payment for fertilization or seeding the pit or material disposal site will be made without the Owner's approval.
   b. Fertilizer: Payment will be considered full compensation for providing, hauling and placing the material.
   c. Mulch: Payment will be considered full compensation for providing all materials, including tackifiers and nitrogen; for all hauling, treating, placing, spreading and anchoring of the mulch material; and for maintaining the Work and repairing all damaged areas.
   d. Payment will be considered full compensation for watering, mowing and maintaining prior to final acceptance and for all labor, tools, equipment, and incidentals necessary to complete the Work.
2. Topsoil will be paid for according to Section 31 23 00.
3. All other Work and costs of this Section shall be considered included in the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements
1. 625 – Topsoil and Salvaged Topsoil.
2. 627 – Mulching.
3. 629 – Fertilizer and Agricultural Limestone.
4. 630 – Seeding.

1.04 SUBMITTALS

A. Provide the following submittals consistent with Section 01 33 00.

B. Provide nursery source and invoice for seed to be purchased for this Project.

C. Producer's Certificate of Compliance - Written document verifying compliance of mixture of seed furnished. Submit to the Engineer 5 days prior to delivery. Include percentage of various seed species mix, year of production, net weight, date of packaging, location of packaging, seed bags/tags (germination rate, weed seed content), and copy of seed dealer's invoice.

D. Fertilizer manufacturer's certificate of compliance. Written document verifying compliance with fertilizer specified.

E. Label from soil moisture amendment product, if utilized.

1.05 PLANT ESTABLISHMENT PERIOD

A. At the conclusion of the establishment period, which will be 1 year following initial installation, a final inspection of planting will be made to determine the conditions of areas specified for seeding. All areas with insufficient plant establishment as determined by the Engineer will be noted. This material shall be re-supplied and planted in the next growing season at no additional cost to the Owner.

B. The expectations for the seeded areas are as follows:
   1. In order to qualify for acceptance all lawn areas shall have had two mowing before final inspection and shall have a good clean stand of grass.
   2. Seeded areas must show indications of healthy establishment (90 percent of species occurring are those seeded) in the specified areas and weed species are less than 10 percent.

1.06 FIELD QUALITY CONTROL

A. Provide Engineer with seed bag tags used for identification purposes.

B. "Pick rocks" from topsoil that are larger than 1-inch in diameter.

C. All topsoil shall be approved by the Engineer prior to seeding and sodding.

PART 2 PRODUCTS

2.01 TOPSOIL: Conform to Section 31 23 00.

A. All topsoil shall be screened and pulverized.

2.02 FERTILZER

A. All fertilizer shall conform to WisDOT Section 629. Fertilizer shall be Type A as specified in Section 629.2.1.2 of the State Specifications.

2.03 SEED: Conform to WISDOT Spec. 630 – No. 75 Seed Mixture.

A. Seed mix shall conform to the requirements of WisDOT Section 630. The composition of the seed mixture shall be No. 75 at an equivalent seeding rate of 0.7 pounds Per 1,000 square feet.

2.04 MULCH: Conform to Section 01 57 13.

2.05 HYDRAULIC SOIL STABILIZER (HYDROMULCH): Conform to Section 01 57 13.

2.06 EROSION MATTING: Conform to Section 01 57 13.

PART 3 EXECUTION

3.01 EXAMINATION

A. Review restoration areas with the Engineer. Determine locations for seed or sod. Schedule for restoration of areas may be revised to fit field conditions.

B. Notify the Engineer at least 3 days in advance of hauling topsoil borrow on Site so the Engineer may visually inspect and sample for testing if deemed necessary.

C. Finish grades are to be inspected and approved by the Engineer prior to start of restoration.

3.02 DELIVERY AND STORAGE

A. Delivery
1. Notify the Engineer of the delivery schedule in advance so the plant material may be inspected upon arrival at the Site. Remove unacceptable plant material from the Site immediately.
2. Deliver fertilizer and lime to the Site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name or trademark, and in conformance to state and federal law. In lieu of containers, fertilizer and lime may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.
3. During Delivery: Protect seed from contamination.

B. Storage
1. Sprinkle seed with water and cover with moist burlap, straw, or other approved covering, and protect from exposure to wind and direct sunlight. Covering should permit air circulation to alleviate heat development.
2. Keep seed, lime, and fertilizer in dry storage away from contaminants.

3.03 PREPARATION

A. General: Conform to WisDOT Spec. 630.3.

B. Soil Preparation: Conform to WisDOT Spec. 630.3.2.

C. Fertilizers and Conditioners: Conform to WisDOT Spec. 629
1. Apply fertilizer at a rate of 305 lbs. per acre (7 lbs./1,000 sq. ft.).
2. The fertilizer used shall be a commercial grade slow-release complete fertilizer.
3. Where soil pH is lower than 5.5, apply lime at 2.2 tons per acre (100 lbs./1,000 sq. ft.).

3.04 SOWING SEED

A. Seeding Dates: Conform to WisDOT Spec. 630.

B. Seeding Preparation and Application: Conform to WisDOT Spec. 630.3 for the mixes specified.

C. Seeding Rates: Conform to WisDOT Spec 630.3.5.

D. Applying Mulch: Conform to WisDOT Spec 627.3.2 and apply at a rate of 2 tons per acre (90 lbs./1,000 sq. ft.).

E. Sowing Seed: Conform to WisDOT Spec. 630.3.3.
   1. Winter and Summer: At the approval of the Engineer.
   2. Deviations in planting schedule from WisDOT Spec 630 will be at the approval of the Engineer.

F. Disk anchoring shall be considered incidental to placement of Seed and Mulch Material.

3.05 MULCH: CONFORM TO SECTION 01 57 13.

3.06 EROSION MATTING: CONFORM TO SECTION 01 57 13.

3.07 HYDRAULIC SOIL STABILIZER (HYDROMULCH): CONFORM TO SECTION 01 57 13.

3.08 TOPSOIL

A. Place topsoil subgrade. Final in place depth shall be as shown on the drawings.

B. Surface of topsoil shall conform to the final grade.

C. Place topsoil so as not to compact underlying soils. Do not compact topsoil.

3.09 COMPOST

A. When Compost is specified, thoroughly mix specified compost with specified topsoil prior to placement.

3.10 SOIL MOISTURE AMENDMENT

A. Apply per manufacturer's recommendations.

B. Thoroughly mix with topsoil and compost mixture prior to placement.

C. This item shall be incidental to the Work.

3.11 TURF ESTABLISHMENT

A. Water seeded areas as necessary during the establishment period to provide establishment of turf over 90-percent per each square foot of seeded areas.

3.12 MAINTENANCE

A. Maintain restored areas in accordance with WisDOT Spec. 630.3.6 and 630.3.7. Contractor is responsible for all maintenance activities as required to ensure proper seed growth, including but not limited weed control, watering, and mowing.

B. Restored areas that have been satisfactorily completed and are disturbed by additional construction activity required by the timing and sequencing of the Work shall be restored over to the same requirements of the original work.

C. Watering of seeded areas shall be done throughout the establishment period to ensure establishment of permanent vegetation. The Contractor will work together with the Owner to create a watering schedule to help ensure proper watering of the seeding areas. The watering must be approved prior to occurring by the Owner, and water tickets for seeded areas only must be submitted to the Engineer on a weekly basis.

3.13 INSPECTION AND ACCEPTANCE

A. Seeding and turf work will be inspected for acceptance in parts agreeable to the Engineer, provided Work offered for inspection is complete, including maintenance for the portion in question.

B. At the conclusion of the establishment period(s), a final inspection of planting(s) will be made to determine the conditions of areas specified for landscaping.
   1. All permanent seed species within the applied mix shall be uniformly established over the seeded area.
   2. The acceptance of the seed establishment shall be at the Engineer's discretion.

C. When inspected landscape work does not comply with requirements, replace rejected Work and continue specified maintenance until re-inspected by Engineer and found to be acceptable. Remove rejected materials from the Site.

D. Seed evaluation at the conclusion of the establishment period shall be based on at least 1 species per square foot and 90-percent of seeding per square foot is of the permanent seed species within the applied mix.

END OF SECTION

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SECTION 33 05 05

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Trenching requirements for underground piping and appurtenances, including requirements for excavation, backfill, and compaction.

B. Related Sections
1. Section 31 10 00 - Site Clearing.
2. Section 33 10 00 - Water Utilities.
3. Section 33 12 12 – Water Services.
4. Section 33 31 00 - Sanitary Utility Sewer Piping.
5. Section 33 39 00 – Sanitary Utility Sewer Structures.
6. Section 33 40 00 - Storm Drainage Utilities.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Trench Excavation: Excavation and backfilling of trench shall be included in the price of pipe provided.
2. Pipe Bedding: Considered incidental and shall be included in the price of pipe furnished and installed.
3. Temporary Bracing and Sheeting: Considered part of the excavation costs with no additional compensation to Contractor, unless provided for otherwise.
4. Density Tests may be required upon Owner's request.
   a. Passing Tests: All costs paid by Owner.
   b. Failing Tests: All costs charged to and paid by the Contractor.
5. No payment will be made for dewatering. All costs to dewater trenches shall be incidental to the appropriate bid item.
6. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Standard Specifications for Sewer & Water Construction in Wisconsin, 2003 Edition (Green Book)
1. 2.20 - Excavation.
2. 2.6.2 - Granular Backfill.

B. American Society of Testing Materials (ASTM)
1. C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.
2. D698 - Test Method for Laboratory Compaction Characteristics for Soil Using Standard Effort (12,400 ft-lbf/ft).
3. D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

1.04 SUBMITTALS

A. Provide the following submittals consistent with Section 01 33 00:
   1. Product Data for each Borrow Material:
      a. Name and location of source.
      b. Results of gradation tests.

1.05 DEFINITIONS

A. Bedding: The soil material adjacent to the pipe which makes contact with the pipe foundation, walls of the trench, and upper level of backfill. The purpose of bedding is to secure the pipe to true line and grade, and to provide structural support to the pipe barrel.

B. Foundation: Soil material beneath the pipe bedding.

C. Improved Pipe Foundation: Foundation provided by importing material from sources outside the Site. Required when foundation is soft or unstable.

D. Filter Aggregate: Free draining mineral product used around drain tile pipe.

E. Rock Excavation: Includes such rocks that are not decomposed, weathered, or shattered, and which will require blasting, barring, wedging, or use of air tools for removal. Also included are any boulders, concrete, or masonry structure (except concrete pavement, curb and gutter, and sidewalk) exceeding 1 cubic yard.

F. Pipe Zone: That part of the trench below a distance of 1-foot above the top of the pipe.

G. Sand Cushion: Aggregate bedding material used around pipe in areas where rock excavation is encountered, where pipe insulation is used, and when crossing existing utilities.

1.06 SEQUENCING AND SCHEDULING

A. Known existing underground utilities are shown on the Drawings in a general way. Owner does not guarantee the locations as shown on the Drawings. Contractor shall anticipate variations in both the vertical and horizontal locations of underground utility lines from those shown on the Drawings.

B. Uncover utilities and verify both horizontal and vertical alignments sufficiently in advance of construction to permit adjustments in the Work. Determine location of existing utilities and identify conflicts before excavating trench for pipe installation.

C. Notify Diggers Hotline before starting construction in a given area, requesting utility locations in the field.

D. Provide continuance of flow of existing sewer and other facilities.

E. Backfill and compact all trench excavations promptly after the pipe is laid.

1.07 WARRANTY

A. Trench settlements that occur during the correction period and are greater than 1/2-inch as measured from the beginning to the end of the settlement, as determined by the Engineer, will be repaired in a manner acceptable to the Owner at the Contractor's expense.

PART 2 PRODUCTS

2.01 PIPE BEDDING MATERIAL

A. Material shall conform to Chapter 8.43.2 of the Standard Specifications for Sewer and Water Construction in Wisconsin.

2.02 IMPROVED PIPE FOUNDATION MATERIAL

A. Comply with WisDOT Section 209, Grade 1:
   1. Crushing Requirements: At least 50 percent of the material by weight retained on the No. 4 sieve shall have 1 or more crushed faces.

2.03 SAND CUSHION MATERIAL

A. Material shall conform to Section 8.43.2.c of the Standard Specifications for Sewer and Water Construction in Wisconsin:
   1. No onsite granular material encountered during construction may be used.
   2. 1-inch maximum aggregate size.

2.04 BACKFILL MATERIAL

A. Granular Backfill (under and within 5 feet of pavement surfaces ONLY)
   1. Comply with Chapter 8.43.4 of the Standard Specifications for Sewer and Water Construction in Wisconsin.

B. Excavated Material:
   1. Minimum of 5 feet outside pavement surfaces and as directed by the Engineer.
   2. Suitable materials selected from the excavated materials to the extent available and practical.
   3. Suitable materials are mineral soils free of rubbish, trees, stumps, branches, debris, frozen soil, oversize stone, concrete and asphalt chunks, and other similar unsuitable material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to construction, inspect existing utility structures and surface features, and document condition.

B. Re-inspect foundation soils if rain fall or snow has occurred after initial inspection but prior to placing pipe and bedding.

3.02 PREPARATION

A. Notify Utility Owners to field mark their utility locations.

B. Protect as necessary surface features, such as utility poles, trees, structures, pavement, etc., that are not designated on the Drawings to be removed.

C. Notify utility companies of progress schedule so they can accomplish any necessary relocations and removals that they have agreed to relocate, remove, or support.

D. Implement traffic control.

E. Complete temporary removal or relocation of surface features, such as fences, shrubs, signs, and mailboxes.

F. Strip off existing topsoil from within the trench excavation limits and stockpile. Separate vegetative strippings from salvageable topsoil and dispose of appropriately.

G. Crossing Under Existing Utility Lines
   1. Use extreme care when excavating in the vicinity of underground utility lines to avoid damage to protective coatings or surfaces.
   2. Where possible and as authorized by the utility, temporarily remove the utility line, install the new pipe, and reinstall the utility line.
   3. Where existing line cannot be removed, or is not feasible to remove, securely support, excavate under, backfill under and around the utility line to 100-Percent Standard Proctor Density.
   4. Report and repair damaged lines prior to backfilling trench.

3.03 CONSTRUCTION

A. Conform to ASTM C2321, or modified herein.

B. Trench Excavation
   1. Excavate trench to alignment and grade shown on the Drawings.
   2. The trench width at the surface may vary and depends on the depth of trench and nature of the excavated material encountered. However, it shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly.
   3. Correct any part of the trench that is inadvertently excavated below grade with approved material compacted to 100-Percent Standard Proctor Density.
   4. Brace, shore, or sheet trench and provide drainage. Comply with applicable State Regulations relating to industrial safety to a safe angle of repose. Angle of repose may be no less than that required by the Accident Prevention Division of the State Industrial Commission or the requirements of the Occupational Safety and Health Act (OSHA), whichever is most restrictive.
   5. Pile all excavated material in a manner that will not endanger the Work or obstruct sidewalks, driveways, gutters, etc.
   6. Segregate soils in the excavated material that are not suitable for trench backfill and dispose of in a manner that is consistent with the requirements specified herein under "Backfill Above Pipe Zone."
   7. Dispose of excess excavated materials off of right-of-ways and easements in a suitable site selected by the Contractor.

8. Haul materials, other than natural soil materials that are suitable as backfill material, to an approved landfill as directed by the Engineer.

C. Water Control
   1. Dewater the ground as necessary to excavate the trench and install the pipe. All pipe and structures shall be laid in a dry condition prior to backfill. Maintain groundwater level a minimum of 1 foot below the pipe invert. Measure the rate of flow from dewatering pumps at the beginning of the dewatering operation(s) and once per week thereafter. Keep a daily log of hours pumped.

D. Trench Bottom
   1. Excavate to a sufficient depth to insure adequate foundation when the bottom of the trench is soft or where in the opinion of the Engineer unsatisfactory foundation conditions exist. Bring excavation up to pipe grade with thoroughly compacted granular materials meeting the requirements of Improved Pipe Foundation Material.
   2. Provide temporary support, remove, relocate, or reconstruct existing utilities located within the trench excavation. Utility shall designate method employed. Use particular care and provide compacted fill or other stable support for utility crossings to prevent detrimental displacement, rupture, or failure.
   3. Excavate to expose existing utilities that cross in close proximity to the planned pipeline to determine the utilities' exact location sufficiently ahead of pipe installation to plan for the avoidance of grade conflict. Measure to determine the utilities' location relative to the planned pipeline location. A deviation from the alignment, grade, and location to avoid conflict may be ordered by the Engineer.
   4. In locations where rock affects the pipe foundation, excavate the trench 6 to 12 inches below the pipe and place sand cushion material up to the proposed invert elevation. The remainder of the trench up to the top of rock elevation shall be backfilled with granular backfill material
      a. Sand Cushion: The removal and disposal of the unsuitable material within the trench and below the invert elevation, and the replacement up to invert elevation with the appropriate bedding material.
      b. Granular Backfill: The removal and disposal of unsuitable material within the trench, above the invert elevation, and replacement up to the surface with appropriate backfill material. No additional compensation will be allowed for wider or deeper trenches in rock excavations.
      c. For PVC and HDPE Pipe, the sand cushion shall be placed to 1 foot above the pipe and shall be paid as pipe bedding. The remainder of the trench up to the top of the rock shall be backfilled with granular backfill material.
   5. Improved Pipe Foundation: When unsatisfactory foundation conditions exist, excavate to a depth consisting of solid materials. Fill to pipe grade with thoroughly compacted granular materials meeting the requirements of Improved Pipe Foundation Material.

3.04 PIPE BEDDING

A. Use only selected materials free from rock, boulders, debris, or other high void content substances to a level 1 foot above the top of pipe. Remove ledge rock, boulders, and large stones to provide at least 6-inch clearance from pipe.

B. Dig bell holes of ample dimension at each joint such that the pipe barrel rests continuously on the bedding.

3.05 BACKFILL WITHIN PIPE ZONE

A. Backfill immediately after pipe is laid. Restrain pipe as necessary to prevent their movement during backfill operations.

B. Place material completely under pipe haunches in uniform layers not exceeding 4 inches in depth.

C. Hand (shovel) tamp along pipe within haunch zone.

3.06 BACKFILL ABOVE PIPE ZONE

A. Use suitable materials meeting the requirements of Backfill Material.

B. Place in uniform depth layers not to exceed 12-inches before compaction. Complete the compaction of each layer before placing material for the succeeding layer.

C. Compact each layer by mechanical means until it meets the requirements of Wisconsin Green Book Section 2.6.14.b. Trenches shall be compacted to a minimum of 95-percent, except to 100-percent in the upper 3-feet. If the moisture content of the backfill materials is greater than 3-percent above the optimum moisture, compact the materials to a minimum density of 3 pounds/cubic foot less than the Standard Proctor Curve at that moisture content, except that minimum compaction shall be 85-Percent of Standard Proctor Density.

D. The method and means of placement and type of compaction equipment used is at the discretion of the Contractor. However, all portions of the trench backfill must meet minimum specified compaction requirements.

E. Any deficiency in quantity of backfill material (caused by shrinkage or settlement) shall be supplied at no additional cost to the Owner.

F. Excavated material not suitable or required for backfill shall be disposed of outside of the Site.

3.07 RESTRICTED TRENCH WIDTH

A. Restrict width of trench to conform to construction limits indicated on the Drawings and where directed by the Engineer to prevent damage to specimen trees or adjacent structures.

3.09 QUALITY CONTROL

A. Density Tests: To be performed by an approved soils testing firm at various locations and depths throughout the Site as directed by the Engineer. The Contractor shall cooperate fully and provide assistance as necessary to complete these tests.

B. Failed density test areas shall be excavated and re-compacted until the density requirements are met.

END OF SECTION

SECTION 33 05 17

ADJUST MISCELLANEOUS STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Adjustment of utility structures.

B. Related Sections
1. Section 33 10 00 – Water Main Utilities.
2. Section 33 31 00 – Sanitary Utility Sewer Piping.
3. Section 33 39 00 – Sanitary Utility Sewer Structures.
4. Section 33 40 00 – Storm Drainage Utilities.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. **Adjusting Manhole Frame and Ring Casting**: Adjustment of the manhole frame and ring castings will be measure and paid for per Each casting adjustment made. Payment shall include removing and salvaging the existing frame and lid, removing and disposal of concrete rings, installing new rings and mortar, external and internal seals, and replacing salvaged frame and lid.
2. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM)
1. ASTM A48 – Specification for Gray Iron Casting.
2. ASTM A240 – Specification for Heat – Resisting Chromium – Nickel Stainless Steel Plate Sheet and Strip for Pressure Vessels.
3. ASTM C6 – Specification for Normal Finishing Hydrating Lime (Mortar).
4. ASTM C141 – Specification for Hydraulic Hydrated Lime for Structural Purposes (Mortar).
5. ASTM C150 – Specification for Portland Cement (Concrete Rings/Mortar).
6. ASTM C923 – Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Materials.
7. ASTM D1248 – Polyethylene Plastics Molding and Extrusion Materials.
8. ASTM F593 – Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
9. ASTM F594 – Specification for Stainless Steel Nuts.

1.04 DEFINITIONS

A. Adjust Frame and Ring Casting: A change in rim elevation accomplished for manholes or catch basins through the addition or removal of adjustment rings only. Adjustment does not include the addition or removal of sections from the structure.

B. Remove and Replace Adjustment Rings: The process of removing the existing concrete adjustment rings from an existing structure and placing new rings on manholes and catch basins.

1.05 SEQUENCING AND SCHEDULING

A. Contractor, Engineer, and Owner shall inspect all existing structures prior to beginning construction.

B. Owner will remove any foreign material found in the existing structures prior to construction. Contractor is responsible for removing any foreign material that enters the structures during construction.

PART 2 PRODUCTS

2.01 ADJUSTING RING

A. Concrete
   1. Size to match cone or opening in top slab.
   2. Concrete Compressive Strength: Minimum 3,000 psi.
   3. Reinforcing: Single hoop 8-gauge steel wire.
   4. Thickness: Minimum 2-inches, maximum 4-inches.

B. High-Density Polyethylene (HDPE)
   1. Molded high-density polyethylene conforming to ASTM D1248.

2.02 ADHESION MATERIALS

A. Ram-Nek material, or approved equal.

B. Mortar
   1. Standard Portland Cement: Type I, ASTM C150.
   2. Normal Finishing Hydrated Lime: ASTM C6.
   3. Hydraulic Hydrated Lime for Structural Purposes: ASTM C141.
   4. Mix Proportions: 1-part cement to 3-parts mortar sand; lime may be added to mixture: maximum amount 15-percent by volume.

2.03 EXTERNAL/INTERNAL SEALS

A. External Seals Approved Manufacturer: Infra-Shield, or approved equal
   1. Multiple section seal system.
   2. Top section made of neoprene rubber.
   3. All other sections made of EPDM rubber; 60 mil minimum thickness, 8-inches minimum height for extension sections.
   4. Mastic: ASCO ST-30, BIDCO C56, or approved equal.

B. Internal Seals Approved Manufacturer: Cretex Type Chimney Seal, or approved equal
   1. Sleeves and Extensions: Minimum thickness 3/16-inch, extruded or molded high grade rubber compound conforming to ASTM C923; 1,500-psi tensile strength, maximum 18-percent compression set and hardness.
   2. Bands: Used for compressing the sleeve and extension against the manhole: 16-gauge stainless steel conforming to ASTM A240, Type 304, screws, bolts, and nuts of stainless-steel conforming to ASTM F593 and F594, Type 304.

2.04 CASTINGS

A. Manhole, Catch Basin Frames, and Covers
   1. Requirement: ASTM A48.
   2. Material: Class 35 cast iron. Best grade. Free from injurious defects and flaws.
   3. Finish Preparation: Sandblast.
   4. Machine cover and frame contact surface for non-rocking protection.

2.05 GEOTEXTILE

A. Woven filter fabric, 4-1/2 ounces for use in conjunction with HPDE rings.

PART 3 EXECUTION

3.01 GENERAL

A. The necessary vertical alignment will be determined by the Engineer and generally as indicated on the schedule of adjustments.

B. Where existing frame is within 0.10-feet of grade, no adjustment is to be made.

C. The frame shall be raised or lowered to match the street or gutter.

D. Protect existing structures from damage.

E. Prevent sand, concrete, or any other debris from entering the structures.

3.02 PREPARATION

A. Call utility owners to field mark their utility locations.

B. Contractor to verify exact location of existing utilities.

3.03 ADJUST FRAME AND RING CASTING

A. Remove all dirt, debris, dust, and other deleterious material from surface prior to placement of first adjusting ring.

B. Concrete Adjusting Ring
   1. Mortar on top and bottom surfaces of all concrete adjusting rings; between surface of top slab or cone and bottom ring; between surface of top ring and casting; on entire surface of area of ring with no gaps
      a. Mortar Thickness: 1/4 to 1/2-inch.
   2. No shims of any material allowed.
   3. Required cross slope of casting to be achieved by varying thickness of mortar.
   4. Do not plaster the inside surface of rings.
   5. Wipe clean all excess mortar from the joints inside all rings and frame.
   6. Remove all mortar spills from the structure.
   7. Minimum of 2, maximum of 5, 2-inch adjusting rings allowed.
      a. Adjustments requiring more than 5 rings shall be brought to the Engineer's attention immediately and an agreed upon price will be determined for the necessary reconstruction.
   8. Use a 6-inch ring where applicable.

3.04 INSTALLATION OF EXTERNAL/INTERNAL SEAL SYSTEM

A. Infra-Shield Type (External Seal)
   1. Remove all dirt, debris, dust, and other deleterious material from surfaces of structure, rings, and casting prior to installation of seal system.
   2. System to be installed per manufacturer's recommendation.
   3. Secure bottom section to top slab or cone, top section to casting flange with mastic.
   4. Minimum of 2-inches overlap required between top and bottom sections of seal system
      a. If minimum overlap is not achieved, extension section(s) must be inserted between the top and bottom sections until 2-inches overlap at all seams between all sections of the seal system is achieved.
   5. Secure all seams between sections with mastic
      a. Mastic to be installed continuously around entire perimeter of section with no gaps.

B. Cretex Type (Internal Seal)
   1. Remove all dirt, debris, dust, and other deleterious material from surfaces of structure, rings, and casting prior to installation of seal system.
   2. System to be installed per manufacturer's recommendation.
   3. Complete the installation of rings and casting prior to installation of seal system.
   4. Secure top stainless-steel band to flange of casting.
   5. Secure bottom stainless steel band to exterior of adjusting rings.

3.05 REMOVE EXISTING AND PLACE NEW MANHOLE AND CATCH BASIN FRAME

A. Remove and dispose of frame and casting as indicated on the Drawings.

B. Place new adjustment rings conforming to Section 3.03 – Adjust Frame and Ring Casting.

C. Install new frame and casting.

D. Patch road to match existing pavement section.

E. Dispose of removed material off Site.

3.06 FIELD QUALITY CONTROL

A. For adjustments made within bituminous surfaced areas, any settlements of the bituminous surface greater than 3/8-inch below the rim of the adjustment structure will require removal and replacement of the bituminous surfacing at the Contractor's expense.

B. Secure manholes and structures immediately after completion or before suspension of operations at the end of working day with castings or suitable alternative device.

C. Adjust Manholes and Catch Basin Frames 1/8 inch below grade prior to placing the final wear course. Thorough tamping of the material around manhole and catch basin frames is required. Where existing frame is within 0.10 feet of grade, no adjustment is to be made. In such cases the crown or gutter shall be either lowered or raised, as the case may be, to put the street and frame at the same grade.

D. Adjust frame upward with standard concrete adjustment rings of the same size as the cone or slab opening. Place each adjustment ring and frame in a full mortar bed.

Adjusting rings needed to raise the casting to grade shall be incidental to the adjustment pay item.

E. Adjust frame downward by removing the necessary number of adjustment rings from the structure and resetting the frame in a full mortar bed to grade.

F. Regardless of the direction of adjustment, no shims of any material will be allowed. The minimum thickness of all mortar joints shall be at least 1/4-inch with a maximum allowable thickness of 1/2-inch. All excess mortar from the joint shall be wiped clean from the inside of all rings and frame. All manhole castings must be replaced prior to the placing of the final wear course.

END OF SECTION

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SECTION 33 05 22

STEEL CASING PIPE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Minimum requirements for manufacturing, furnishing, and transporting Steel Casing Pipe to be installed at the locations shown on the Drawings.

B. Related Sections
1. Section 33 05 05 – Trenching and Backfilling.
2. Section 33 05 23.13 – Utility Horizontal Directional Drilling.
3. Section 33 08 30 – Commissioning of Sanitary Sewer Utilities.
4. Section 33 10 00 – Water Utilities.
5. Section 33 12 12 – Water Services.
6. Section 33 31 00 – Sanitary Utility Sewer Piping.
7. Section 33 39 00 – Sanitary Utility Sewer Structures.

1.02 PRICE AND PAYMENT PROCEEDURES

A. Measurement and Payment
1. Bid Items have been provided for **Steel Casing Pipe, (Size).** Measurement shall be on the basis of units of lineal feet for each size measured horizontally along the centerline length of Steel Casing Pipe installed. The unit price for Steel Casing Pipe shall include furnishing and installing Steel Casing Pipe as specified, excavation below roadway subgrade, hauling, disposal of excess material, furnishing, placement, and compaction of embedment, furnishing, placement, and compaction of backfill up to roadway subgrade.
   a. Payment for pavement removal, excavation to roadway subgrade, roadway bases, roadway geotextile fabrics and roadway pavements shall be paid under separate bid items.
   b. Payment for carrier pipe shall be paid under a separate bid item as described in Section 33 31 00.

1.03 REFERENCED STANDARDS

A. Definitions
1. Carrier Pipe: Permanent pipe for operational use that is used to convey flows
2. Casing: A steel pipe or tunnel linear installed by trenchless methods that supports the ground and provides a stable underground excavation for installation of the carrier pipe.

B. Reference Standards
1. BNSF Utility Accommodation Policy.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00:
   1. Shop Drawings identifying the casing pipe materials and installation procedure.
   2. Product Data
      a. Exterior Coating
         1) Material Data.
         2) Field Touch-up Procedure.
      b. Interior Coating
         1) Material Data.
         2) Field Touch-up Procedures.

1.05 DELIVERY, STORAGE, AND HANDELING

A. Delivery, Handling, and Storage
   1. Prior to delivery of the pipe, end/internal bracing shall be furnished and installed, as recommended by the manufacturer, for protection during shipping and storage.
   2. Deliver, handle and store pipe in accordance with the Manufacturer's recommendations to protect coating systems.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Casing Pipe
   1. Steel pipe shall be in conformance with ASTM A1097 and of leakproof construction, such as butt welded or interlocking joints which are capable of withstanding railroad loading. Pipe shall have a specified minimum yield strength, SMYS, of at least 35,000 psi (pounds per square inch / 241,317kPa).
   2. Casing pipe and joints shall be made of metal, and of leakproof construction. Casings shall be capable of withstanding the railroad loadings and other loads superimposed upon them.
   3. Steel Casing Pipe shall be provided with inside diameter sufficient to efficiently install the required carrier pipe with casing spacers.
      a. Allowable casing diameters are shown on the Drawings for each crossing.
   4. Wall thickness designations for steel carrier and casing pipe for E-80 loading (including impact) are:

Nominal Diameter (inches)	**When coated or cathodically protected Nominal Thickness (inches)**
12-3/4 and under	0.188
14	0.188
16	0.219
18	0.250
20 and 22	0.281
24	0.312
26	0.344
28	0.375

30	0.406
32	0.438
34 and 36	0.469
38	0.500
40	0.531
42	0.562
44 and 46	0.594
48	0.625
50	0.656
52	0.688
54	0.719
56 and 58	0.750
60	0.781
62	0.812
64	0.844
66 and 68	0.875
70	0.906
72	0.938

5. All metallic casing pipes are to be designed for effective corrosion control, long service life and relatively free from routine servicing and maintenance. Corrosion control measures for metallic casing piping must include cathodic protection or protective coating.
    a. Protective Coating such as Fusion Bonded Epoxy Coating (FBE) with an Abrasion Resistant Overcoating (ARO) or equal.
    b. Cathodic Protection
        1) One (1) seventeen-pound magnesium anode shall be provided and installed for each end of each casing for cathodic protection.
        2) Follow manufacturer's recommendations for attaching to casing pipe and proper burial procedures.

B. Casing Spaces
1. Treat stainless steel metal surfaces and welds in order to reduce chemical reactivity of its surface.
2. Bands and Risers
    a. Minimum 2 pieces, stainless steel plate: ASTM A666 Type 304.
    b. Minimum thickness: 14 gauge for carrier pipes up to 12 inches diameter and 12 gauge for more than 12 inches.
3. Runners
    a. High density molecular polyethylene or polymer reinforced fiberglass with DURO Hardness A of 80 and minimum dielectric strength of 500 volts per mil with sufficient compressive and shear strengths.
    b. Attach to risers with bolts or welded studs.
    c. Fill bolt holes with silicone caulk
4. Spacer Band: Line with minimum 0.090 inch thick ribbed PVC liner of DURO Hardness A of 80 and minimum dielectric strength of 50,000 volts per mil.
5. Approved Manufacturers:
    a. Pipeline Seal and Insulator Inc.
    b. Cascade Waterworks Manufacturing Company.

c. Advanced Products and Systems, Inc. (APS).
d. Or equal (Minimum 5 years of fabricating casing spacers in the United States).

C. Casing End Seals.
1. Approved Manufacturers:
a. Advance Products & Systems, Model AC or AM.
b. Pipeline Seal & Insulator, Inc., Model S or C.
c. Maloney Technical Products, MULTIFLEX End Seal.
d. Or equal.

D. Grout Mixes (If required)
1. Low Density Cellular Grout (LDCC)
a. Annular space (between sewer carrier pipe and casing/liner) grout shall be LDCC)
1) The LDCC shall be Portland cement-based grout mix with the addition of a foaming agent designed for this application.
2) Develop 1 or more grout mixes designed to completely fill the annular space based on the following requirements:
3) Provide adequate retardation to completely fill the annular space in 1 monolithic pour.
a) Provide less than 1 percent shrinkage by volume.
b) Compressive Strength.
c) Minimum strength of 10 psi in 24 hours, 300 psi in 28 days.
d) Design grout mix with the proper density and use proper methods to prevent floating of the carrier pipe.
e) Proportion grout to flow and to completely fill all voids between the carrier pipe and the casing or liner.

E. Carrier Pipe
1. As shown on the drawings and specified in applicable sections under Division 33-Utilities.

PART 3 EXECUTION

3.01 GENERAL

A. Notify Engineer and City of Superior Environmental Services Division 7 days prior to beginning work.

3.02 INSTALLATION

A. The casing and carrier pipes shall be installed on the lines and grades shown on the Drawings and within tolerances required to allow the carrier pipe to pass through the crossing in accordance with the lines and grades shown, specified, or directed.

B. Excavation for Steel Casing Pipe and Carrier Pipe in accordance with Section 33 05 10.

C. Installation of Steel Casing Pipe
1. Steel Casing Pipe connections shall be achieved by full penetration field butt welding or an integral machine press-fit connection (Permalok or equal) prior to installation of the pipe, depending on the type of carrier pipe.
2. Field butt welding a square end piece of steel pipe to a 35-degree beveled end of steel pipe is acceptable.

3. Integral machined press-fit connections shall be installed in accordance with the manufacturer's installation procedures and recommendations.

D. Installation of Carrier Pipe
   1. Pipe Installation
      a. Remove all loose soil from casing or liner.
      b. Grind smooth all rough welds at casing joints.
   2. Installation of Casing Spacers
      a. Provide casing spacers, insulators or other approved devices to prevent flotation, movement or damage to the pipe during installation and grout backfill placement.
      b. Assemble and securely fasten casing spacers to the pipeline to be installed in casings or tunnels.
      c. Correctly assemble, evenly tighten and prevent damage during tightening of the insulators and pipe insertion.
      d. Install spacers in accordance with manufacturer's recommendations.
      e. Install carrier pipe so that there is no metallic contact between the carrier pipe and the casing.
      f. Carrier pipe shall be installed without sliding or dragging it on the ground or in the casing/liner in a manner that could damage the pipe or coatings.
      g. Coat the casing spacer runners with a non-corrosive/environmentally safe lubricant to minimize friction when installing the carrier pipe.
      h. Grade the bottom of the trench adjacent to each end of the casing to provide a firm, uniform and continuous support for the pipe. If the trench requires some backfill to establish the final trench bottom grade, place the backfill material in 6-inch lifts and compact each layer.
      i. After the casing has been placed, pump dry and maintain dry until the casing spacers and end seals are installed.
   3. Insulator Spacing
      a. Maximum distance between spacers is to be 6 feet.
      b. For 18 and 20 foot long joints, install a minimum of 4 spacers.
         1) Install 2 spacers within 1 foot on each side of the bell or flange.
         2) Remaining 2 spacers shall be spaced equally.
      c. If the casing or pipe is angled or bent, reduce the spacing.
      d. The end spacer must be within 6 inches of the end of the casing pipe, regardless of size of casing and pipe or type of spacer used.
      e. Install spacers on PVC pipe at the insertion line to prevent over-insertion of the spigot into the bell.
   4. After installation of the carrier pipe:
      a. Commission carrier pipe in accordance with Section 33 08 30.
      b. Mortar inside and outside of the joints, as applicable.
      c. Verify electrical discontinuity between the water carrier pipe and tunnel liner.
         1) If continuity exists, remedy the short, by all means necessary including removing and reinstalling the carrier pipe, prior to applying cellular grout.
      d. If hold down jacks or casing spacers are used, seal or plug the ends of the casing.
      e. If steel pipe is used and not welded prior to installation in casing/liner, welding of pipe will only be allowed after grouting of annular space is complete.

E. Installation of End Seals
   1. For Water Pipes
      a. Place pull-on synthetic rubber end seals on the pipe and pull over the end of the casing. Securely fasten with stainless steel bands.

2. For Sewer Pipes
   a. Provide the end treatment as shown on the plans. If plans do not specify, either option shall be considered acceptable.
      1) Place pull-on synthetic rubber end seals on the pipe and pull over the end of the casing. Securely fasten with stainless steel bands.
      2) Grout end of casing/liner a minimum of 6 inches and a maximum of 12 inches.

END OF SECTION

SECTION 33 05 23.13

UTILITY HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Pipe installation by Horizontal Directional Drilling.

B. Related Sections
1. Section 33 05 05 - Trenching and Backfilling.
2. Section 33 05 22 – Steel Casing Pipe.
3. Section 33 10 00 - Water Utilities.
4. Section 33 12 12 – Water Services.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. No Bid Items have been provided for pipe directionally drilled. Costs for trenchless installations should be included within the appropriate Casing Pipe Bid Item.
2. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Iron and Steel Institute (AISI)
1. Type 316 stainless steel.

B. American Petroleum Institute (API)
1. API 13A - Oil Well Drilling - Fluid Materials.

C. American Society for Testing and Materials (ASTM)
1. C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture In Portland Cement Concrete.
2. D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
3. D3035 - Polyethylene (PE) Plastics Pipe (DR-PR) Based On Controlled Outside Diameter.
4. D3261 - Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
5. D3350 - Polyethylene Plastic Pipe and Fittings Materials.
6. F714 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based On Outside Diameter.
7. F1055 - Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
8. F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.

D. American Water Works Association (AWWA)
1. C901 - AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2-Inch (13 mm) Through 3-Inches (76 mm), for Water Service.
2. C906 - AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-Inches Through 63-Inches, for Water Distribution.

1.04 DEFINITIONS

A. Contact Grouting: The injection of a mixture of pea gravel, fine gravel, sands, and fines plus water and Portland cement, chemical compound, and perhaps a non-setting or other admixture into voids outside of the casing pipe or drilled pipe to achieve continuous contact between the casing pipe or drilled pipe and the ground.

1.05 SUBMITTALS

A. Submit the following items consistent with Section 01 33 00:
   1. Product Data: For carrier pipe, fittings, skids, bracing, and related appurtenances.
   2. Shop Drawings: A layout plan showing stationing, elevations, pipe classes, and class coding.
   3. Field Quality Control Test Results.
   4. Results of Source Quality Control Tests.
   5. Results of alignment plots. Superimpose these plots on a copy of the design alignment for comparison to verify compliance with alignment tolerances.
   6. If entry and exit pits are proposed, shop drawings showing size, location, and design calculations for the pits and all supports.
   7. Description of system to be used for handling and disposal of drilling mud and cuttings.
   8. Grout mix design.

1.06 QUALITY ASSURANCE

A. Submit a list of similar projects completed in the last 3-years. Include pipe material, pipe diameter, project length, typical length of pull, including typical thrust and pullback requirements, soil conditions, project owner, and owner's address.

B. For each pipe material, use only pipe from a single manufacturer. Furnish certifications of tests and inspection of pipe at the factory, plant, or foundry as required by the Specifications to which the material is manufactured.

C. Names and project lists for key equipment operators and supervisors, including the following:
   1. List equipment each operator is certified to operate.
   2. Years of experience for each operator.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to the pipe when loading, transporting, and unloading. Do not drop pipe.

B. Inspect all pipe and materials during unloading process.

C. Notify Engineer of any cracked, flawed, or otherwise defective material.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. HDPE Pipe and Fittings
   1. 4-Inches Diameter and Greater: Manufactured in accordance with AWWA C906 and ASTM F714, designation code PE 3408, meeting ASTM D3350 cell classification 345464C, IPS (Iron Pipe Size).
   2. Less Than 4-Inches Diameter: Conform to AWWA C901 and ASTM D3035, designation code PE 3408, PC 160/DR 11.

B. HDPE to PVC/DIP Connections: Shall be "MJ" adapter type, or approved equal.

2.02 DRILLING FLUID

A. Bentonite Slurry when used or required in the design prepared by the Contractor
   1. Bentonite: API Specification 13A, high swelling montmorillonite, capable of mixing with water to form a stable homogeneous suspension.
   2. Water: Clean, potable, containing no more than 500-ppm chlorides.

B. Sand for Contact or Consolidation Grouting
   1. Clean, natural silica sand graded such that all of the material passes the No. 20 sieve and not more than 20-percent passes the No. 200 sieve.

C. Controlled Low Strength Fill (Flowable Fill)
   1. Select and proportion ingredients to obtain compressive strength between 25 to 75 psi at 28 days in accordance with ASTM D4832.
   2. Materials
      a. Cement: ASTM C150, Type I or II.
      b. Fly Ash: ASTM C618, Class F.
      c. Water: Clean, potable, containing less than 500 ppm of chlorides.

2.03 TRACER WIRE FOR WATER MAIN AND/OR FORCEMAIN

A. Conform to the applicable requirements of NEMA WC3, WC5, and WC7.

B. Shall be Underwriters Laboratories (UL) listed for use in direct burial applications (e.g. USE, UF, or tracer wire).

C. Conductor: Minimum AWG No. 8 in copper or AWG No. 12 stainless steel rated to 30 volts.

D. Identification: Volts (or V), AWG size, UL and designation (example: "tracer wire").

E. Attach to bolt on break off flange of hydrants and valves.

2.04 EQUIPMENT

A. Certified by manufacturer for intended purpose, diameter of pipe, and expected loadings.

2.05 SOURCE QUALITY CONTROL

A. Manufacturer's Certifications: Provide certification of all testing performed by the pipe manufacturer at the manufacturing site documenting compliance with the Specifications under which the pipe is manufactured. Certifications shall include but not be limited to pipe thickness, pipe strength, static pressure tests, material composition, and gasket test requirements.

PART 3 EXECUTION

3.01 GENERAL

A. Notify the Owner and the Engineer at least 7 days in advance of the planned start of Work.

B. Water Control
   1. Keep drilling pit subgrades continuously free from ground and surface waters during operations. Implement additional groundwater controls on short notice as required. Observed water levels prior to construction are to be below the invert elevation of the pits.
   2. Direct discharge from dewatering operations into approved receiving basins in accordance with all applicable regulatory requirements as required.

C. Operations
   1. It is not necessary to complete drilling work in 1 continuous, non-stop, operation. If Work is interrupted or stopped prior to completion at the Contractor's discretion without prior Owner approval, the Contractor shall bear all costs related to the stoppage and restarting operations without additional payment.
   2. Operate to prevent settlement, movement, or cracking of adjacent structures. If any movement or settlement occurs which cause or might cause damage to the structures over, along, or adjacent to the Work, stop drilling operations immediately, except for those activities which will assist in making the Work secure and prevent further movement, settlement, or damage.
   3. Resume drilling operation only after all necessary precautions have been taken to prevent further movement, settlement, or damage.

3.02 INSTALLATION

A. Preparations
   1. Locate positions of entry and exit pits, establish elevation and horizontal datum for bore head control, and lay out pipe assembly area.
   2. Lay out and assemble pipe in manner that does not obstruct adjacent roads and commercial or residential activities adjacent to construction easements. Elevate pipe over streets or railroads as necessary to avoid disruption to traffic.

B. Drilling Pilot Hole
   1. Drill pilot hole from entrance point to exit point following vertical and horizontal alignment shown.
   2. As pilot hole is advanced, plot actual horizontal and vertical alignment of pilot hole at intervals not exceeding 25-feet. Provide the Engineer with position and inclination of pilot bore.

3. Use drilling fluid under pressure or other method designed by the Contractor to control ground water and to keep the pilot hole open.
4. Alignment Requirements
    a. Keep the grade to no shallower than the profile shown and with no intermediate high points that might trap air in pipe after installation.
    b. Keep curvature of completed pilot hole less than that which will produce wall stresses at 0.50 of yield stress in the pipe after it is installed and subject to maximum working pressure.
    c. Return pilot hole that is deviating from designed horizontal and vertical alignment to proper alignment with no abrupt changes and at a rate not exceeding [1 foot per 50-feet of pilot hole advance].
    d. Horizontal Alignment of Pilot Hole: Within 3-feet of plan data.
5. Acceptance: If pilot hole alignment fails to conform to specified requirements, drill new pilot hole with alignment meeting specified requirements.

C. Reaming Pilot Hole and Pulling Pipe
1. Obtain Engineer approval to proceed before enlarging pilot hole and pulling pipe into position.
2. While pulling pipe, enlarge pilot hole ahead of pipe to diameter sufficient for pulling pipe into position.
3. While pulling pipe, handle pipe in manner that does not over stress pipe. Limit radius of curvature along length of pipe. If pipe buckles or is otherwise damaged, remove damaged section and replace it with new pipe.
4. Pull pipe so that a minimum of 10 feet of pipe is exposed at both ends of bore.

D. Cleaning Pipe Ends
1. After pulling pipe, clean exposed ends for installation of fittings.

E. Pipe Joining Method
1. 3-inch diameter and greater, thermo-butt fusion process in accordance with ASTM D2657.
2. Less than 3-inch diameter, electrofusion joining processes conforming to ASTM F1290 shall be used to connect PE water service line to all transition fittings or joining pipe.

F. Handling and Disposal of Drilling Fluid and Cuttings
1. adequate provisions for handling and containing muddy water, drilling fluid, and cuttings during drilling operations. Do not discharge these contaminants into waterways. Handle water and materials to conform with requirements of the agency(s) with regulatory jurisdiction.
2. Construct drilling fluid pits at entry and exit points in manner that completely contains mud and prevents its escape.
3. When on Site provisions for storing muddy water, drilling fluid, or cuttings on Site are exceeded, haul contaminants away to suitable legal disposal site.
4. Conduct directional drilling operation in such manner that drilling mud is not forced into waterways, wetlands, or the ground surface.

G. End Fittings
1. Fabricate and install mitered fittings at ends of pipe as required for attachment of adjacent sections of pipe. Fabricate fitting angles to correspond to field conditions. Do not connect adjacent sections of pipe by beveling pipe ends. Coat and line fittings as specified for pipe.

H. Pipe Abandonment
   1. In event of failure to install pipe conforming to all tolerance and test requirements of this Section, retain possession of pipe and remove it from Site. Completely fill borehole with grout, sand, or flowable fill so as to prevent future settlement.
   2. If pipe cannot be withdrawn, cut pipe off at least 3-feet below ground surface, record location on Drawings, and abandon pipe after filling pipe and the annular space with flowable fill.

3.03 FIELD QUALITY CONTROL

A. Perform an elevation survey of the surface of the ground above each pipe centerline before, during, and after the drilling operations. Conduct the survey to an elevation accuracy of 0.1 feet at 25-foot intervals along the pipe centerline. Measure daily during active operations above the Work and at least 10-feet in front of the Work.

B. Pressure Testing: After pulling pipe into position but prior to grouting and before attachment to adjacent sections of pipe, pressure test pipe as listed below:
   1. Minimum Test Pressure: 150 psi.
   2. Criteria: No drop in pressure allowed for over 2 hours.
   3. Provide temporary pipe restraint as required for testing.

C. Tracer Wire Testing: Demonstrate the electrical continuity of the tracer wire.

3.04 RESTORATION

A. At the conclusion of each directional drilling operation, remove excavation support systems for drilling entry pits and exit pits.

B. Backfill entry and exit pits consistent with the requirements of Section 33 05 05. Restore the profile of the right of way to its original condition.

C. Remove all equipment, supplies, excess excavation materials, and miscellaneous items associated with the directional drilling operation and leave the Site in a clean and tidy condition.

D. Promptly replace damage pavement and structures at the ground surface above the drilled pipe.

END OF SECTION

SECTION 33 08 30

COMMISSIONING OF SANITARY SEWER UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Testing of sanitary sewer pipe, manholes, fittings, and miscellaneous appurtenances.

B. Related Sections
   1. Section 33 05 22 – Steel Casing Pipe.
   2. Section 33 05 23.13 - Utility Horizontal and Directional Drilling.
   3. Section 33 31 00 - Sanitary Utility Sewer Piping.
   4. Section 33 39 00 - Sanitary Utility Sewer Structures.

1.02 PRICE AND PAYMENT

A. Measurement and Payment
   1. All Work and costs of this Section shall be incidental to the Project and included within the appropriate Pipe Bid Item.

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM)
   1. C924 - Standard Practice for Testing Concrete Pipe Sewer Line by Low-Pressure Air Test Method.
   2. C969 - Standard Practice for Infiltration and Exfiltration Testing of Installed Precast Concrete Pipe Sewer Lines.
   3. C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Line.
   4. C1244 - Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure.
   5. F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air.

1.04 SUBMITTALS

A. Submit the following items consistent with Section 01 33 00:
   1. Proposed field-testing methods.
   2. Results of field testing.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

A. Commence test procedures only when pipe and structures are clean and free of dirt, water, or other foreign matter, and for buried pipe, trench has been backfilled.

3.02 FIELD QUALITY CONTROL

A. Engineer will observe all tests and visually inspect the Work for compliance.

B. Contractor shall provide all material, equipment, and labor required to test the sanitary sewer systems.

C. Continuity Test
   1. Test to be completed on the tracer wire after installation of all Project utilities.
   2. Test all lines, including sanitary services and stubs.
   3. Test: Physically locate all pipes with use of an electronic utility locating device such as a "Metrotech".
      a. Completing a low voltage circuit with the use of a suitable voltage source and meter to ensure continuity of the tracer wire will be allowed at the discretion of the Engineer.

D. Gravity Pipe Leak Testing
   1. General
      a. Test all systems (pipe and structures) for leakage before being put in service. Notify Engineer of the date and time for each test 1 day prior to actual testing. Test in section length increments deemed necessary by the Engineer.
      b. Individual segments MH to MH pipe runs must be tested and accepted by the Engineer prior to starting construction of the next pipe run.
   2. (For pipes less than or equal to 24-inches diameter):
      a. Low Pressure Air Test
         1) Must meet criteria set forth in ASTM F1417.
         2) Groundwater level shall be no higher than 2-feet above the top of pipe at upstream end.
         3) Acceptable time for loss of 0.5 psig of air pressure shall be the larger of the 2 times below:

Pipe Size	Min. Time (Min's)	Time (s/ft of pipe)
8	3:50	0.760
10	4:40	1.187
12	5:40	1.709
15	7:05	2.671
18	8:30	3.846
21	9:55	5.235
24	11:20	6.837

         4) Requirement may be waved for reconstruction projects where reconnection of active sewer services prevents testing with permission from Owner.
      b. Pipe Joint Acceptance Testing
         1) Must meet criteria set forth in ASTM C1103, or as modified by pipe manufacturer.
         2) Must observe confined space procedures.
      c. Infiltration and Exfiltration Acceptance Testing
         1) Must meet criteria set forth in ASTM C969.
         2) If this method is to be used for testing manholes, test must be performed prior to welding sheet liner (if applicable).

3. (For pipes greater than or equal to 24-inches diameter):
    a. Pipe Joint Acceptance Testing
        1) Must meet criteria set forth in ASTM C1103, or as modified by pipe manufacturer.
        2) Must observe confined space procedures.
    b. Infiltration and Exfiltration Acceptance Testing
        1) Must meet criteria set forth in ASTM C969.
        2) If this method is to be used for testing manholes, test must be performed prior to welding sheet liner (if applicable).

E. Gravity Pipe Deflection Testing
1. Required for all flexible pipe (FRP, PVC, and HDPE).
2. Deflection Testing Methods
    a. Pipe Diameters Through 24 Inches: Pull mandrel through the pipe by hand (without aid of mechanical pulling devices).
    b. Pipe Diameters Greater Than 24-Inches Through 36-Inches: Deflections shall be determined by use of a mandrel or a method submitted to and approved by the Engineer. If mandrel is used, it shall be pulled through the pipe by hand (without aid of mechanical pulling devices).
    c. Pipe Diameters Greater Than 36-Inches: Deflection measurements shall be determined using a mandrel, rigid bar, a circular rigid template, or by a method approved by the Engineer. If mandrel is used, it shall be pulled through the pipe by hand (without aid of mechanical pulling devices).
3. Deflection testing shall be conducted at least 30 days after the pipe has been backfilled to the desired finish grade on all direct bury flexible pipe.
4. 5-percent deflection allowance.
5. Mandrel Diameter Requirements
    a. Diameter equal to 95-percent of the base inside diameter noted in Appendix XI of ASTM D3034 for PSM PVC pipe (SDR pipe) and calculated from Appendix X2 of ASTM F679 for PS 46 or 115 pipe.
    b. For all other pipe, the minimum diameter shall be equal to 95-percent of the Average Internal Diameter of the pipe as specified below:
        1) Average Internal Diameter = (Average Outside Diameter) minus [2 by 1.06 by (Minimum Pipe Wall Thickness)].
        2) The Average Outside Diameter will be based on applicable ASTM or AWWA Standard.
        3) No adjustments to the Average Internal Diameter will be allowed for out-of-roundness, diameter variation, or thickness variation due to manufacture, shipping, and handling.
    c. Mandrel shall be constructed of rigid steel, be non-adjustable, and have an odd number of legs (9 legs minimum). Its effective length shall not be less than its nominal diameter.
6. Deflection Template/Bar Requirements
    a. The circular template diameter (or rigid bar length) shall be equal to the mandrel diameter requirements as determined above.
    b. Circular templates shall be constructed of rigid materials and be non-adjustable.
    c. Rigid bars shall have a 1-inch diameter circular section, be constructed of steel, and be non-adjustable.

F. Televising (Public Owned Utilities Only)
1. Televising inspection shall be performed for all sewer installations. Digital video and a televising report shall be submitted for each inspection. Analog video is generally not

acceptable under this specification. The video shall be produced such that the display indicates the date of televising, line number, direction of travel, and relative position (footage count) of the camera for the duration of televising. The video shall be produced with a "crawler" or "tractor" type camera, or other device approved by the ESD, so that the camera retains a generally vertical alignment. The device shall maintain the camera near the center of the pipe being inspected. The resolution, lighting, and contrast shall be adequate to capture details within the pipe. The use of "pan and tilt" is required for all inspections. Black and white video does not meet the requirements of this specification.

3.03 REQUIREMENTS FOR TEST FAILURES

A. Pressure or Leak Test Failure
   1. Repair piping as necessary to conform to product requirements.
   2. All repair work shall be subject to approval by the Engineer.
   3. Chemical type sealants added to the test water will not be permitted.
   4. The Engineer may require removal and replacement of pipe in failed test sections.
   5. The cost of replacement, repair, and re-testing of failed pipe sections shall be borne by the Contractor.

B. Deflection Test Failure
   1. Unless otherwise permitted by the Engineer, any over deflected pipe shall be uncovered, and if not damaged, reinstalled. Damaged pipe shall not be reinstalled, but shall be removed from the Site. All work to remove and replace damaged pipe shall be at the Contractor's expense.

END OF SECTION

SECTION 33 10 00

WATER UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Water main pipe, hydrants, valves, fittings, and miscellaneous appurtenances.

B. Related Sections
1. Section 31 23 00 - Excavation and Fill.
2. Section 33 05 05 - Trenching and Backfilling.
3. Section 33 05 17 - Adjust Miscellaneous Structures.
4. Section 33 05 23.16 - Utility Pipe Jacking.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Dry Hydrant Assembly**. Measurement will be based on units of each Hydrant Assembly installed. Payment at the Bid Unit Price shall include all labor, materials, and equipment necessary to complete the work as specified and shown in the plans including excavation, dewatering, strainer and strainer cap assembly, pipe bedding and cover materials, PVC pipe, pipe fittings, valve, and valve box, backfill, compaction, steamer hose connection, steel bollards, DIP Pipe from water source to Dry Hydrant location, including necessary fittings and sleeves, and all related work.
2. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Water Works Association (AWWA)
1. C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
4. C116 - Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
5. C150 - Ductile-Iron Pipe, Centrifugally Cast.
6. C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
7. C153 - Standard for Ductile-Iron Compact Fittings.
8. C502 – Dry-Barrel Fire Hydrant.
9. C504 - Rubber-Seated Butterfly Valves.
10. C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
11. C550 - Protective Interior Coatings for Valves and Hydrants.
12. C600 - Installation of Ductile-Iron Water Main and Their Appurtenances.
13. C651 - Disinfecting Water Mains.
14. C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches Through 12 Inches, for Water Transmission and Distribution.

15. C905 - AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches Through 48 Inches, for Water Transmission and Distribution.
16. C906 - AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 Inches Through 63 Inches, for Water Transmission and Distribution.

B. American Society of Testing and Materials (ASTM)
1. A48 - Gray Iron Castings.
2. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
3. A307 - Carbon Steel Bolts and Studs, 60,000-PSI Tensile Strength.
4. A536 - Standard Specification for Ductile Iron Castings.
5. A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
6. C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation.
7. D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds.
8. F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. National Electrical Manufacturers Association (NEMA)
1. WC 70 - Non-Shielded Power Cables Rated 2,000 Volt or Less for the Distribution of Electrical Energy.

1.04 SUBMITTALS

A. Submit Product Data for the following items consistent with Section 01 33 00:
1. Pipe, fittings, valves, and hydrants.
2. Joint restraint and corrosion resistant coatings.
3. Tracer wire.

1.05 SEQUENCING AND SCHEDULING

A. Notify the Owner and City of Superior WPL, a minimum of 48 hours prior to performing Work.

B. Successfully complete required test and inspections before restoration of surface.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS (DIP)

A. General Requirement: AWWA C151/A21.51.

B. Cement-mortar lining conforming to AWWA C104/A21.4.

C. Pipe: ductile iron pipe and fittings shall be thickness class 52. Pipe shall be polyethylene wrapped

D. Fittings: shall be cement lined ductile iron fittings furnished with mechanical joints. Fittings shall be 250 psi rated water working pressure. Mega Lug retainer glands shall be used on all fittings. Fittings shall be polyethylene wrapped.

E. Joints
1. Mechanical Joint Pipe and Fittings: Mechanical joint pipe and fittings shall conform to AWWA C110, AWWA C111, and ANSI B16.1.

2. Rubber Gasket Joint Pipe and Fitting: Rubber gasket joint pipe and fittings shall conform to AWWA C111 or ANSI 21.51 for cast or ductile iron pipe. Lubricant for jointing shall be as approved by the pipe manufacturer.

2.02 POLYVINYL CHLORIDE (PVC) PLASTIC PIPE AND FITTINGS

A. General: Pipe shall be made of compounds conforming to ASTM D1784 in accordance with the material requirements of AWWA C900 (4 to 12-inch diameter pipe) or AWWA C905 (14 to 48-inch diameter pipe).

B. Design: Cast-iron pipe equivalent outside diameter with a minimum pressure class (PC) or dimension ratio (DR) as shown on the Drawings.

C. Joints: Integral bell with elastomeric gasket joints providing a water-tight seal conforming to ASTM F477.

D. Fittings: Conform to Ductile Iron Pipe (DIP) and Fittings specified under this Section.

E. Marking: Conform to AWWA C900 and C905.

2.03 BOLT ASSEMBLIES

A. Tee-Head Bolts
1. General: Conform to ANSI/AWWA C111/A21.11.
2. Fluorocarbon Resin Coating: FluoroKote No. 1® (by Metal Coating Corp.); NSS Industries Cor-Blue bolt coating, or approved equal.
3. No other bolts are approved for use with mechanical joint restraints.

B. Stainless Steel Bolts
1. General: Conform to requirements of ASTM F593 and ASTM F594, Alloy Group 1, 2, or 3.
2. Approved for use as exterior bolts for hydrants and gate valves.

C. Carbon Steel Bolts
1. General: Conform to requirements of AWWA C515 and ASTM A307.
2. Fluorocarbon Resin Coating: FluoroKote#1® (by Metal Coating Corp.), NSS Industries Cor-Blue bolt coating, or approved equal.
3. Approved for use as exterior bolts for hydrants and gate valves.

2.04 DRY HYDRANT

A. General Requirements:
1. Dry barrel (conventional) hydrants may not be used due to excess suction loss and the necessity that they be absolutely airtight.
2. A recessed hydrant or flush mount hydrant (below ground-level connection) may be specified for use in areas with special needs, such as in a high vandalism area or for low profile and esthetic needs. It may be used with the 45° or straight dry hydrant head assembly,

B. Two 2-1/2 inch hose connections.

C. One 4-1/2 inch steamer.

D. National standard operating nut.

E. 5-inch valve opening.

F. 6-inch mechanical joint pipe connection.

G. Break-off flange with breakable rod coupling.

H. 8'–0" cover.

I. 16-inch high traffic section.

J. Nozzle caps attached to hydrant with metal chains.

K. Exterior Bolt Assemblies: Conform to Part 2 – Bolt Assemblies.

L. Fiberglass Flag: Hydrafinder Hydrant Marker, or approved equal:
   1. White fiberglass rod, with 4 red reflective bands without a bulb end.
   2. 54-inches long, 3/8-inch diameter.

M. Hydrants placed where the ground water table is less than 8 feet below the ground surface shall have the drain holes plugged and shall be equipped with a tag stating the need for pumping after use.

N. Color: Painted Waterous Enamel No. V1814-R at the place of manufacture.

O. After installation and testing is complete, the "field coat" of paint shall be applied with a brush.

2.05 DRY HYDRANT HEAD

A. The hydrant sleeve shall be made of bronze, brass, aluminum alloy or other durable, non-corrosive metal. Sleeve must be permanently affixed inside a PVC head using epoxy adhesive and stainless-steel bolts.

B. The hydrant head shall be able to accept a 6 inch NHT (American National Fire Hose Thread) connection to provide maximum supply. Hydrant (6 inch) head shall conform to ASTM 2466.

C. All hydrants shall contain a removable head strainer and stainless steel snap ring that can be removed without special tools. The strainer shall be conical in shape to maximize straining area. All hydrants shall use a rubber "0" ring between the threaded sleeve and PVC head.

2.06 DRY HYDRANT CAP

A. The cap shall be of snap-on/snap-off design and removable without special tools. It shall be joined with a steel cable or chain and be permanently attached to the dry hydrant head. The cap shall be hard plastic or of same metal as NHT connection for maximum corrosion resistance.

2.07 STRAINER

A. The strainer shall be fabricated from PVC material compatible with the pipe. Individual inlet holes shall not exceed 3/8-inch diameter. All components, including pins, shall be

non-corrosive. Manufactured well screens shall be corrosion resistant. Screens and strainers shall have a minimum open area of 4 times the pipe cross sectional area.

B. A strainer may be formed by drilling 1/4 inch to 3/8 inch diameter holes with a minimum of one hole diameter between the holes in PVC pipe. Drill holes shall be deburred and the pipe cleaned before putting the strainer into service. The screens or strainers shall be capped with a removable end cap.

2.08 END CAP

A. The end cap must be easily removed without special tools. Perforations are recommended in the end cap, also, to improve flow conditions into the strainer and for jetting action for silt cleanout.

2.09 DRY HYDRANT PIPING

A. The pipe material may be iron, steel or plastic. Plastic pipe shall be schedule 40, SDR-26 or otherwise protected from ultraviolet rays. No more than two 90-degree elbows shall be used in the entire pipe system. Pipe shall be 6 inches nominal diameter or larger. The pipe shall be fitted with intake screen or strainer and standard fire truck hose adapters for quick connect/release operations acceptable to the local fire department.

B. The depth at which the pipe is installed shall be below the frost-free depth for the area.

2.10 DRY HYDRANT PIPE INTAKE

A. The pipe intake depth shall be calculated from the design water elevation plus pipe diameter plus 2 feet. The intake screen should have a minimum opening of 4 times the pipe cross sectional area. Where the intake is more than 3 feet off the bottom, a trash rack may be used in lieu of a screen.

B. A dry hydrant installation shall provide for a positive slope toward the water source. In pits or impoundment's, the intake screen or strainer shall be supported and secured at least two feet above the pool bottom. The intake shall be at least 4 feet beyond the earth slope.

C. To avoid a vortex or whirlpool during pumping, the top of the inlet pipe shall be at least 2.0 feet below the design water level unless a special design is prepared to prevent vortex.

2.11 DRY HYDRANT PUMP LIFT

A. The top of the fire truck pumping connection or centerline of pump (whichever is higher) shall be no more than 15 feet in elevation above the bottom of the fire protection pool or stream surface during drought conditions.

B. The fire truck connection shall be approximately 24 inches above the ground surface, but never higher than the intake of the using fire truck.

C. The total lift (pumping head) shall not exceed 20 feet when all losses are totaled. Pumping head for each site shall include head loss from screen or strainer, elbows, line friction, elevation (static head), and hard rubber or flexible suction hose to the fire truck.

2.12 GATE VALVE AND BOX

A. General Requirement: AWWA C515 or C509.

B. Non-rising stem (NRS), opening by turning counterclockwise, 2 inches square operating nut.

C. O-ring seals.

D. Mechanical joint ends conforming to AWWA C111/A21.11.

E. Exterior Bolt Assemblies: Conform to Part 2 – Bolt Assemblies.

F. All internal and external surfaces of the valve body and bonnet shall have a fusion bonded epoxy coating complying with ANSI/AWWA C550 and C116/A21.16.

G. Spray exterior nuts and bolts of valve and restraints using a bituminous coal tar as supplied by the manufacturer.

H. Wrap gate valves according to Part 2 - Polyethylene wrap.

I. Spur gear actuator for valves 16-inches and larger.

J. Valve Boxes
   1. 3-piece, ductile iron, screw-type.
   2. Adjustable for 7-1/2 foot depth of cover.
   3. Valve and box considered as integral units.
   4. 5-1/4 inch diameter shafts.
   5. “Stay put” type drop covers, “WATER” on top with extended skirts.

K. Valve box adaptor to be included with valve box installation.

L. Provide valve stem risers according to Details on the Drawings.

2.13 CONDUCTIVITY STRAP

A. As specified by the pipe manufacturer.

2.14 JOINT RESTRAINT

A. Mechanical Joint Restraint: Not allowed on existing cast iron pipe
   1. Ductile iron conforming to ASTM A536.
   2. Working Pressure: Minimum 250 psi.
   3. EBAA Iron, Inc. Megalug, Star Pipe Stargrip, or approved equal.
   4. Casting body and wedge assemblies coating
      a. Fusion bonded epoxy per ANSI/AWWA C116/A2.
      b. or approved equal.

B. Tie Rods: 3/4-inch diameter rods stainless steel or fusion bonded epoxy coated.

2.15 POLYETHYLENE WRAP

A. Material: Polyethylene film conforming to AWWA C105/A21.5 and ASTM A674, tube form.

B. Color: Black.

C. Film Marking Requirements: Conform to AWWA C105/A21.5 and ASTM A674, including AWWA/ASTM standard, corrosion protection warning and applicable range of nominal pipe diameter size(s) every 2-feet along its length.

2.16 INSULATION

A. Polystyrene Insulation: Extruded type conforming to ASTM C578, Type VI, VII, or V.

2.17 TRACER WIRE

A. Conform to the applicable requirements of NEMA WC3, WC5, and WC7.

B. Shall be Underwriters Laboratories (UL) listed for use in direct burial applications (e.g. USE, UF, or tracer wire).

C. Conductor: Minimum No. 12 AWG – Copper Clad Steel Tracer Wire rated to 30 volts.

D. Outside Identification: Volts (or V), AWG size, UL and designation (ex. "tracer wire").

PART 3 EXECUTION

3.01 PREPARATION

A. Conform to the requirements of Section 33 05 05.

B. HDPE Pipe
   1. Section of polyethylene pipe shall be joined into continuous lengths on the Site above ground. The joining method shall be the butt fusion method, flange assemblies, or mechanical method as recommended by the pipe supplier
      a. HDPE shall not be joined by solvent cements, adhesives, or threaded-type connections.

3.02 INSTALLATION OF PIPE

A. Install pipe and fittings in accordance with the manufacturer's instructions and with the details shown on the Drawings.

B. Permanently support, remove, relocate, or reconstruct existing utility pipes, cables, structures, or other appurtenances when they obstruct the line, grade, or location of the pipe or appurtenance.

C. Remove foreign matter or dirt from the inside of pipe.

D. All jointing of mechanical joint pipe and push-on joint pipe in accordance to AWWA C600.

E. Outside of the spigot and the inside of the bell, wire brush, wipe clean and dry. Keep pipe ends clean until joints are made.

F. Lay and maintain pipe and appurtenances to the alignment, grade, and location shown on the Drawings. No deviation from the Drawing alignment, grade, or location is allowed, unless approved by the Engineer. No pipe shall be laid in water or when the trench conditions are unsuitable for such Work.

G. Provide conductivity throughout the water system by use of conductivity strap, except for HDPE and PVC water main pipe.

H. Precautions are to be taken to prevent debris or groundwater from entering the pipe being laid.

I. Installing Fittings
   1. General Requirements: AWWA C600.
   2. Set and jointing to existing pipe and fittings as specified for cleaning, laying, and joining pipe.
   3. Spray exterior ductile iron nuts, bolts, and joint restraint bolts using a bituminous coal tar as supplied by the manufacturer.

J. Dead End Lines
   1. Install plug tapped for a 1-inch corporation at all stubs.
   2. Extend a temporary section of 1-inch copper to above grade for flushing and testing.
   3. Install a temporary curb stop on the 1-inch copper bleed off above ground.
   4. Remove all but 12 inches of the temporary copper and backfill trench after flushing and testing is completed.
   5. Crimp over short stub to keep the corporation clean.

K. Wrap all ductile iron pipe and fittings with polyethylene wrap.

L. Backfilling: Conform to Section 33 05 05.

3.03 INSTALLATION OF HYDRANT

A. Location determined by Engineer. A grade stake and location stake will be provided by the Engineer before the hydrant may be set.

B. Set on 8-inch concrete block, or approved equal concrete base.

C. Brace according to Drawings.

D. After each hydrant has been set, place around the base of the hydrant not less than 1 cubic yard of Class A round washed rock with a minimum diameter of 3/4-inch. Carefully place 2 layers of polyethylene, minimum 4 mm thickness each, over the rock to prevent backfill material from entering voids in the drain rock.

E. Wrap the hydrant assembly with polyethylene wrap to the bottom of the break off flange.

F. Maintain hydrants in a plumb position during the backfilling operation.

G. Attach a fiberglass marker to the hydrant using an existing flange bolt located at the back of the hydrant.

H. Furnish 1 additional marker for each hydrant to the Owner.

3.04 INSTALLATION OF VALVE

A. Set and joint valves to new pipe in the manner as specified for cleaning, laying, and jointing pipe. Location to be determined by the Engineer.

B. Valves and boxes shall be supported on an 8-inch concrete block as shown on the Drawings.

C. Maintain valve box centered and plumb over the operating nut of the valve.

D. Set top of valve box flush with the existing surface to provide 12 inches of upward adjustment.

E. Wrap gate valves with polyethylene wrap.

3.05 POLYETHYLENE WRAP

A. Corrosion protection shall be provided for all ductile iron pipe by use of polyethylene wrap. Before installing the polyethylene wrap the exterior of the pipe shall be free of foreign material. The polyethylene wrap shall be cut approximately 2 feet longer than that of the pipe section. After assembling the pipe joint, the polyethylene shall be overlapped approximately 1 foot and sealed at all joints with approved adhesive tape. Additional taping shall be used at 3-foot intervals along the pipe. Any rips, punctures or other damage to the polyethylene shall be repaired immediately with adhesive tape.

B. When fittings cannot be practically wrapped in a tube, a flat sheet or split tube shall be used. All seams shall be securely taped.

C. The bedding and cover material shall be placed with care so as to prevent damage to the polyethylene wrap. Any rips or punctures in the wrap shall be repaired immediately.

3.06 ANCHORAGE

A. Brace hydrants securely against undisturbed soil using precast concrete block. Use mechanical joint restraints or rod all joints from main line tee to hydrant gate valve, then from gate valve to hydrant.

B. Restrain all bends and fittings with mechanical joint restraints.

C. Where lines terminate with plugs, restrain the plug and next 2 joints with mechanical joint restraints or tie rods in conjunction with the blocking, as directed by the Engineer. The number of rods required is as follows:

Pipe Size	No. of 3/4 Inch Rods
6 Inches	2
8 Inches	2
12 Inches	4
16 Inches	6
18 Inches	6
20 Inches	8
24 Inches	10

3.07 INSULATION

A. Review insulation installation with Engineer
   1. Place insulation between water pipe and sanitary pipe when water main or service is within 1-foot above or below the sanitary pipe.
   2. Place insulation between storm sewer pipe and water main or water service when pipes are separated by less than 2-feet.

3.08 TRACER WIRE

A. Attach to bolt on break off flange of all hydrants, valves, and curb stops. Contractor will furnish and install cast bronze ground clamp to be installed on curb stop just below the cap on the standpipe.

B. Splice shall be accomplished by joining the 2 bare ends of the wires with either a copper mechanical split bolt compression fitting or a crimp-type compression sleeve for copper connections. No other connection is allowed.

C. All joined splices and connections shall be fully enclosed using a 3M Brand Scotchfil™ Electrical Insulation Putty, or approved equal. The putty shall be fully sealed and bonded on all sides.

D. Splices shall not be more frequent than 1 splice per 250 feet.

E. Tracer wire shall be laid below all pipe, fittings, and hydrants.

3.09 PROTECTION

A. Existing valves and hydrants shall be operated by the Owner, unless under emergency situations.

B. Securely plug all water main openings promptly before suspension of Work at any time to prevent earth or other substances from entering the water main.

C. Mark valve boxes and structures susceptible to being hit by construction or vehicular traffic.

END OF SECTION

SECTION 33 12 12

WATER SERVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Construction of water service pipe, corporation stops, curb stops and boxes, and all appurtenances.

B. Related Sections
1. Section 33 05 05 - Trenching and Backfilling.
2. Section 33 10 00 - Water Utilities.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. **Water Service, HDPE, 2-Inch**: Measurement by lineal foot measured along the axis of the pipe, from centerline of the water main to termination as shown on the Drawings with no regard to intervening fittings. Payment at the Bid Unit Price per foot shall include cost of all pipe, fittings, laying, excavation, backfilling, and testing
   a. Placement and compaction of the aggregate material around the corporation stop and gooseneck is incidental to the service line.
   b. Supplying and installing wooden markers or fence a post is incidental to the service line.
2. Corporation Stop and stainless-steel saddle to be included in the Bid Unit Price for each Water Service.
3. Curb Stop and Box to be included in the Bid Unit Price for each Water Service.
   a. For services located within driveway pavements areas, a 6 inch gate valve box top section shall be included.
4. Bedding and cover stone, backfill, placement, compaction, and removal of excess trench material to be included in the Bid Unit Price for each Water Service.
5. Connections to existing water services, including any required sleeves or reducers to be included in the Bid Unit Price for each Water Service.
6. Dewatering shall be considered incidental to the installation of each Water Service.
7. Tracer Wire: Shall be considered incidental to the installation of each Water Service.
8. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Standard Specifications for Sewer and Water Construction in Wisconsin, Latest Edition (Standard Specifications).

B. American Society of Testing and Materials (ASTM)
1. B88 - Class K Copper Water Service Pipe.
2. A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.

3. D3035 - Standard Specification for Polyethylene (PE) Plastics Pipe (DR-Pr) Based on Controlled Outside Diameter.
4. F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.

C. American Water Works Association (AWWA)
1. C105 - American National Standard for Polyethylene Encasement for Ductile Iron Pipe Systems.
2. C900 - AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches through 12 Inches, for Water Distribution.
3. C901 - AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 Inch (13 mm) Through 3 Inches (76 mm), for Water Service.

1.04 SUBMITTALS

A. Submit the Product Data for the following items consistent with Section 01 33 00:
1. Pipe and fittings.
2. Corporation stop and curb boxes.
3. Service saddles.

1.05 SEQUENCING AND SCHEDULING

A. Install sanitary sewer, water main, and all pipe deeper than the services prior to the installation of the services.

B. Perform testing of new water main prior to reconnecting existing services.

C. Notify the Owner a minimum of 48 hours prior to performing Work.

PART 2 PRODUCTS

2.01 PIPE BEDDING AND COVER

A. Bedding and cover material shall conform to Section 33 05 05 – Trench Excavation and Backfill and the details on the Drawings.

2.02 SERVICE PIPE

A. High Density Polyethylene (HDPE) Pipe: CTS SDR9 conforming to AWWA C901 and ASTM D2737 CTS, DR9/PC 200 for sizes less than 4 inches.

2.03 CORPORATION STOP

A. Approved Manufacturers: Mueller No. B-25008N, or approved equal.

B. Threaded on outlet for compression type fitting.

C. Threaded on inlet end with standard tapered corporation cock thread.

D. Saddles are required on all PVC and HDPE water main.

2.04 CURB STOP

A. Approved Manufacturers: Mueller No. B-25219N, Mueller No. B-25155, or approved equal.

B. Same size and connection type for inlet and outlet.

C. Compression type fitting utilizing stainless steel pipe insert.

D. Full opening through the valve body with no smaller restriction allowed.

2.05 CURB BOX

A. Approved Manufacturers: Mueller H-10300-N, Mueller H-10302-N, or approved equal.

B. Adjustable in height from 78 inches to 90 inches.

C. Stationary rods.

D. 1-1/4 inch upper section.

2.06 SERVICE SADDLES

A. Stainless steel.

B. For use on PVC C900: Smith-Blair 372, or approved equal.

2.07 TRACER WIRE

A. Conform to the requirements of Section 33 10 00.

2.08 MAGNESIUM GROUNDING ROD ANODE

A. Conform to the requirements of Section 33 10 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. Governing Code: Wisconsin Plumbing Code and any local ordinances that may apply.

B. Trench excavation and preparation: Conform to Section 33 05 05.

C. New services shall be connected at the locations shown on the Drawings or if not shown as directed by the Engineer.

D. Water Service Line
   1. Parallel and upstream of the sewer service line in the same trench where feasible.
   2. Terminate water service as shown on Drawings or as directed by the Engineer.

E. Corporation Stop
   1. Tap into main only when water main is under pressure.
   2. Use 2 layers of pipe tread sealant tape on corporations as a thread lubricant and sealant, or product approved by Owner.
   3. Support corporation with 1/2 cubic yard 3/4-inch crushed stone chips per Chapter 8.43 of the Standard Specifications.

F. Curb Box
   1. Support on full size pre-cast segmental manhole block.
   2. Place in a plumb, vertical position.
   3. Install to elevation matching finished grade.
   4. Grade stakes will be furnished to establish elevations.
   5. Wrap curb box with pipe encasement conforming to Section 33 10 00.

G. Tracer Wire
   1. Install tracer wire with all water services.
   2. Install tracer wire below pipe.
   3. Dead end tracer wire with approved connector at the curb box.
   4. Install tracer wire connection boxes at the hydrants per the Drawings.

H. All trenches shall be backfilled and compacted in accordance with Section 33 05 05.

3.02 FIELD QUALITY CONTROL

A. Do not backfill trench until the service has been inspected and approved by the Engineer.

B. Pressure Testing: All water services will be pressure tested in conjunction with the water main, conforming to Section 33 10 00.

C. Tracer Wire Testing: Demonstrate the electrical continuity of tracer wire.

3.03 PROTECTION

A. Mark Each Curb Box
   1. Solid wood post extending 4 feet above grade until end of Project.
   2. Metal fence post extending 4 feet above grade.

B. Mark the End of the Utility Services
   1. Solid 4 inches by 4 inches by 8 feet wood post extending 4 feet above grade.
   2. Metal fence post extending 4 feet above grade.

END OF SECTION

SECTION 33 31 00

SANITARY UTILITY SEWER PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Sanitary sewer gravity pipe, fittings, and miscellaneous appurtenances.

B. Related Sections
1. Section 02 41 13 - Selective Site Demolition.
2. Section 33 05 05 - Trenching and Backfilling.
3. Section 33 31 14 - Sanitary Sewer Services.
4. Section 33 39 00 - Sanitary Utility Sewer Structures.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Bid Items have been provided for **Sanitary Sewer**. Measurement will be per lineal foot of each type and size of pipe installed as measured along the axis, for furnishing and installing pipe complete in place as specified, including excavation, dewatering backfilling, and compaction. Pipe will be measured from centerline to centerline of manholes or to the connection point of the existing pipe, building face, or septic tank.
   a. PVC pipe bedding will be considered incidental to sanitary sewer installation.
   b. Temporary conveyance of wastewater shall be incidental to sanitary sewer installation.
   c. Improved pipe foundation material, if necessary, shall be paid for per Section 33 05 05.
2. Connections to existing sanitary sewers, existing manholes, or proposed septic tanks shall be considered incidental to the sewer installation and included in the Total Base Bid.
3. No Bid Items have been provided for Wyes. Wyes or tee branches shall be considered incidental to sanitary sewer installation.
4. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Standard Specifications for Sewer and Water Construction in Wisconsin, 6th Edition (Standard Specifications), December 22, 2003.

B. American Society of Testing and Materials (ASTM)
1. C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation.
2. D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (PVC) Compounds.
3. D3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
4. D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

5. D3262 - Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
6. D4161 - Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
7. F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
8. F679 - Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
9. F794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based On Controlled Inside Diameter.
10. F894 - Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drainpipe.

C. American Water Works Association (AWWA)
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C111 - American National Standard for Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
3. AWWA C116 - American National Standard for Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. AWWA C153 - American National Standard for Ductile-Iron Compact Fittings for Water Service.
6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches Through 12 Inches, For Water Distribution.
7. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches Through 48 Inches, For Water Transmission and Distribution.

1.04 SITE CONDITIONS

A. Sanitary sewer lines are shown on the Drawings in a general way. Contractor should anticipate minor variations in both horizontal and vertical directions in locating existing system.

1.05 SUBMITTALS

A. Submit Product Data for the following items consistent with Section 01 33 00:
1. Pipe and fittings.
2. Transition couplings.
3. Tracer wire.
4. Insulation.

1.06 SEQUENCING AND SCHEDULING

A. Do not pursue Work causing shut off of utility services (gas, water, electric, telephone, TV, etc.) to consumers until the utility owner is contacted and all consumers are notified of the shut-off schedule.

B. Verify vertical and horizontal location of sanitary sewers sufficiently in advance of installing new pipe to determine the extent of conflict, if any.

C. Bypass flows according to WDNR standards.

D. Install sanitary sewer to line and grade as shown on the Drawings.

E. Successfully complete required inspections and testing before restoration of surface.

PART 2 PRODUCTS

2.01 BEDDING, COVER, AND BACKFILL

A. Conform to Section 33 05 05 – Trench Excavation and Backfill.

2.02 SOLID WALL PVC PIPE

A. PSM Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings (4 Inches Through 15 Inches Diameter)
   1. General: Pipe and fittings shall be made of compounds conforming to ASTM D1784 in accordance with the material requirements of ASTM D3034.
   2. Design: Integral bell gasketed joint and a minimum wall thickness conforming to SDR 35 as shown on the Drawings.
   3. Joints: Elastomeric gasket joints providing a water-tight seal conforming to ASTM D3212 or ASTM F477.
   4. Marking: Conform to ASTM D3034.

2.03 INSULATION

A. Polystyrene Insulation: Extruded type conforming to ASTM C578, Type VI, VII, or V.

2.04 TRACER WIRE

A. Conform to the applicable requirements of NEMA WC3, WC5, and WC7.

B. Shall be Underwriters Laboratories (UL) listed for use in direct burial applications (e.g. USE, UF, or tracer wire).

C. Conductor: Minimum AWG No. 12 in copper rated to 30 volts.

D. Outside Identification: Volts (or V), AWG size, UL, and designation (ex. “tracer wire”).

E. Color: Green.

F. Tracer wire shall conform to the Details in the Drawings.

2.05 CONNECTION TO EXISTING PIPE

1. Connection to existing pipe shall be made with flexible mechanical compression joint coupling conforming to ASTM 1173 with Series 300 stainless steel bands as manufactured by Joints, Inc. (Calder) of Gardena, CA; Fernco Joint Sealer Co. of Ferndale, MI; or equal.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION AND PREPARATION

A. Excavation and Preparation of Trench: Conform to Section 33 05 05.

B. By-Pass Pumping: Contractor shall be responsible for all items required to maintain sewer flows during construction of the new sanitary sewer line. All Work and costs for this are considered incidental to the Project, unless otherwise specified. By-pass pumping shall conform to WDNR standards.

C. Erosion control and dewatering in conformance with Section 01 57 13.

3.02 PIPE INSTALLATION

A. Trench Excavation and Backfill: Conform to Section 33 05 05.

B. Install pipe to the alignment, grade, and location as shown on the Drawings and/or staked in the field. No deviation from the Drawings and/or staked alignment, grade, or location is allowed. Tolerances measured along pipe centerlines or invert as follows:
   1. Horizontal: Within 0.50 feet of alignment shown.
   2. Vertical: Zero plus and 0.08 feet minus elevation shown with no intermediate high points, level sections, or reverse invert slope.
   3. Joint Deflection: No more than 75 percent of the maximum allowable, as recommended by manufacturers of pipe and joint material.

C. Maintain reference line and grade with laser equipment or other equipment approved by the Engineer. Periodically check equipment for adjustment and accuracy. Correct deficiencies in equipment, reference line, and reference grade. Take precautions to prevent deflections in reference line and grade.

D. Non-Conforming Pipe Installation: Remove and reinstall.

E. Inspect pipe for defects and cracks while suspended immediately prior to installation.

F. Install pipe from lower to higher invert elevation with uniform and smooth invert line.

G. Install pipe length spigot ends pointing in the direction of flow.

H. No pipe is to be laid in water or when trench conditions are unsuitable for such Work.

I. Jointing
   1. Bell and spigot joints sealed by an elastomeric gasket conforming to ASTM D3212.
   2. All joints must be watertight.
   3. Lubricant for jointing shall be as approved by the pipe manufacture.
   4. Hand fill and compact all bell depressions with granular bedding materials to prevent joints from sagging or movement.

J. Cleaning and Protection
   1. Remove all dirt and debris from the interior of each pipe length as the Work progresses.
   2. Protect the exposed end of the pipe with temporary covers or plugs.
   3. Protect in place pipe from damage and dislocation.

K. Sanitary Sewer Service Connections
   1. Wye
      a. Wye to be at 45-degree angle from horizontal. Minor deviations may be required to match elevation of the existing service pipe.
      b. All existing wye sections included in pipe removal and replacement areas shall be replaced. No reinstallation will be allowed.
   2. Risers: Conform to Section 33 31 14.

L. Installation of Insulation
   1. Place insulation between water pipe and sanitary pipe when water main or service is within
      1 foot above or below the sanitary pipe.
   2. Place insulation between storm sewer pipe and water main or water service when pipes are separated by less than 2 feet.
   3. As shown on Drawings.

3.03 CONNECT TO EXISTING SYSTEM

A. Connect to Existing Manhole
   1. Connect to existing structure at location shown on the Drawings.
   2. If rubber boot exists at manhole opening, connect new pipe to the boot and secure.
   3. If manhole opening does not contain rubber boot or the existing boot is damaged, core drill opening in the structure, and install a rubber boot in manhole opening prior to connection of pipe.
   4. Make repairs to the structure required due to the Work performed, including installation of doghouse.
   5. If necessary, the invert shall be reconstructed to accommodate new flow location. Reconstruction of invert will also be necessary if pipe sizes increase.

B. Connection to Existing Pipe
   1. Existing pipe shall be cut to create a uniform edge.
   2. Clean soil from around the pipe and prevent soil or debris from entering joint.
   3. Install flexible coupling to connect both pipes per manufactures recommendations.

3.04 MANHOLE INSTALLATION

A. Conform to the requirements of Section 33 39 00.

3.05 FIELD QUALITY CONTROL

A. Testing in conformance with requirements of Section 33 08 30.

B. Re-test after corrective measures are completed.

C. Cleanup
   1. Cleaning Pipe and Structures
      a. If newly installed mains and structures are kept clean during construction, cleaning will not be required.
      b. If newly installed mains and/or structures become dirty due to negligence of the Contractor, cleaning will be performed at the sole expense of the Contractor.

2. The bailing or flushing method of cleaning pipe is acceptable only if adequate provisions, acceptable to the Engineer, for keeping dirt and debris out of the existing sewer system. Jetting may be required.
3. Complete prior to final inspection for acceptance.

END OF SECTION

SECTION 33 39 00

SANITARY UTILITY SEWER STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Sanitary sewer manholes and miscellaneous appurtenances.

B. Related Sections
   1. Section 02 41 13 - Selective Site Demolition.
   2. Section 33 05 05 - Trenching and Backfilling.
   3. Section 33 05 17 - Adjust Miscellaneous Structures.
   4. Section 33 31 00 - Sanitary Utility Sewer Piping.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Refer to Section 33 31 00 for gravity sewer pipe pay items.
   2. A Bid Item have been provided for **Septic Tank**. Measurement will be Lump Sum. Payment will include all excavation, dewatering, sheeting/bracing, bedding, and backfill necessary to install the sanitary holding tank as specified on the Drawings.
      a. Sanitary holding tank to include tank, baffles, inlet, outlet, manhole covers, cleanouts, risers, boots/seals and connection to sanitary sewer/service.
   3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. Wisconsin Department of Safety and Professional Services (DSPS) – Holding Tank Component Manual For Private Onsite Wastewater Treatment Systems (Version 2.1).

B. Wisconsin Department of Natural Resources – NR 213, Wis. Adm. Code.

C. American Society of Testing and Materials (ASTM)
   1. C-1227 – Standard Specification for Precast Concrete Septic Tanks.

1.04 SITE CONDITIONS

A. Sanitary structure locations are shown on the Drawings in a general way. Contractor should anticipate minor variations in both horizontal and vertical directions in locating existing system.

1.05 SUBMITTALS

A. Submit Product Data for the following items consistent with Section 01 33 00.
   1. Gaskets.
   2. Joint sealants.
   3. Manufacturers recommended installation procedures for jointing.

4. Plastic liner materials.

B. Submit shop drawings for the following items consistent with Section 01 33 00.
   1. Holding Tank, including castings.
   2. Shop drawings shall indicate complete information for fabrication and installation of units. Include the following:
      a. Plans and elevations locating and defining all material furnished by manufacturers.
      b. Sections and details showing connections, cast-in items, field installed lifting devices, capacities, all openings, and their relation to the structure.

C. Submit Manufacturer's Certificate of Compliance for the following items consistent with Section 01 33 00.
   1. Castings.
   2. Precast maintenance hole sections and steps.
   3. Corrosion resistant lining.

1.06 QUALITY ASSURANCE

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer or other representative of the Owner. Such inspection may be made at the place of manufacture or on the Work after delivery, or at both places and the materials shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein. Material rejected after delivery to the Site shall be marked for identification and shall be removed from the Site at once. All materials which have been damaged after delivery will be rejected and if already installed shall be removed and replaced entirely at the Contractor's expense.

B. At the time of inspection, the materials will be carefully examined for compliance with this Section and with the approved manufacturer's drawings. All precast products shall be inspected for general appearance, dimension, "scratch-strength," blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

C. In Plant Certification of Holding Tank Joints for Water Tightness
   1. All certifications from manufacturer shall be provided with delivery of tank system and approved by Engineer prior to installation.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Holding Tank: Must meet or exceed ASTM C-1227 Requirements
   1. Wieser Concrete – WLP2000-MR Tank, or equal.
      a. Dimensions (See Drawings for Plan & Section details):
         1) Wall: 3 inches.
         2) Bottom: 5 inches.
         3) Cover: 6 inches.
         4) Manhole: 24 inch I.D. Precast Concrete Riser.
         5) Height: 55 inch O.D.
         6) Length: 164 inch O.D.
         7) Width: 96 inch O.D.
         8) Below Invert: 43 inch O.D.
         9) Liquid Level: 36 inches
         10) Weight: Bottom – 14,060 lbs., Cover – 8,170 lbs.

b. Inlet and Outlet:
   1) 4 inch Cast-A-Seal Boot, or approved equal.
c. Inlet and Outlet Baffle and Filter: (See Drawings for details).
d. Liquid Capacity: Min. 56 gal/in.
e. Loading Design: 8'-0" Unsaturated Soil.
f. Holding Tank:
   1) Outlet Hole Plugged.
   2) Actual Capacity: Min. 2,000 gallons.

2.02 ACCESSORIES

A. Sealant
   1. ConSeal, or approved equal.

B. Seal Gasketing
   1. Press-Seal Gasket Corp. – PSX Series, or approved equal.
   2. Press-Seal Gasket Corp. – Cast-A-Seal, or approved equal.

PART 3 EXECUTION

3.01 TRANSPORTATION

A. Transport precast units by rail or truck in a manner to avoid excessive stress or strain on units.

B. Support units during hauling and stockpiling with sufficient hardwood shores to prevent cracking and spalling. Secure units in place to prevent shifting or undesired movements. Location of temporary supports shall be as directed by precast manufacturer.

3.02 EXCAVATION

A. Excavation should be approximately 18 inch minimum larger than tank size to allow for adequate backfill. This may vary with soil conditions. Excavation below the tank center to be 2" lower to prevent undue pressure at center of tank.

3.03 BEDDING

A. Proper use of bedding material is important to ensure service life of tank structure. Bedding must be capable of bearing the weight of the tank. Bedding material shall have the ability of 100 percent to be able to pass through a 3/4 inch screen. Bedding thickness shall be 4 inches minimum compacted (thickness may vary with soil conditions).

3.04 JOINT SEAL

A. Joint surfaces to be clean and proper placement of sealant according to manufacturer's recommendations.

3.05 WATER TABLE

A. If water table encountered is higher than the elevation of the tank cover, attention must be brough to the Engineer and Manufacturer. Additional design may be required.

3.06 BACKFILL MATERIAL

A. Sidewalls of tank requires dry backfill materials that have the ability of 100 percent to be able to pass through a 2 inch screen. Minimum of 12 inches of backfill on all side from bottom to top of tank. Backfill material shall be placed with a backhoe or concrete bucket to avoid impact loads on sidewall of tank. No compaction of backfill material is permitted on sidewalls of tank. If more than 85 percent modified proctor compaction is required by Manufacturer, use 3/8 inch or 3/4 inch washed gravel for backfill material.

3.07 COVER MATERIAL

A. Cover materials shall be dry soil, sand or gravel material that has the ability of 100 percent to be able to pass through a 4 inch screen. Cover materials should be mounded over tank and around risers to direct runoff away from both.

3.08 CLEANING

A. All new tanks shall be thoroughly cleaned of all silt, debris, and foreign matter of any kind prior to final inspection.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Storm sewer pipe, manholes, catch basins, fittings, and miscellaneous appurtenances.

B. Related Sections
   1. Section 31 23 00 - Excavation and Fill.
   2. Section 32 11 23 - Aggregate Base Courses.
   3. Section 32 16 13 - Concrete Curbs and Gutters.
   4. Section 33 05 05 - Trenching and Backfilling.
   5. Section 33 05 17 - Adjust Miscellaneous Structures.
   6. Section 33 46 00 - Subdrainage.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. Bid Items have been provided for **Storm Sewer Pipe**. Measurement will be based on units of lineal feet for each size, type, and class of pipe furnished and installed complete in place as specified, including excavation, bedding, backfilling, shoring, dewatering, and compaction. Pipe will be measured from centerline of structure to centerline of structure:
      a. Improved pipe foundation material, if necessary, shall be per Section 33 05 05.
   2. Bid Items have been provided for **Culvert Pipe**. Measurement will be based on units of lineal feet for each size, type, and class of pipe furnished and installed complete in place as specified, including excavation, bedding, backfilling, shoring, dewatering, and compaction.

B. A Bid Item has been provided for **Flared End Section**. Measurement will be based on units of each size installed at locations indicated in the Drawings complete in place as specified, including trash guard if specified, excavation, bedding, backfilling, shoring, dewatering, and compaction
      a. Where a sewer line is terminated with a flared end section, tying the last 3 joints as specified is considered incidental to the installation of the pipe.
   2. A Bid Item has been provided for **Bentonite Collar**. Measurement will be per each collar constructed according to plan dimensions. Payment at the Bid Unit Price shall include all costs related to constructing the collar in accordance with the Drawings, including excavation, forms, and material.
   3. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM)
   1. A48 - Specification for Gray Iron Castings.
   2. A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

3. A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. A760 - Specification for Corrugated Steel Pipe, Metallic – Coated for Sewers and Drains.
5. C76 - Specification for Reinforced Concrete Culvert, Drain, and Sewer Pipe.
6. C139 - Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
7. C150 - Specification for Portland Cement.
8. C206 - Specification for Finishing Hydrated Lime.
9. C361 - Specification for Reinforced Concrete Low Head Pressure Pipe.
10. C443 - Specification for Joints for Circular Concrete Sewer and Pipe, Using Rubber Gaskets.
11. C478 - Specification for Precast Reinforced Concrete Manhole Sections.
12. D1248 - Specification for Polyethylene Plastic Molding and Extrusion Materials for Wire and Cable.
13. D1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
14. D2837 - Specification for Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
15. D3212 - Specification for Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals.
16. F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
17. F794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
18. F894 - Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drainpipe.

B. Standard Specifications for Sewer & Water Construction in Wisconsin, 2003 Edition (Green Book)

C. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.)
1. 504 – Culverts, Retaining Walls, and Endwalls.
2. 520 – Pipe Culverts.
3. 521 – Corrugated Steel Culverts.
4. 522 – Reinforced Concrete Culverts.
5. 608 – Storm Sewer.
6. 645 – Geosynthetics.

1.04 SEQUENCING AND SCHEDULING

A. Do not pursue work-causing shut off of utility service (gas, water, electric, telephone, TV, etc.) to consumers until the utility owner is contacted and all consumers are notified of the shut-off schedule.

B. Successfully complete required inspections and tests before commencement of Section 32 11 23 and Section 32 16 13.

1.05 SUBMITTALS

A. Submit Shop Drawings for storm sewer structures consistent with Section 01 33 00.

B. Shop drawings shall indicate complete information for fabrication and installation of units. Include the following:
   1. Plans and elevations locating and defining all material furnished by manufacturers.
   2. Sections and details showing connections, cast-in items, field installed lifting devices, capacities, all openings, and their relation to the structure.

C. Submit Manufacturer's Certificate of Compliance for the following items:
   1. Pipe.
   2. Flared End Sections.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mortar Materials
   1. Cement: Use Type 1 Standard Portland Cement conforming to ASTM C150.
   2. Lime: Use normal finishing hydrated lime meeting the requirements of ASTM C206.
   3. Mix Proportions
      a. 1-part cement to 3-parts of suitable plaster sand for mortar used for plastering the exterior walls of block manholes and catch basins, adjusting rings, and lift holes. Use lime or mortar mix in the amount necessary to make a suitable mixture for plastering purposes, but not to exceed 15-percent by volume.
      b. 1-part Portland cement to 2-parts of sand to which lime or mortar mix may be added, but not to exceed 15-percent by volume for mortar used for laying concrete block.

2.02 PIPE MATERIALS

A. Reinforced Concrete (RCP) Pipe and Fittings
   1. General Requirement: ASTM C76, Wall B with circular reinforcing.
   2. Materials: Conform to the requirements of ASTM C76, Wall B with circular reinforcing. O-ring gaskets shall be synthetic rubber, circular reinforcing in cross-section, and shall conform to ASTM C361.
   3. Pipe Joints: Bell and spigot ASTM C361.
   4. Pipe Class: As shown on the Drawings.
   5. Marking: Each pipe shall be identified with the name of the manufacturer trade name or trademark and code, identification of plant, date of manufacture, and the pipe class and specification design.

B. Corrugated Steel Pipe
   1. Galvanized corrugated steel pipe shall be manufactured in accordance with AASHTO Specifications M 36 and M 218. All areas of surface rust on re-corrugated ends or lock seams shall be painted using the hot-dip or metallizing process.
      a. Where two types of corrugation are acceptable, the use of standard 2-2/3" x 1/2" material is preferred, if available. 5 x 1 corrugations to be used only on helical pipe.

C. Steel Pipe
   1. Steel pipe shall be in conformance with ASTM A1097 and of leakproof construction, such as butt welded or interlocking joints which are capable of withstanding railroad loading. Pipe shall have a specified minimum yield strength, SMYS, of at least 35,000 psi (pounds per square inch / 241,317kPa).
   2. Wall thickness shall be a minimum 0.50 inches.

2.03 FLARED END SECTIONS

A. Conform to WisDOT Spec. 520.2.3 for Materials.

2.04 TRASH GUARDS

A. General Requirement: ASTM A153.

B. Materials: Galvanized steel rods meeting the requirements in ASTM A153.

C. Bar size and configuration as shown on the Drawings.

D. Securely attached to end section.

PART 3 EXECUTION

3.01 PREPARATION

A. Trench Excavation and Backfill shall conform to Section 33 05 05.

B. By-Pass Pumping: Contractor responsible for all items required to maintain sewer flows during construction of the new storm sewer. All Work and costs for by-pass pumping is considered incidental to the Project, unless otherwise specified.

3.02 INSTALLATION

A. Connect to Existing Structure
   1. Connect to existing structure at location shown on the Drawings.
   2. Core the hole in the structure and saw cut the pipe flush with the inside wall of the structure.
   3. Bulkhead void between outside wall of pipe and edge of opening with mortar and brick.
   4. Reconstruct manhole bench/invert.

B. Connect to End of Existing Pipe
   1. Connect to existing pipe at locations shown on the Drawings.
   2. Locate and expose end of existing pipe.
   3. Remove existing bulkhead or plug and dispose of off Site.
      a. Take care not to damage existing pipe.
      b. Any segment of pipe damaged by Contractor shall be replaced with new materials at no expense to the Project.
   4. Utilize standard bell and spigot joint with rubber O-ring gasket if possible.
   5. If butt connection must be made to existing pipe, construct concrete collar around joint. Collar shall be minimum 12-inches thick in all locations and shall extend a minimum of 12-inches each way of the joint.

C. Pipe Installation
   1. Lay and maintain pipe appurtenances to the alignment, grade, and location shown on the Drawings and/or staked in the field. No deviation from the Drawing and/or staked alignment, grade, or location is allowed, unless approved by Engineer. Deviation from grade in excess of 0.05 percent may be cause for removal and relaying pipe at the Contractor's expense.

2. General Pipe Installation Procedures
    a. Wipe joints clean; apply the manufacturer's recommended lubricant compound over the entire joint surface; center spigot in bell and push spigot home; take care to prevent dirt from entering the joint space; bring pipe to proper line and grade, and secure pipe in place by properly bedding.
3. Lay pipe upgrade with spigot ends pointing in the direction of flow.
4. All joints must be watertight.
5. Remove all foreign matter or dirt from inside the pipe. Keep the bell and spigot clean during and after installation. Take care to prevent dirt from entering the joint space. Remove any superfluous material from inside the pipe after pipe installation by means of an approved follower or scraper.
6. Where cut-ins make it impossible to construct bell and spigot joints or when dissimilar pipe materials are joined, a reinforced concrete collar shall be placed completely surrounding the joint or the connection shall be made by using an approved adapter.
7. Any pipe which has been disturbed after being laid must be taken up, the joint cleaned and properly re-laid as directed by the Engineer.
8. Where a sewer line outlets to grade or where the line is terminated with a flared end section:
    a. Fasten at least the last 3 joints together using 2 "U" bolt fasteners per joint approved and as recommended by the pipe manufacturers.

D. Structures and Appurtenances Installation
1. Furnish and install structures in accordance with the Drawings.
2. Excavate to depth and size as shown in the Drawings.
3. Poured in place bases must be acceptably cured before manhole sections are placed on the hardened slab. Poured in place bases must be approved by Owner.
4. Preformed inverts are not allowed.
5. Pour inverts shaped to the half section of equivalent size pipe conforming to the inlet and outlet pipe so as to allow for a free, uninterrupted flow with all surfaces sloping to the flow line.
6. All concrete pipes entering manholes must be cut with a concrete saw.
7. Steps
    a. Locate on the downstream side, except for pipe 24-inches in diameter or greater. Install in the most appropriate place, to provide suitable access.
    b. Secure and neatly mortar in place 15-inches on center spacing.
8. Position vertical wall of the eccentric cone on the downstream side.
9. On structures with a build that contains more than 1 barrel section, the section immediately below the precast top slab shall be maximum 16-inch height.
10. Lift holes neatly mortared up.
11. Install Adjustment Rings and Adjust Casting: Conforming to Section 33 05 17.

E. Construct Manhole Over Existing Pipe
1. Construct manhole over existing pipe at locations shown on the Drawings.
2. Saw cut existing pipe to fit flush with inside wall of new structure.
3. Seal any openings in manhole.

F. Riprap
1. General: Conform to Section 33 47 24.

G. Bulkhead Pipe
   1. Bulkhead pipe at locations shown on Drawings with brick, non-shrink concrete grout, or concrete block masonry 8-inches thick.
   2. Precast concrete plugs may be used in lieu of bulkhead. Plug must fit snugly into pipe opening and be watertight.

H. Bentonite Collar
   1. Construct at location indicated on Drawings.
   2. Construct per Detail on Drawings.

3.03 FIELD QUALITY CONTROL

A. Scope
   1. All pipeline testing is considered incidental to the Bid cost of the pipe.
   2. Engineer to observe and verify that all tests and visual inspections have been completed prior to final acceptance.

B. Cleaning
   1. Consists of Cleaning the Pipe and Structures
      a. If newly installed mains and structures are kept clean during construction, cleaning will not be required.
      b. If newly installed mains and/or structures become dirty due to negligence of the Contractor, cleaning will be performed at the sole expense of the Contractor.
   2. The bailing or flushing method of cleaning pipe is acceptable only if adequate provisions acceptable to the Engineer for keeping dirt and debris out of the existing sewer system or ponds are employed. Jetting may be required.
   3. Complete prior to final inspection for acceptance.

C. Required Tests and Inspections
   1. Infiltration
      a. To determine the amount of ground water infiltration into the sewers.
      b. Test waived if no visible infiltration is observed during the lamping inspection.
      c. Measurement made by means of 90-degree v-notch weirs placed in the lines as directed by the Engineer.
      d. Measurements taken at the points where in the Engineer's opinion the flow of water in the sewer is greater than the maximum allowable leakage.
      e. Maximum Allowable Rate of Leakage: Not more than 100 gallons per mile per inch diameter per day.
      f. Tests may be taken between individual manholes and the infiltration in any given line must not exceed the specified maximum allowable rate.
      g. Method of Measurement: Measurement of time for a predetermined volume of flow to occur.
   2. Lamping
      a. Verify installation is to true line and grade.
      b. Verify installed pipe is structurally sound.
      c. Verify there are no broken or deflective pipes.
      d. Verify that joints are all home.
      e. Verify structures conform to specified requirements.
   3. Mandrel Test: (If using PVC or HDPE Storm Sewer Pipe)
      a. Perform on PVC or HDPE main after installation has been completed.

b. Minimum waiting period of 30 days after completion of installation prior to performing test.
c. Contractor to furnish the mandrel and all labor, materials, and equipment necessary to perform the test.
d. Engineer must be present during pulling of the mandrel.
e. Deflection of inside diameter of pipe in excess of 5 percent shall be considered failure of the test.
f. Contractor shall repair/replace any failing segment of main, such that it successfully passes the test. All costs for such work, including but not limited to excavation, new materials, and restoration of surface to existing condition, shall be the sole expense of the Contractor.
g. Owner reserves right to measure deflection of PVC pipe at any time during the warranty period.

3.04 PROTECTION

A. Plug all entrances and openings to the system promptly and before suspension of operations at the end of working day.

B. Secure manholes and structures immediately after completion or before suspension of operations at the end of working day with castings or suitable alternative device.

C. Mark all structures to avoid being hit by construction or vehicular traffic.

D. Mark each plug location with 4-inch by 4-inch timbers to above grade to aid in marking the future connection.

E. Establish erosion control measures as per Section 01 57 13.

END OF SECTION

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SECTION 33 47 24

STABILIZATION POND EROSION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Turf Reinforcement Matting to help permanently stabilize the soil within the proposed emergency spillway path.

B. Related Sections
   1. Section 01 57 13 – Temporary Erosion and Sediment Control.
   2. Section 31 23 00 – Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. **Turf Reinforcement Matting** shall be measured and paid for based on the class, type and square yard Plan Quantity as listed in the Bid Schedule. Payment for this Bid Item shall be compensation in full for all material including matting, subgrade preparation, anchoring, backfill, labor, and equipment required to furnish and place the matting material as specified.
   2. All other Work and costs in this Section shall be considered incidental to the Project and included in the Total Base Bid.

1.03 SPECIFICATION REFERENCE

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.)
   1. 628 – Erosion Control.
   2. 645 – Geosynthetics.

B. Wisconsin Erosion Control Product Acceptability List (PAL).

C. Wisconsin Department of Natural Resources.
   1. Technical Standard 1052 – Non-Channel Erosion Mat.

1.04 SUBBMITTALS

A. Shop Drawings
   1. Submit shop drawings for material consistent with Section 01 33 00.

B. Product Data
   1. Submit product shear strength test results consistent with Section 01 33 00.

PART 2 PRODUCTS

2.01 TURF REINFORCEMENT MATTING

A. Heavy duty synthetic turf reinforcement.
   1. Matting shall be exclusively organic material (no plastic).

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Conform to WisDOT Specification 628.3.2.

B. Install and anchor erosion mat in accordance with manufacturer's instructions.

C. At the time of installation, retain material labels and manufacturer's installation instructions until the site has been stabilized.

D. Install ECRMs after topsoil is placed and seeding is complete.

E. Install TRMs in conjunction with placement of topsoil, followed by ECRM installation.

F. Install erosion mat so that it bears completely on the soil surface.

G. Use staples that are at least 6 inches long.

END OF SECTION

SECTION 34 11 10

RAILROAD TRACK CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Unloading, stockpiling, transporting and inventory of material, distributing and placing of ties, tie plates, all other track material (OTM), fittings and fastenings. Track Construction shall also include the laying, bolting, gauging and spiking of rail and adjustments of rail, the installing of bumping posts or earthen berms, derails, frogs, switches, guardrails, switch stands, road crossings, the placing of ballast, lining, surfacing and finishing of tracks, on previously prepared sub-ballast.

B. Related Sections
1. Section 02 41 13 – Selective Site Demolition.
2. Section 31 10 00 – Site Clearing.
3. Section 31 20 00 – Earthmoving.
4. Section 31 23 33 – Excavation and Fill.
5. Section 31 23 13 – Subgrade Preparation.
6. Section 31 32 19 – Geosynthetic Soil Stabilization and Layer Separation.
7. Section 32 11 23 – Aggregate Base Courses.
8. Section 34 78 23 – Railroad Car Scales.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement And Payment
1. A Bid Item has been provided for **Construct Track**. Measurement will be by the track foot as measured in feet along the centerline of track, excluding turnouts, crossings, and switch point derails. The unit price for track construction shall include furnishing and installing the rail, ties, tie plates, joint bars, track bolts, nuts and lock washers, track spikes, rail anchors, ballast, bumping posts or earthen berms, railroad protection flagging, and surfacing and lining as required to achieve proposed top of rail elevation.
2. Bid Items have been provided for **Turnout (Number)**. Measurement will be per each individual unit acceptably completed. A turnout is considered both the straight side and diverging side. Payment is full compensation for furnishing and the installation of all materials for turnouts, to include frogs, switches, switch stands with connecting rods, guardrails, switch ties, and appurtenant rails with fastenings; and all labor, tools equipment and incidentals necessary to complete the contract work according to the plans and details.
3. A Bid Item has been provided for **Derail Sliding with Wheel Crowder**. Measurement will be per each individual unit acceptably completed. Payment is full compensation for furnishing and the installation of all materials, labor, tools equipment and incidentals necessary to complete the contract work according to the plans and details. Item includes derail sign and post.
4. Bid Items have been provided for **Crossing (Type)**. Measurement will be measured in track feet along the centerline of track for each type of crossing

installed. The unit price for Crossing bid items is for furnishing and the installation of all material for grade crossings, to include timber crossing material, concrete crossing material or flangeway rail and fasteners, rail, hardwood ties, joint bars and joint bars compromise.

1.03 REFERENCED STANDARDS

A. Current versions of the following rules, standards, specifications, and references shall apply to all track work:
   1. BNSF Railway Company Guidelines for Industrial Track Projects.
   2. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.
   3. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction," 2022 Edition (WisDOT Spec.) and supplements.

1.04 QUALITY ASSURANCE

A. Construction Supervision - The track construction shall be progressed with skilled supervision and labor and the Contractor shall assemble the track material in such a manner as may be required by the Engineer.

B. Inspection Of Subgrade - Shall be made just prior to track laying. Track construction shall not commence until the subgrade and sub ballast has been approved by the Engineer.

C. Damage And Restoration - The Contractor shall perform hauling, loading and unloading operations as well as track construction in such a manner as to cause no damage to the roadbed, ditches, shoulders, slopes, drainage pipes, risers, drop inlets, roads and any other facilities. Any damage to the foregoing shall be repaired or replaced, where necessary, in a manner satisfactory to the Engineer and at the expense of the Contractor. In making repairs and replacements, equivalent materials shall be used and the method of placement shall be as directed by the Engineer.

1.05 TRACK PROTECTION AND SAFETY

A. All BNSF Requirements for Contractors Working on BNSF Right-of-Way apply.

B. Contractor must not at any time foul the main line tracks. A BNSF flagman will be required, at the Contractor's expense, when working within 25 feet from centerline of the track. This shall be considered incidental to the work.

1.06 SUBMITTALS

A. Provide material certifications for materials listed in Part 2 – Products.

PART 2 PRODUCTS

2.01 RAIL

A. For trackage maintained by the Customer the minimum acceptable rail shall be 115# section and shall be compatible with BNSF standard rail section. For

locations where trackage will be maintained by BNSF rail and fastenings shall conform to the BNSF standard rail section in use in that area. Contractor shall contact BNSF Engineering for approved section. Transition rails or compromise joints at the BNSF-Customer interface are the responsibility of the customer. Minimum length shall not be less than 39 feet except in turnouts and shall be free from defects. Rail should be minimum full ball relay rail, not exceeding 3/16 inch wear on any surface. Continuous welded rail (CWR) will need to be destressed as soon as possible after laying (see "Procedures for the Installation, Adjustment, Maintenance, and Inspection of CWR in Industry Tracks" appendix, page A-1 thru A-9). CWR is recommended when using concrete ties. Thermite and flash-butt welds must be placed in crib area between ties. An abrasive rail saw will be used to cut rail—no torch cutting.

2.02 ANCHORS

A. Rail anchors shall be new or reconditioned, sized to fit the rail section, and shall be provided per industrial track design criteria on pages 3 and 6. High traffic volumes or unusual grade or alignment problems may require additional anchors as determined by Engineer. Turnouts shall also be anchored.

2.03 TIES

A. Hardwood ties shall be new 7" X 8" (AREMA No. 4) 8'-6" long, placed on 21.5 inch centers. Switch ties shall have a minimum cross section of 7" x 9" and minimum lengths shall conform to applicable BNSF Standard plans. Concrete ties shall be pre-stressed, measure 11 inches wide at the bottom and 9 inches high with a length of 8' 3" and weight of 630 pounds. Concrete ties can be placed on 28 inch centers provided there is a minimum ballast section of 8 inches below the tie. Second-hand, or "3/4" concrete ties can be used after inspection and approval from the BNSF Roadmaster. When placing 3/4 ties, the damaged shoulders should be alternated from left to right sides so that they are not on the same side. Steel ties are spaced at 24 inch centers with 8 inch ballast section and can be used with timber or concrete ties. Steel ties should not be used within 200 feet of a signal circuit identified by insulated joints.

2.04 BALLAST

A. Track ballast shall be Class 2 (1" - 3/8"). Ballast shall be free from loam, dust, and other foreign particles and shall not have less than 75 percent crushed particles with two or more fractured faces, unless otherwise approved by BNSF. Processed ballast shall be hard, dense, of angular particle structure, providing sharp corners and cubicle fragments and free of deleterious materials. Ballast materials shall provide high resistance to temperature changes, chemical attack, have high electrical resistance, low absorption properties and free of cementing characteristics. Materials shall have sufficient unit weight (measured in pounds per cubic foot) and have a limited amount of flat and elongated particles. Unless it meets or exceeds BNSF requirements, slag is not an approved ballast material. Walkway ballast shall be Class 2 (1" - 3/8").

B. The quality of the material to be used for ballast shall be determined by the supplier prior to its acceptance by the Owner. A series of tests by the supplier, as

specified herein, shall be made at a testing laboratory approved by the Engineer to establish the characteristics of the material being tested.

C. Prior to installation, the quality of the material to be used for ballast shall be determined by the supplier prior to its acceptance. The producer should provide the Engineer with certified results of ballast quality and gradation as conducted by a testing laboratory acceptable to the Engineer. The producer shall receive approval from the Engineer for the testing laboratory prior to performing the following tests.

FULLY WASHED BRANCH AND YARD BALLAST MATERIAL		
PROPERTY	VALUE	ASTM TEST
Percent Material, Passing No. 200 Sieve	0.5%	X1.3 or C-117
Bulk Specific Gravity (See Note #2)	2.6%	C27
Absorption Percent	0.5%	C127
Clay Lumps & Friable Particles	0.5%	C142
Abrasion Number L.A. Abrasion Number	50.0% 35% max	C535 and MMA C-535
Soundness (Sodium Sulfate) 5 Cycles	5.0%	C88
Flat and/or Elongated Particles	5.0%	USACE CRD-C119 or D-4791
Plasticity Index L.A. Fines	NP	D423, D424
Total Sample Liquid Limit	25	D423, D424
Total Sample Plasticity Index	6	D423, D424

Note #1: The limit for Bulk Specific Gravity is a minimum value. Limits for the remainder of the tests are maximum values.

Note #2: With the implementation of these specifications, the railroads will only accept ballast which has been washed into the cars or stockpile. Deluge type washing of ballast after loading is not acceptable. The larger gradations will be sampled on the belt, material finer than a #200 sieve will be sampled from loaded cars.

NP: Nonplastic.

NOMINAL BALLAST SIZE		PERCENT PASSING (BY WEIGHT)									
SIZE NO.	SQ. OPENING	2 ½"	2"	1 ¾"	1 ½"	1 ¼"	1"	¾"	½"	3/8"	No. 4
Class 2	1 - 3/8"				100		90-100	40-75	15-35	0-15	0-5

2.05 TURNOUTS (SWITCHES, FROGS, GUARDRAILS)

A. All parts shall be new or good secondhand, with secondhand parts being free of injurious defects.

2.06 TIE PLATES

A. Tie plates may be new or secondhand, free of injurious defects and foreign material, conforming to AREMA Specifications, and shall fit rail being used. For rail 110# section and greater, all plates will be double-shouldered.

2.07 JOINTS

A. New or secondhand joints, free of foreign material and without injurious defects, and with 4 or 6 bolt holes, conforming to AREMA requirements, may be furnished to fit rail section for which they are designed. Bolt holes must be drilled with proper equipment. Torch-cutting of bolt holes is not allowed. New or secondhand compromise joints of manufactured type (welded or homemade are not acceptable), free of foreign material and without injurious defects, shall be furnished and used where rail section (weight or design) changes. Rail section by weight shall not be compromised where difference in weight is in excess of 25 lbs. When this becomes necessary, a rail of some weight between the two different rail sections, in excess of 25 lbs., shall be used and the compromise made in two steps. The length of the medium-weight rail should be 39 feet where practical.

2.08 SPIKES

A. Spikes: 5/8" x 6" cut track spikes shall be installed. All spikes shall conform to AREMA requirements.

2.09 TRACK BOLTS & NUTS

A. Track bolts and nuts shall be installed conforming to AREMA Specifications. Bolts will be correct size and length to fit rail.

2.10 LOCK WASHERS

A. One lock washer conforming to AREMA Specifications shall be installed on each track bolt.

2.11 BUMPING POST

A. An earthen berm (see BNSF Railway Company Guidelines for Industrial Track Projects appendix, page A-15) shall be installed at the ends of tracks. Also, a red retro-reflective marker shall be placed at the end of track.

2.12 DERAILS

A. Sliding derail and wheel crowders shall to AREMA Specifications.

PART 3 EXECUTION

3.01 GENERAL

A. All work shall be of good quality in materials, equipment and workmanship and shall conform in every respect with the specifications and instructions.

3.02 TIES

A. Ties will be unloaded and handled in such a manner as not to damage ties, using approved handling equipment. Ties to be placed at design spacing of 21.5-inch center to center (22 ties/39 feet) for wood, and 28-inch centers for concrete, on the finished subgrade, perpendicular to center line of track with the right-hand ends of ties being parallel. Exception: On curves, align the ties to the inside of the curve. All joints are to be suspended between ties. Top surface of ties shall be clean and smooth to provide full bearing for tie plates. Lay wood ties with heartwood face down, and if not possible to determine position of the heartwood, lay the widest surface of the tie down. If spikes are pulled from any tie, hole shall be filled by driving in a treated wood tie plug the full depth of the hole. Boring or adzing of ties shall be kept to a minimum.

3.03 TIE PLATES

A. Double-shouldered tie plates will be used on all ties and set in position with can't surface sloping inward, making sure they are firmly seated and have full bearing. After rails are in place, shoulder of plates shall be in full contact with outside edge of rail base.

3.04 RAILS

A. Assemble joints before fastening rails to ties, using joint bars with full number of track bolts and spring washer for each bolt, first removing loose mill scale and rust from contact surfaces or joint bars and rails. In laying secondhand rail, care must be taken to rail end mismatch at the joints. Under no circumstances must rail be struck in web with tool or any metal object. The right-hand rail facing in direction of increasing construction shall be spiked to ties, and the opposite rail shall be brought to gage of 4' 8-1/2", measured at right angles between the rails, in a place 5/8 inches below top of rail. A track gauge manufactured for the purpose of measuring gage should be used rather than a tape measure. Gauge is to be checked at every third tie. Do not strike rail directly with a maul, either on top when driving spikes, or on side to obtain track gauge. Rail shall be laid with staggered joints. Joints shall be located as nearly as possible to the middle of the opposite rails with the following variation: (a) except through turnouts, the staggering of the joints on one side shall not vary more than 6 feet in either direction from the center of the opposite rail.

3.05 JOINTS

A. If necessary to force joint bar into position, strike lower edge of bar lightly with 4- lb. maul. Do not drive bolts in place. Tighten bolts in sequence, beginning at joint center and working out to ends. Bolts are to be tightened to a range of 20,000 to 30,000 ft.-lbs. tension. If a bolt tightening machine is not used, a standard

track wrench with a 42 inch long handle may be used. At the time of installation, rail expansion shims of softwood not over 1 inch width shall be placed between the ends of adjacent rails to ensure proper space allowance for expansion required by the rail temperatures in the following table, and shall be left in place:

39-ft Rail

Temperature Deg. F	**Expansion**
Over 85	None
66 to 85	1/16
46 to 65	1/8
26 to 45	3/16
6 to 25	1/4
Below 6	5/16

3.06 BENDING STOCK RAILS

A. Use approved rail bending equipment. Make bends uniform and accurate for all stock rails.

3.07 SPIKING TO WOOD TIES

A. Rails shall be spiked to every tie, using not less than 2 spikes for each rail at each tie. Drive spikes through tie plate holes into ties, located diagonally opposite each other but not less than 2 inches from edge of tie. Start and drive spikes vertically and square with rail. Take care to avoid slanting, bending, or causing sideways movement of spike. Each rail will be spiked with two spikes per tie plate on tangent track staggered with inside spikes to the east or north and outside spikes to the west or south. On curves a third spike is required on the gauge side of the rail. Spikes should not be placed in the slots on skirted joint bars when such practice can be avoided by providing other plates with a hole pattern that will clear the skirts. When spikes are driven by machine, work shall be closely supervised to see that they are driven with hammer centered exactly over each spike head and drive spike vertically. Set stop bolt on the machine to prevent over-driving. Withdraw spikes that are incorrectly driven and fill hole by driving a tie plug to full depth of hole. Locate replacement spike at another hole in tie plate and tie.

3.08 BALLAST AND SURFACING

A. Raise track by means of jacks placed close enough together to prevent excessive bending of rails or strain on joint. Lift both rails simultaneously and as uniformly as possible. Power jack may also be used. Each track raise shall not exceed 4 inches with ties tamped prior to additional raise.

B. Unload and level down ballast by most practical means, taking care not to disturb grade stakes. Perform tamping, using power tamping machines wherever possible, or manually, using approved AREMA tamping tools appropriate for type of ballast being placed. Tamp each layer of ballast from a line 15 inches inside each rail, on both sides of and to the ends of ties. Center area between these limits shall be filled lightly with ballast but not tamped. At turnouts and crossovers, tamp ballast uniformly for full length of ties. Tamping shall proceed simultaneously

at both ends of same tie, making sure ballast is forced directly under the ties and against sides and ends of ties.

C. Dress ballast in conformance with dimensions shown on drawings, placing additional ballast material as necessary. When placing pavement up to the track and flush with top of rail it is important to make sure water drains away from the track. This will prevent pooling and freezing which create hazardous walking conditions. Lines should be painted 10 feet parallel to the centerline of track on both sides to serve as visual reminder of the track's foul zone. Crushed rock or fabric should be placed over the ties to keep the pavement from adhering to them. Flange ways need to be kept clean to allow wheels to contact top of rail at all times.

3.09 DERAILS & BUMPERS

A. Where required, derails and bumpers shall be installed in conformity with standard plans and/or instructions and shall be inspected and approved by the Engineer before final acceptance and operation over the track.

B. It is the Contractor's responsibility to install temporary derails as necessary to protect the main track or any track in that may be in operation.

3.10 ROAD CROSSINGS

A. Where required, road crossings shall be installed in conformity with standard plans and/or instructions and shall be inspected and approved by the Engineer before final acceptance and operation over the track.

3.11 FINAL INSPECTION

A. After ballasting and surfacing are completed, inspect track to see that joints are tight and rail attachments to ties are secure. Contractor will notify the Engineer that the track work is complete and ready for inspection. The Engineer, along with a BNSF Engineering Representative will inspect the finished track work. If continuous welded rail is placed, the Contractor will provide a copy of the "Record of Neutral Temp of Welded Rail as Laid" form to the Engineer prior to inspection. After the Engineer's approval, the track will be considered complete.

END OF SECTION

SECTION 34 41 05

TRAFFIC SIGNS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Signs, signposts, and hardware.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement And Payment
   1. A Bid Item has been provided for Signs Type II Reflective H. Measurement will be in accordance with WisDOT Spec. 637.4. Payment for all sign installation shall be in accordance with WisDOT Spec. 637.5.
   2. A Bid Item has been provided for Posts Wood 4x6 Inch X 14-Foot. Measurement will be in accordance with WisDOT Spec. 634.4. Payment for all post installation shall be in accordance with WisDOT Spec. 634.5

1.03 REFERENCED STANDARDS

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction" 2022 Edition (WisDOT Spec.).
   1. Wisconsin Manual on Uniform Traffic Control Devices (WMUTCD).

1.04 SUBMITTALS

A. Buy America
   1. Certification documents for steel items must denote compliance to all elements of Buy America provisions.

B. Reflective Sheeting
   1. Product & Manufacturer from WisDOT's approved product list

C. Sign Base Material, Sign Message Material, Mounting Hardware, Posts:
   1. Manufacturer certification of compliance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Signs
   1. Sign materials shall be in accordance with WisDOT Spec. 637.2.

B. Posts
   1. Post materials shall be accordance with WisDOT Spec. 634.2.

PART 3 EXECUTION

3.01 GENERAL

A. The sign number designation indicated on the Drawings shall comply with applicable requirements of WMUTCD and WisDOT Standard Signs Manual.

3.02 CONSTRUCTION

A. Signs
   1. Unless otherwise noted or modified herein, all sections of WisDOT Spec. 637.3 shall apply.

B. Posts
   1. Unless otherwise noted or modified herein, all sections of WisDOT Spec. 637.3 shall apply.

END OF SECTION

SECTION 34 78 23

RAILROAD CAR SCALES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install a railcar scale system to provide a complete working system.

B. Related Sections
   1. Section 31 23 00 – Excavation and Fill.
   2. Section 31 23 13 – Subgrade Preparation.
   3. Section 34 11 10 – Railroad Track Construction.

1.02 PRICE AND PAYMENT PROCEEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Railroad Car Scale**. Measurement will be by the lump sum as specified. The unit price for Railroad Car Scale shall include furnishing and installing a complete railcar scale system according to this specification, as shown on the plans, and in accordance with the manufactures instructions. Item includes weighbridges, weigh rail, scale foundation, scale deck, approach slabs and rail, load cells, scale instrumentation, weigh indicators and recording devices, sump pump or gravity drain piping, wiring, power supply, scale house, bollards, poles, lights, bases, excavation and backfill, subgrade improvements, foundation bedding, bollards, testing, and other incidentals included in the work that do not have a separate pay item in the contract.

1.03 REFERENCES

A. Current versions of the following rules, standards, specifications, and references shall apply:
   1. Association of American Railroads “AAR Scale Handbook”.
   2. American Railway Engineering and Maintenance -of-Way Association (AREMA) Standards
   3. National Institute of Standards and Technology (NIST), Handbook 44, "Specifications, Tolerances, and Technical Requirements for Weighing and Measuring Devices".
   4. Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction.

1.04 INFORMATIONAL SUBMITTALS

A. Contractor shall provide drawings, specifications, and descriptions in sufficient dimensional detail to permit design calculations for stresses and to allow adequate checking of the design requirements for finish, and workmanship of steel, approach wall, and scale pit construction including sump pit/pump or gravity drain. Such information with site plan showing final location and details for the scale house, electrical supply, pole and remote display and other necessary equipment location,

shall be furnished by the contractor, distributor, or installer for review prior to commencement of construction. All plans shall include location of scale and owner's name. Drawings, details, and specifications shall be signed and sealed by a professional engineer licensed in the State of Wisconsin.

B. Certificate of Conformance (NTEP Certification) that scale meets the requirements as set forth by NIST H-44 for Class IIIL devices.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment and material furnished shall be new.

B. Scale shall be certified for Legal for Trade usage.

C. Scale to accommodate a railcar length of 54 feet.

D. Furnish and install one double tandem static railroad car scale system.

E. The double section shall have a clear and unobstructed weighing surface of not less than 25 feet in length.

F. The scale shall be fully electronic in design and shall not incorporate any mechanical weighing elements, check rods, or check stays.

G. The scale shall be designed to perform as a summed weighing platform and shall be of a shallow-pit, self-contained, and live-rail/live-deck design.

H. The scale shall have a gross weighing capacity of 170 tons (340,000 pounds) and shall have a sectional capacity of 85 tons (170,000 pounds).

I. The scale shall be designed to meet the requirements established by AAR/AREMA for Cooper E-80 loading and the current edition of the National Institute of Standards and Technology Handbook 44 (NIST H-44).

J. The scale shall be calibrated to 340,000 pounds by 50-pound increments.

K. The design and manufacture of the scale weighbridge, load cells, digital instrument, printer, and associated accessories shall be of one manufacturer to maximize compatibility and availability of components. Also, the manufacturer shall have a quality system that has been registered to the standards of ISO 9001.

2.02 SCALE WEIGHBRIDGES

A. Weighbridges shall meet the minimum specifications as required in AAR Scale Handbook Section 2.14 and as supplemented as follows:
   1. The weighbridge shall be designed to allow access to the load cell cables, base plates, and all foundation anchor bolts via removable access covers.
   2. The weighbridge shall consist of prefabricated modules and shall not require special wide-load permits for shipping.
   3. All welding should be completed in accordance with the American Welding Society (AWS) D1.5 Bridge Welding Code.

4. All welding should be performed by welding operators that have been certified to the AWS D1.5 Bridge Welding Code.
5. All welding should be performed in position 1F, to ensure maximum weld integrity.
6. Weigh rails shall be a minimum of 115lb/yd and new rail.
7. The weigh rails should be smooth, straight, and without joints throughout their entire length. Surface and alignment must be preserved between the ends of the approach and weigh rails. The gap between the approach and weigh rails shall be maintained to not less than 1/8 in. (4 mm) and shall not exceed 5/8 in. (16 mm). The gap should be protected against change by the use of expansion joints or other suitable means, in the approach track.

2.03 PROTECTION FROM CORROSION

A. The finish and treatment of all surfaces shall be durable and appropriate for the intended use and be treated to prevent corrosion.

2.04 APPROACH RAILS

A. Weighbridges shall meet the minimum specifications as required in AAR Scale Handbook Section 2.16 and as supplemented as follows:
   1. Approach rails shall be a minimum of 115lb/yd and new rail.

2.05 SCALE DECK

A. Shall meet the minimum requirements of Section 2.18 of the AAR Scale Handbook.

2.06 SCALE FOUNDATION AND PIT

A. Scale Foundation and Pit shall meet the minimum specifications as required in AAR Scale Handbook Section 2.22 and as supplemented as follows:
   1. The foundation shall be constructed to provide positive drainage to a sump pump reservoir or gravity drain as determined foundation designer.

2.07 SCALE HOUSE

A. Shall meet the minimum requirements of Section 2.24 of the AAR Scale Handbook or as supplemented as follows:
   1. Scale house is to be unattended.
   2. Size
      a. Min. size: 6' x 8'.
      b. 8 foot interior ceiling height.
   3. Walls
      a. 2x4 Studs with 1/2 inch Sheathing.
      b. 8 foot Interior ceiling height.
      c. R-11 fiberglass insulation.
      d. Exterior Walls
         - Grey vertical steel siding.
         - White Steel Trim.
      e. Interior Walls
         - 3/8 inch white vinyl panels.
         - Baseboard and corner trim.
   4. Roof
      a. 2x8 bowed rafters @ 16 inch O.C.

b. 3/8 inch sheathing.
c. R-19 fiberglass insulation.
d. Gray steel panels.

5. Door
   a. 36" x 6'-8" hollow metal steel door.
   b. Heavy gauge steel frame.
   c. Gray enamel finish.
   d. Keyed lock & dead bolt.
   e. Hydraulic door closure.
   f. Weather stripping and threshold.
6. Electrical
   a. 2410/120 VAC single phase service
      - 100A main breaker.
      - 12 circuit capacity.
      - 4 - 20A circuit breakers installed.
      - 1 1/2 inch conduit thru wall entrance.
   b. Wiring & fixtures:
      - Surface mount EMT conduit & boxes.
      - 12 AWG insulated copper wiring w/ ground (90 degrees C rated).
      - 4 - 120VAC/20A duplex outlets.
      - 1 - 4' LED Wrap surface mount light w/ acrylic light diffuser.
      - 1 - Exterior LED light w/ photocell.
7. HVAC
   a. Combination 120 VAC thru wall unit.
   b. Heat: 3,900 BTU.
   c. Cool: 9,000 BTU.
   d. Automatic heat/cool switching.
8. Foundation
   a. Concrete Slab designed to support Scale House structure.

2.08 WEIGHT INDICATOR, REMOTE DISPLAY SYSTEM, AND RECORDING DEVICES

A. Shall meet the minimum requirements of Section 2.25 of the AAR Scale Handbook or as supplemented as follows:
   1. Scale instrument shall have the ability to connect with external PC software to allow configuration, data backup and restore, security unlock capabilities, FTP access to log files so as to significantly reduce service cost and downtime during any repair and maintenance of the scale.
   2. The scale instrument shall output the following information:
      a. Gross, Tare, and Net Weight.
      b. ID.
      c. Transaction Counter.
      d. Time and Date.
      e. Variable Application-Specific Information.
      f. Standard Reports Generated by the Scale Instrument.
   3. Remote Display System
      a. General:
         - Provide remote display and traffic light indicator near the rail scale to regulate movement of traffic over scale. System shall include lights, pole(s), concrete bases, mounting hardware, power supply and other necessary items to provide a functioning system to provide communication at a distance up to 200 feet.

b. Remote Display
   - 6-digit, red LED display.
   - IPP66 Weather Tight Rating
   - -40 degrees F to 120 degrees F (-40 degrees C to 49 degrees C) operating temperature.
   - Steel enclosure with sun shield.
   - 2-Year limited warranty.

c. Traffic Control
   - Red and green LED lights for stop and go communication.

d. Pole and Base
   - Type 3 per WisDOT Standard Specification 657.
   - Concrete base Type 2 per WisDOT Standard Specification 654.

e. Site Lighting
   - Luminaires Utility LED 8 per WisDOT standard Specification 659.
   - Luminaire arms single member 4-inch clamp 6-ft per WisDOT standard specification 657.

4. The printer shall be housed in a suitable enclosure for desktop mounting.
5. The printer shall be capable of printing all information sent from the scale instrument, including:
   a. Gross, Tare, and Net Weights.
   b. Time and Date.
   c. Transaction Counter Number.
   d. 12-Digit Numeric ID.

2.09 LOAD CELLS

A. Shall meet the minimum requirements of Section 2.26 of the AAR Scale Handbook.

2.10 SUMP PUMP

A. If a sump pit is designed and constructed in the scale pit, then provide design and construction of a sump pump system sufficient to dewater the pit. Provide discharge piping to grade and heat tape/wire on discharge pipe to prevent from freezing.

2.11 POWER SUPPLY

A. See Rail Scale Electrical Drawings Sheets R110 and R111.

2.12 LIGHTNING PROTECTION

A. A comprehensive lightning protection system shall be provided with the scale.

B. The system shall not require complicated wiring or devices to provide this protection.

C. Major scale components including load cells, scale instrument, and printer shall be included in the lightning protection system.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Scale system shall be installed in accordance with the manufacturer's instructions.

B. Foundation constructed in accordance with the engineered foundation drawings and specifications (contractor or vendor supplied).

C. Electrical supply and systems shall be installed in accordance with local and state codes, drawings, and specifications.

D. Subgrade Improvements
   1. See sheet R120 for sub foundation to rail scale. Scale foundation shall bear on scale sub foundation. Alternatively provide written alternative to achieve 4000 psf subgrade foundation per geotechnical report.

3.02 TESTING

A. Contractor shall test and certify the scale in accordance with NIST 44 Handbook and AAR Scale Handbook.

END OF SECTION

SECTION 34 78 23.1

TRUCK SCALES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Furnish and install a truck scale system to provide a complete working system.

B. Related Sections
   1. Section 03 3010 – Reinforced Cast-in-Place Concrete.
   2. Section 31 23 00 – Excavation and Fill.
   3. Section 34 78 23 – Railroad Car Scales.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Truck Scale**. Measurement will be by Lump Sum as specified. The unit price for Truck Scale shall include furnishing and installing a complete truck scale system according to this specification, as shown on the plans, and in accordance with the manufacturer's instructions. Payment shall include compensation delivery, installation, and start up for above ground truck scale, ramps, foundation, load cells, platform, painting and finishing, weight indicator, scale instrumentation, controller, ticket printer, LED remote display, calibration, excavation and backfill, and any other incidentals included in the work that do not have a separate pay item within this Contract.

1.03 REFERENCES

A. Wisconsin Department of Transportation "Standard Specifications for Highway and Structure Construction" – Latest edition and all current Supplements (WisDOT Spec.).

B. National Conference on Weights and Measures (NCWM)

1.04 SUBMITTALS

A. Contractor shall provide drawings, specifications, and descriptions in sufficient dimensional detail to permit design calculations for stresses and to allow adequate checking of the design requirements. Such information with site plan showing final location and details for the scale and other necessary equipment location, shall be furnished by the contractor, distributor, or installer for review prior to commencement of construction. All plans shall include location of scale and owner's name.

B. Certificate of Conformance (NTEP Certification) that scale meets the requirements as set forth by NIST H-44.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment and material furnished shall be new.

B. Furnish and install one double tandem static railroad car scale system.

C. The design and manufacture of the scale, load cells, digital instruments, printer, displays, and associated accessories shall be of one manufacturer to maximize compatibility and availability of components.

2.02 ABOVE GROUND TRUCK SCALE

A. Scale shall be certified for Legal for Trade usage.

B. Scale dimensions:
1. Min. 70'x10'.

C. The scale shall be fully electronic in design and shall not incorporate any mechanical weighing elements.

D. The scale shall have a min. 90,000 lb. concentrated load capacity and min. 120-ton overall capacity.

2.03 ROCKER COLUMN LOAD CELL

A. 100% hermetically sealed with glass to metal weld at cable entry point.

B. Load cells shall be stainless steel with sheathed load cell cables.

2.04 PROTECTION FROM CORROSION

A. The finish and treatment of all surfaces shall be durable and appropriate for the intended use and be treated to prevent corrosion.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Scale system shall be installed in accordance with the manufacturer's instructions.

B. Foundation constructed in accordance with the engineered foundation drawings and specifications (contractor or vendor supplied).

C. Electrical supply and systems shall be installed in accordance with local and state codes, drawings, and specifications.

3.02 TESTING

A. Testing of the scale shall be certified in accordance with NIST 44 Handbook.

END OF SECTION

SECTION 35 42 13.19

STEEL PILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel Sheet Piles.
2. Steel H-Piles.
3. Steel Round Piles.

B. Related Sections
1. Section 35 42 13.21 - High Performance Coatings.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Steel Sheet Piles**. Measurement will be by the square foot of sheet pile area projected horizontally and perpendicular to the driveline, acceptably completed. The unit price shall include labor and equipment necessary to furnish and install the steel pile for the owner as shown on the plans.
2. A Bid Item has been provided for **Steel H-Piles.** Measurement will be by the Lineal foot of steel pile acceptably completed. The unit price shall include labor and equipment necessary to furnish and install the steel pile for the owner as shown on the plans.
3. The work of this Section is affected as follows:
   a. Additional payment for material in excess of that indicated, and credit for less than that indicated will be calculated at unit prices stated in the Contract.
   b. Unit prices include labor, specialty connectors, tools, equipment, and incidentals for furnishing, driving, cutting off, filing pile and furnishing and installing pile connectors and reinforcing as detailed.
   c. No payment will be made for piles driven out of tolerance vertically, horizontally or piles damaged during handling or driving. Contractor shall inspect all piling delivered to site prior to start of construction.

1.3 SUBMITTALS

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

B. Shop Drawings: For steel piling, show fabrication and installation details as necessary to install piling and fabricate specialty connectors.

C. Qualification Data: For qualified Installer.

D. Mill Test Reports: Provided by contractor and signed by manufacturer.

E. Pile-Driving Equipment Data: Include type, make, and rated energy range, size, and properties of hammer.

F. Dynamic Pile Test Reports to be performed by owners Independent Testing Agency.

G. Pile-Driving Records: Submit within three days of driving each sheet, piling, and H piling.

H. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved for installation of units required for this Project.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

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

D. Refer to Section 01 41 00 for Special Inspection Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery of piles and storage at Project site will be contractor's responsibility. Contractor shall store piles at Project site to prevent buckling or physical damage.
   1. Coated Piles: Contractor will be responsible for all transporting, storage, and handling of the steel piling. Touch up coating damage due to handling before driving piles

1.6 PROJECT CONDITIONS

A. Protect structures, underground utilities, and other construction from damage caused by pile driving.

B. Site Information: A geotechnical report has been prepared for this Project and is included in of this specification as a reference document.

C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Provide photographs of conditions that might be misconstrued as damage caused by pile driving.

PART 2 PRODUCTS

2.1 STEEL SHEET PILE

A. NZ 22 OR EQUIVALENT "Hot Rolled" sheet pile structural section (Minimum Section Modulus 41.47 in^3/ft and Minimum flange thickness of 0.48 inches and Minimum web thickness of 0.48 inches) ASTM A572, Grade 50.

2.2 STEEL H-PILES

A. HP 14 x 73 (See Plan for Locations) ASTM A572 Grade 50.

2.3 PILE ACCESSORIES: N/A.

2.4 COATING

A. Coating: See High Performance Coating Specification Section.

2.5 FABRICATION: N/A.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Conditions: Work from the top of the existing dock site by use of crane or excavator is prohibited within 30 feet of the dock edge due to dock deterioration. General site conditions and the existing dock are currently stable, but vibration from driving equipment could cause the existing docks to move creating additional sink holes or failures.

B. Existing dock alignments and reference points shown have been surveyed and should be set at the site by contractor to maintain proper dock alignments prior to the start of construction.

3.2 DRIVING PILES

A. General: Continuously drive piles to elevations indicated. Establish and maintain axial alignment of leads and piles before and during driving.

B. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
   1. Location: Within 2 inches from baseline indicated on plans after driving completed.
   2. Plumb: Maintain 1/8 inch per foot out of plumb within either plane.

C. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances.
   1. Contractor is responsible for replacement of damaged piling due to improper driving and or handling of piling during the driving process. Contractor will be allowed to re-drive piles not damaged during extraction after inspection and approval by Engineer.

D. Cutting Off: Cut off tops of driven piles square with pile axis and at elevations indicated.

E. Pile-Driving Records: Maintain accurate driving records for each H-pile & sheet piling installed. Include the following data:
   1. Project name and number.
   2. Name of Contractor.
   3. Pile location.
   4. Sequence of driving.
   5. Pile dimensions.
   6. Ground elevation.
   7. Elevation of tips after driving.
   8. Final tip and cutoff elevations of piles after driving pile group.
   9. Records of re-driving.
   10. Type, make, model, and rated energy of hammer.
   11. Weight and stroke of hammer.
   12. Pile-driving start and finish times, and total driving time.
   13. Unusual occurrences during pile driving.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Engineer or owners representative will perform special inspections as necessary to observe for proper installation of piling.

3.4 TOUCHUP COATING

A. Clean field welds, splices, and abraded coated areas and field-apply according to SSPC-PA 1 and coating manufacture's recommendations. Use coating paint and apply same number of coats as specified for original coating.
   1. Apply touchup coating before driving piles to surfaces that will be immersed or inaccessible after driving.

3.5 DISPOSAL

A. Remove withdrawn piles that are not re-useable and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION

SECTION 35 42 13.20

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Miscellaneous steel framing and supports.
2. Steel weld plates and angles.
3. Steel Pipe Jackets.
4. Steel Bar Grating.
5. Safety Ladders.
6. Pile Wall Cap.
7. Wale and Anchor Hardware Assemblies.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Safety Ladders.** Measurement will be by each item acceptably completed. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the item, complete in place, as shown on plans, as specified in these special provisions, and as directed by the Engineer.
2. A Bid Item has been provided for **Pile Wall Cap.** Measurement will be by linear foot acceptably completed as measured along centerline of the wall cap along the dock wall. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the item, complete in place, as shown on plans, as specified in these special provisions, and as directed by the Engineer.
3. A Bid Item has been provided for **Wale and Anchor Hardware Assemblies.** Measurement will be by linear foot acceptably completed as measured along the face of the dock wall. This section includes all plates, structural steel shapes, bolts, nuts, washers, weldments, and other steel accessories shown on the plans and details as needed to complete assemblies, connections, and details. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the item, complete in place, as shown on plans, as specified in these special provisions, and as directed by the Engineer.
4. A Bid Item has been provided for **Weep Drains.** Measurement will be by each item acceptably completed. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the item, complete in place, as shown on plans, as specified in these special provisions, and as directed by the Engineer.

1.3 SUBMITTALS

A. Shop Drawings:
1. Detail fabrication and erection of each metal fabrication, connection assembly, and weldment.

2. Include plans, elevations, sections, and details of metal fabrications and their connections.

1.4 QUALITY ASSURANCE

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

B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code-Steel."
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

A. Field Measurements:
1. Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
2. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions:
1. Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements.
2. Coordinate construction to ensure that actual dimensions correspond to established dimensions.
3. Allow for trimming and fitting.

PART 2 PRODUCTS / MATERIALS

2.1 MATERIALS GENERAL

A. Metal Surfaces, General:
1. For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes.
2. Do not use materials with exposed pitting, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Structural Steel Shapes: W-shapes and WT-shapes complying with ASTM A992.

B. Steel Plates, Angles, and Bars: ASTM A36/A36M, and ASTM A572 Gr. 50 as noted.

C. Steel Tubing: HSS Cold-formed steel tubing complying with ASTM A500, Gr. B.

D. Steel Pipe: ASTM A53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 FASTENERS

A. General:
1. Provide zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn 5. Select fasteners for type, grade, and class required.

B. Bolts and Nuts:
1. Regular hexagon-head bolts, ASTM A325, Grade A; with hex nuts, ASTM A563 and, where indicated, flat washers.

C. Plain Washers:
1. Round, carbon steel, ASME B18.22.1.

2.4 FABRICATION

A. General:
1. Preassemble items in the shop to greatest extent possible.
2. Use connections that maintain structural value of joined pieces.
3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
4. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
5. Form seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
6. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
7. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

2.5 FINISHES

A. Steel and Iron Finishes:
1. Hot-dip galvanize items as indicated to comply with ASTM A123/A123M or ASTM A153/A153M as applicable.

B. Preparation for Protective Coating/Shop Priming:
1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6 “Commercial Blast Cleaning” requirements for metal fabrications exposed to environment.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction:
1. Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction.

B. Cutting, Fitting, and Placement:
1. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 CLEANING AND TOUCH UP

A. Touch up surfaces and finishes after erection.
   1. Galvanized Surfaces:
      a. Clean field welds, bolted connections, damaged and abraded areas and repair galvanizing to comply with the ASTM A780.

END OF SECTION

SECTION 35 42 13.21

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections
   1. Section 35 42 13.19 - Steel Piling

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. All costs related to High Performance Coatings will be considered incidental to the installation of the Steel pile it is applied on.
   2. All other Work and costs of this Section shall be incidental to the Project and included in the Total Base Bid.

1.3 SCOPE OF WORK

A. The work included in this section consists of furnishing all materials, transportation, labor, equipment, and incidentals necessary to clean, and coat steel sheet pile bulkhead wall with a two-part epoxy coating system. All work shall be performed in the dry condition. Work will be performed in accordance with the Steel Structures Painting Council. (SSPC).

B. The coating system will be moisture tolerant. Other applicable publications include: Shop, Field & Maintenance Painting (SSPC-PA1), Near-White Blast Cleaning (SSPC-SP10) and Power Tool Cleaning to Bare Metal (SSPC-SP11).

C. Steel sheet pile (SSP) bulkhead shall be cleaned to SSPC-SP10 and given protective coating to west facing water side surfaces from top of sheet to elevation 591'.0. Payment for this item will be calculated as per square foot, of exposed face of steel acceptably completed. The city will obtain the measured quantity by multiplying the length of wall as shown on the plans by the height of the coating required.

D. The coating shall be applied to the individual steel sheet piles.

1.4 SUBMITTALS

A. General Submissions
   1. Work Plan.
   2. Project Schedule.
   3. Contractor Quality Control Plan.

B. Epoxy Coating Specific Submittals
   1. Certificates of conformance or compliance certifying that materials, surface preparation, coverage and thickness meet the requirements specified.
   2. Certified copies of the reports of all tests required in the standard specifications.
   3. On-site cleaning, collecting and transporting abrasive blast residue, and coating procedures as part of the Environmental Protection Plan.

4. Contractor shall furnish paint manufacturer's certification that the coating complies with coating system requirements specified. Application of coating will not be permitted until the certification has been received by the Owner's Engineer and approved by the Engineer.
5. MSDS and technical specification sheets.

1.5 ADDITIOANL INFORMATION

A. Other information may be required once field work commences. The Engineer will alert the Contractor should additional information be required.

1.6 PROCEDURE APPROVAL

A. Cleaning and coating onsite procedures shall be approved by the Engineer. Contractor shall protect adjacent surfaces from spent abrasive, cleaning residue, overspray, and splatter shall not allow these items to fall into the water or be absorbed into the soil. Proposed methods, procedures, and equipment shall be submitted with the Environmental Protection Plan as well as portable cofferdam(s) descriptions, dewatering methods, and proposed schedules.

PART 2 PRODUCTS / MATERIALS

2.1 RECOMMENDED PRODUCTS

A. Steel Sheet Pile epoxy coating products shall conform to the recommended product specifications and other requirements specified in this document. Recommended products include the following:
1. Aquapure HR Rapid Cure Epoxy Coating TM, Marine Coatings LLC, 716 Garfield Ave., Duluth, MN 55803, Tel. 218-720-2833.
2. HUMIDUR® ML Solvent Free Epoxy Coating, ACOTEC USA, INC. 3200 Southwest Freeway, Suite 3300 Houston, TX 77027, Tel.713-402-6133, Fax 866-316-2882.
3. Fast Clad ER Epoxy, Sherwin Williams Company, 4767 Miller Trunk Road, Hermantown, MN 55811, Tel. 218-722-7413.

2.2 ALTERNATIVE PRODUCTS

A. A different product of equal or better quality may be substituted by the Contractor with the approval of the Engineer. Positive Proof of coating adequacy to withstand heavy ice impact and abrasion must be provided for evaluation.

2.3 COMPATIBILITY

A. Primers, thinners, and coatings used in conjunction with each other should be compatible products of the same formulator (manufacturer) of the coating system.

2.4 ADDITIONAL THINNER, TINTING OR OTHER MATERIAL

A. All paint shall be prepared at the factory ready for application. The addition of thinner or other material to the paint after the paint has been shipped shall not be permitted. All tinting materials required shall be added to the paint at the time of paint manufacture. Field tinting shall not be allowed.

2.5 PRODUCT LABELS

A. All containers shall be labeled showing the exact title of the paint, the manufacturer's name, date of manufacturer, the manufacturer's batch number and the specification number and lot number if appropriate. Precautions concerning the handling and application of paint shall be shown on the label of paint and solvent containers.

2.6 PRODUCT STORAGE

A. All Products used must be stored in a secure area. They must be stored in an area within the storage temperature range suggested by the manufacturer. All other storage recommendations of the manufacturer must also be followed.

2.7 MANUFACTURER RECOMMENDATIONS

A. All other product manufacturer recommendations will be strictly followed.

PART 3 EXECUTION

3.1 CLEANING AND PREPARATION OF SURFACES

A. Abrasive Blasting
   1. All surfaces to be coated shall be abrasive blasted in accordance with SSPC SP-10 (near-white metal) and the appearance of the blast cleaned surfaces shall approximate Visual Standard SP10 of SSPC VIS 1-89. Blast cleaning shall be performed using abrasive of a size which will produce a surface profile height of 1-3 mils.
   2. Abrasive blasting will be permitted only during daylight hours unless otherwise approved by engineer and on surfaces that are not wet after blasting or before coating.
   3. Abrasive blasting will not be permitted when surfaces are less than 5 degrees F above dew point or the relative humidity is greater than eighty five percent (85%). The only exception to this will be for rough initial abrasive blasting which will be allowed during the night, pending engineer approval, and provided surfaces are cleaned and brightened the next morning with fresh light abrasive blasting to provide a near white blasted metal surface.
   4. After blasting, dust and spent abrasive shall be removed from the surfaces by air, vacuum cleaning or brushing with clean brushes made of fiber or bristle. Waste from blasting activities will be managed such that the surrounding environment (soil and water bodies) is not contaminated. Cleaning shall be approved by the coating manufacturer's technical representative. Proof of approval is required.

3.2 HIGH PRESSURE WATER BLASTING

A. High pressure water blasting (above 10,000 psi) meeting SSPC SP-10 as specified herein can be used instead of abrasive blasting. If used, water blasting shall be followed by sweep grit blasting meeting SSPC SP-10. Waste from blasting activities will be managed such that the surrounding environment (soil and water bodies) is not contaminated.

3.3 DURATION BETWEEN CLEANING AND COATING APPLICATION

A. The coating system shall be applied as soon as possible on the same day as cleaning after the blasting preparation is finished. Any cleaned surface which rusts before the application of the coating system shall be re-cleaned.

B. Steel sheet pile (SSP) bulkhead wall coating shall be performed prior to driving of new SSP.

3.4 APPLICATION METHODS

A. All painting to be performed under this contract shall be performed in conformance with the best practices of the trade, in conformance with recommendations of the coating manufacturer, and in conformance with applicable portions of the Steel Painting Council Specification SSPC-PA 1, when those specifications are not in conflict with these specifications.

B. All surfaces cleaned to bare metal shall be coated with the coating the same working day. Any cleaned surface which rusts before the application of the coating system shall be re-cleaned.

C. Apply coating system with high pressure airless spray equipment as specified by the coating manufacturer. All printed instructions from the coating system manufacturer shall be strictly followed.

D. Paint film thickness measurements will be made by the engineer's/ owner's representative. One hundred percent (100%) of all thickness measurements shall be within the specified minimum dry film thickness. Where thickness measurements fall below the specified minimum, additional applications of paint shall be made as necessary to meet the thickness required. Manufacturer's printed instructions on additional applications of paint shall be strictly followed.

E. The new SSP may be driven after eight (8) days of cure time.

F. One or two coats, total of 20 mils (minimum) dry film thickness (500 microns).

3.5 FACTORS AFFECTING APPLICATIONS OF COATINGS

A. Temperature: Coating shall not be applied when temperature of the steel or coating is below 50□F or when the air temperature is below 45 degrees F. Coating shall not be applied when the surface temperature is expected to drop to 40 degrees F before the coating has dried. Coating shall not be applied to steel which is at a temperature that will cause blistering or porosity or otherwise will be detrimental to the life of the coating. When coating is applied in hot weather, or thinned in cold weather, precautions must be taken to insure that the specified thickness of paint is obtained.

B. Moisture: Coating shall not be applied in rain; wind, snow, fog or mist, or when the steel surface temperatures are less than 5 degrees F above dew point shall not be applied on frosted or ice-coated surfaces. Follow manufacturer's recommendations for coating used.

C. Humidity: The manufacturer's instructions shall be followed regarding the acceptable humidity range for the application of the coating. Expect that no coating shall be applied when the humidity is more than 85 percent, without prior approval from the Engineer.

D. Damage: Damaged areas of coating which are detrimental to service life shall be removed, and the surface shall again be prepared and repainted with the same number of coats of coating of the same kind as the undamaged areas.

E. Continuity: To the maximum extent practical, each coat of coating shall be applied as a continuous film of uniform thickness free of pinholes. All thin spots or areas missed in the

application of alternate coatings shall be reapplied and permitted to dry before the next coat is applied. Pin hole testing will be performed by the Contractor prior to requesting the owner inspection in the intermediate coat of alternate coatings with up to a 90-volt wet sponge holiday detector. All areas containing pinholes shall be abraded lightly if required and over coated sufficiently to close these imperfections. At the owner's discretion, the inspector may witness the Contractor's pinhole testing. When more than five such areas are found in any 100 square feet of surface area, the inspector may require the entire 100 square foot area to be abraded and recoated.

3.6 COATING EXTENT

A. Steel sheet pile bulkhead are to be cleaned to SSPC-SP10 and given protective coating to harbor side exposed surfaces including knuckles from elevation 605.5' to 591.1' relative to IGLD 1985. This coating coverage applies to the finished condition.

PART 4 FIELD TESTING AND INSPECTIONS

A. Contractor shall provide and pay for the services of a qualified technical representative employed by the manufacturer of the coating system who shall:
   1. Observe and approve the Contractor's surface preparation and coating system application techniques.
   2. Test for thickness, holidays, and pin holes on random samples.
   3. Provide a written summary of the final coating product and its expected performance in a marine environment.
   4. Provide inspection and testing reports to the Contractor and Engineer.
   5. Provide testing facility and/or testing personnel's certifications .Test for thickness, holidays, and pin holes: Measure thickness by commercial film thickness gages.
   6. Test coatings of steel sheet piling and other waterfront structures for pin holes, holidays, and other defects with an electrical flaw detector when visual inspection shows that coating continuity is doubtful.
   7. Where detection of pinholes, holidays and other defects is noted, contractor shall repair areas in a manner in accordance with the manufacturer's technical representative's directions.
   8. Owner/ Engineer will provide Quality Assurance of the Contractor's technical representative.

END OF SECTION

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SECTION 35 42 13.23

HEAVY TIMBER CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Use of heavy timbers for use as dock fendering.

B. Definitions
1. Timbers: Lumber sized as indicated on the plan for use as dock fendering.
2. Inspection agencies, and the abbreviations used to reference them, include the following:
   a. NELMA - Northeastern Lumber Manufacturers Association.
   b. NLGA - National Lumber Grades Authority.
   c. SPIB - Southern Pine Inspection Bureau.
   d. WCLIB - West Coast Lumber Inspection Bureau.
   e. WWPA - Western Wood Products Association.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. A Bid Item has been provided for **Timber Fenders**. Measurement will be by linear foot acceptably completed as measured along the face of the dock wall. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the Timber Fenders, complete in place, as shown on plans.
   a. Item includes timber connectors.

1.03 SUBMITTALS

A. Certificates of Inspection: For exposed timber not marked with grade stamp, a letter must be issued by an independent lumber grading agency to the engineer, prior to installation.

1.04 QUALITY ASSURANCE

A. Timber Standard: Comply with ANSI/ AWC National Design Specifications. (NDS).

1.05 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of heavy timber construction to avoid extended on-site storage and to avoid delaying the Work.

PART 2 PRODUCTS

2.01 TIMBER

A. General: Comply with DOC PS 20 and grading rules of lumber grading agencies certified by American Lumber Standards Committee Board of Review, as applicable.
   1. Factory mark each item of timber with grade stamp of grading agency.
   2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that will not be exposed to view or omit grade stamps and provide certificates of grade compliance issued by grading agency.

B. Timber Species and Grade: White Oak; No. 1, Select Structural, or better as determined by NELMA, NLGA, SPIB, WCLIB, or WWPA.

C. Moisture Content: Provide timber with 22 percent maximum moisture content at time of dressing.

D. Dressing: Provide timber that is rough sawn (Rgh).

E. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts.

2.02 TIMBER CONNECTORS

A. General: Fabricate as directed by the plans in accordance with appropriate specifications.

2.03 FABRICATION

A. Shop fabricate members by cutting to a cross-section of 12" x 12" of appropriate length. Predrilled for fasteners and assembly of units. Individual timber lengths shall not be less than 14'-0".

B. Seal Coat: After fabricating each unit, apply a saturation coat of penetrating sealer on sur- faces of each unit.

PART 3 EXECUTION

A. General: Install timber as indicated on the plans, maintaining lines and levels.

END OF SECTION

SECTION 35 42 34.10

SOIL ANCHOR ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Engineering for the permanent soil anchors associated with the bulkhead wall as required in the plans and details.

B. Related Sections
   1. Section 35 42 34.20 - Soil Anchors.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Soil Anchor Engineering**. Measurement will be as a single lump sum for the item acceptably completed.

1.03 SUBMITTALS

A. The final anchor design configuration documents shall be sealed by an Engineer licensed in the State of Wisconsin.

1.04 QUALITY ASSURANCE

A. The Section refers to responsibility of the Soil Anchor Engineer ("Engineer") and Contractor.

B. Engineering for the permanent soil anchors as required in this bid must be completed by an engineer experienced in permanent soil anchor design configuration and licensed in the State of Wisconsin. Contractor MUST submit name and credentials of proposed engineer at the time of bid submittal.

C. Engineer must demonstrate a minimum of 5-years' experience in projects of similar size and scope for **permanent** soil anchor design configuration. Experience must be recent, and references must be provided.

D. Engineer must present proof of licensure in Wisconsin.

E. Engineer must observe and approve test installations of soil anchors.

F. Engineer shall be available to the Contractor to respond to technical questions on design and installation of soil anchors.

G. The Owner reserves the right to reject any proposed engineer for lack of sufficient experience or credentials. Contractor shall immediately secure an alternate firm to supply engineering services in compliance with the requirements that meets with Owner approval. Should the Contractor be unable to attract a qualified, credentialed engineer for the soil anchor design configuration, it may be grounds for disqualification from the project.

H. Contractor and Soil Anchor Engineer shall attend a required pre-installation meeting with Engineer and Owner to establish timeline, submittal requirements, review of subsurface conditions including utilities, quality control procedures, and all other items related to the soil anchor installation.

1.05 DESIGN CRITERIA

A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of two.

END OF SECTION

SECTION 35 42 34.20

SOIL ANCHORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. This section describes constructing soil anchors.

B. Related Sections

1. Section 35 42 34.10 - Soil Anchor Engineering

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. A Bid Item has been provided for **Soil Anchors**. Measurement will be by each individual soil anchor acceptably completed. The work to be performed under this item shall consist of engineering design, drilling, furnishing, installing, testing and stressing permanent soil anchors at locations shown on the plans. The final anchor design configuration documents shall be sealed by an Engineer licensed in the State of Wisconsin.
   a. Item includes pavement removals, excavation, backfilling and dewatering.

1.03 QUALITY ASSURANCE:

A. Contractor and Soil Anchor Engineer shall attend a required pre-installation meeting with Engineer and Owner to establish timeline, submittal requirements, review of subsurface conditions including utilities, quality control procedures, and all other items related to the soil anchor installation.

B. The Contractor or subcontractor performing the work in this Specification shall submit proof at the time of bid submittal of a minimum of 5-years of experience in projects of similar size and scope for permanent soil anchor installation. Experience must be recent and references must be provided at the time of bid submittal.

C. The Contractor shall submit to the Engineer results of performance and proof tests as soon as possible following completion but not later than 24- hours following completion of the tests.

D. Refer to Section 01 41 00 for Special Inspection Requirements.

1.04 DESIGN CRITERIA

A. Refer to Soil Anchor Schedule on sheet M002.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soil anchors illustrated as the Base Bid are detailed consistent with Helical Anchors. Refer to the Helical Anchor notes on Sheet M001, for additional requirements which apply in addition to this section.

B. Couplers for anchor sections shall be capable of developing 100 percent of the guaranteed minimum ultimate tensile strength of the anchor.

C. Corrosion protection shall consist of hot dipped galvanized steel upper and helix sections.

PART 3 EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall be responsible for determining the anchor configuration and installation process necessary to develop adequate load capacity to satisfy anchor testing acceptance criteria for design load shown on the plans.

3.02 ANCHOR TESTING AND STRESSING

A. Prior to the installation of production anchors, two pre-production sacrificial anchors must be installed and performance tested to a minimum of 133 percent of the design capacity. The test should include holding the applied loads for sufficient duration to allow the projection/calculation of the anchor creep over the life of the structure using log time methods.

1. The Soil Anchor testing equipment shall consist of:
   a. A dial gauge capable of measuring to 0.001-of-an-inch of the anchor movement.
   b. A hydraulic jack and pump to apply the test load. The jack and pressure gauge shall be calibrated by an independent test firm as a unit. The pressure gauge shall be graduated to 200 psi increments or less. The pressure gauge will be used to measure the applied load. The ram travel of the jack shall not be less than the theoretical elastic elongation of the total anchor at the maximum load.
   c. A calibrated master pressure gauge shall also be kept at the site. The master gauge shall be calibrated at the same time as the test jack pressure gauge.

2. The Contractor shall submit for review and acceptance, the proposed anchor loading test procedure including test frame, jack, dial gauge, and other test hardware setup details in addition to a written test procedure to ensure anchor conformance to performance specification.

3. The two pre-production sacrificial anchor tests, the first two production anchor performance tests, and first four proof tests shall be observed by an independent test agency experienced in the review and observation of soil anchor test practice and standards consistent with PTI or AASHTO guidelines. The same independent test agency shall review the proposed anchor loading test procedure.

B. Prior to the installation of production anchors, performance testing shall be performed on a minimum of four anchors, where the test anchors shall be performance tested to

133 percent of their design capacity. The test should include holding the applied loads for sufficient duration to allow the projection/calculation of the anchor creep over the life of the structure using log time methods.

C. In addition to the performance-tested anchors, 5 percent of production anchors shall be proof tested to 133 percent of the design load.

D. The performance testing shall proceed by placing and recycling test loads as follows:

1. P = design load for production anchor.

2. AL = load necessary to maintain alignment of stressing and testing equipment
   a. AL, 0.25 P
      3. AL, 0.25 P, 0.5 P.
      4. AL, 0.25 P, 0.5 P, 0.75 P.
      5. AL, 0.25 P, 0.5 P, 0.75 P, 1.00 P.
      6. AL, 0.25 P, 0.5 P, 0.75 P, 1.00 P, 1.33 P.
      7. AL.

E. During the performance testing, each load shall be held until movement stabilizes, but no longer than 1 minute and the final 1.33 P load shall be held for a minimum of 10 minutes. At the 1.33 P load, a creep test shall be performed by holding the load constant and recording readings at 0, 1, 2, 3, 4, 5, 6, and 10 minutes. If the creep exceeds 1 mm (0.040 inches) the test load shall be maintained for an additional 50 minutes. The movements shall then be recorded at 20, 30, 40, 50, and 60 minutes.

F. The load increments during the proof testing shall be as follows:
   1. AL, 0.25 P, 0.5 P, 0.75 P, 1.00 P, 1.20 P, 1.33 P.

G. During the proof testing, each load up to 1.20 P shall be held for a minimum of 1 minute. For 1.33 P load, the holding period shall increase to a minimum of 10 minutes. At the 1.33 P load, creep test of each proof test shall be performed by holding the load constant and recording readings at 0, 1, 2, 3, 4, 5, 6, and 10 minutes. If the difference between the 0 and 10-minute reading is more than 0.040 inches, the load shall be maintained for an additional 50 minutes and the movement readings shall be recorded at 20, 30, 40, 50 and 60 minutes.

3.03 ACCEPTANCE CRITERIA

A. Performance Tests

1. The value of the anchor creep measured between 1 minute and 10 minutes following the application of the 1.33 P load shall not exceed 0.04 inch.

2. The value of the anchor creep measured between 6 and 60 minutes following the application of the 1.33 P load shall not exceed 0.08 inch.

B. Proof Test

1. The value of the anchor creep measured between the 0 minute and 10 minutes following the application of the 1.33 P load shall not exceed 0.04 inch.

2. If the creep value is exceeded, the test duration shall be increased to 60 minutes. Anchor creep measured between 6 and 60 minutes following the application of the 1.33 P load shall not exceed 0.08 inch.

3.04 FAILURE OF ANCHOR TEST

A. When an anchor fails, the Contractor may modify Contractor's approved anchor configuration by the addition of anchors, alteration of bond zone helical configuration, and other means after submittal, review and approval by the Engineer. Any modification of design or construction procedures shall be at no change to the contract price and shall be approved by the Engineer. Expenses for additional engineering/review analysis/detailing or structural modifications incurred by the Owner shall be borne by the Contractor.

END OF SECTION

SECTION 35 42 34.30

TIEROD ANCHORS

PART 1 GENERAL

Summary

A. This specification establishes the material, fabrication, handling and testing of Permanent Threaded Reinforcing Bar Tie-rod Anchors.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A Bid Item has been provided for **Tierod Anchors**. Measurement will be by each individual item acceptably completed. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in constructing the tie-rods (including stressing), complete in place, as shown on plans, as specified in these special provisions, and as directed by the Engineer.
      a. Item includes pavement removals, excavation, backfilling and dewatering.

1.03 REFERENCES

A. ASTM Standards
   1. ASTM A615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement".

B. Other Standards
   1. "Guide Specification for Post-Tensioning Materials and Rock and Soil Anchors"; Post-Tensioning Manual, 5th Edition.

1.04 SUBMITTALS

A. The Contractor shall furnish evidence that they have been engaged in successful installation, supply and testing of similar projects for at least five years.

B. The Contractor shall also submit the following samples and date:
   1. One five-foot length of anchor having Corrosion Protection System (CP) indicated on the drawings.
   2. Certified mill certifications for tie-rod and bearing plate steel.
      a. A shop drawing detail made by Williams Form Engineering Corp. or approved equal with the following information:
         1) Plan, Section, and Elevation details.
         2) Corrosion protection system used.
         3) Anchorage (bearing plate).
         4) Drilled or formed hole size.
         5) Any revision to structure details necessary to accommodate the tie-rod system intended for use.
         6) Total length of the tie-rod.
         7) The grout mix design and procedures for placing the grout.

8) Thread bar physical properties, maximum design, test and lock-off load.

1.05 QUALITY ASSURANCE

A. Tie-rod Manufacturer
   1. Tie-rod shall be corrosion protected as manufactured by Williams Form Engineering Corp. or approved equal.
   2. The anchor shall be manufactured according to this specification and approved shop-drawing details made by Williams Form Engineering Corp. or approved equal.

B. After shop drawing approval, the Engineer must approve any detail modifications.

C. Refer to Section 01 41 00 for Special Inspection Requirements for Concrete Reinforcement for Inspection of Tierod Anchors.

PART 2 PRODUCTS / MATERIALS

2.01 MATERIALS

A. Tie-rod Steel:
   1. The tie-rod steel shall be Threaded Reinforcing Bar, Grade 75 ksi conforming to ASTM Designation ASTM A-615. Minimum yield stress to be 75 ksi. Minimum ultimate stress to 100 ksi at 7 percent elongation within 8-inch length.

B. Anchorages and Splices:
   1. Splices and anchorages shall be capable of developing 100 percent of the ultimate tensile strength of the pre-stressing steel and shall conform to the static strength requirements of the PTI "Guide Specification for Post-Tensioning Materials".
      a. A Williams Form Engineering Anchor Nut or approved equal shall fit into the countersunk hole in the bearing plate. Anchor nuts shall be heavy-duty type with an integral spherical seat, as per thread bar manufacturer's specifications.

C. Bearing Plate Criteria:
   1. The bearing plate shall be fabricated from mild steel conforming to ASTM A36 and shall effectively distribute the design force to the supporting concrete or structural steel element.
   2. Unless specified, bearing plate dimension shall be designed for 100 percent of the minimum ultimate tensile strength (UTS) of the pre-stressing steel. The concrete or structural steel support bearing stress shall not exceed allowable limits shown in the contract specifications and drawings. Bending stress of the bearing plate shall not exceed specified allowable yield strength (FY) of the steel material.

D. Bearing Plate Assembly:
   1. The bearing plate shall be fabricated from mild steel conforming to ASTM A36.

PART 3 EXECUTION

3.01 PRODUCT HANDELING AND STORAGE

A. Handling, shipping, and storage shall be such that the material is properly identifiable and protected against mechanical damage, corrosion, chemical attack, and dirt. Materials stored at the site shall be placed above ground on a well-supported platform and covered with plastic or other approved material.

3.02 TIE-ROD INSTALLATION

A. The tie-rod anchor installation method selected by the Contractor shall be sufficient to achieve the loadings specified by contract plans. Tie-rod shall be inserted in such a manner that they are not damaged, and the corrosion protection remains intact. Bearing plate at each end should be placed normal to tie-rod axis. Couplers will be used as shown on the shop drawing details.

3.03 TIE-ROD STRESSING

A. Tie Rods are not required to be pre-stressed and can be installed to a snug-tight fit.

END OF SECTION

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SECTION 35 59 33

CAST STEEL BOLLARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. This specification consists of supply and installation of the cast steel mooring bollards as shown on the drawings.

B. Related Sections
   1. Section 03 10 00 – Concrete Formwork.
   2. Section 03 20 00 – Concrete Reinforcement.
   3. Section 03 30 10 – Reinforced Cast-In-Place Concrete.
   4. Section 03 35 00 – Concrete Finishes.
   5. Section 32 42 13.19 - Steel Piles.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
   1. A bid item has been provided for **Cast Steel Bollards**. Measurement will be by each individual item acceptably completed. The work to be performed under this item shall consist of furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in constructing the item, complete in place, as shown on plans, as specified in these special provisions, and as directed by the Engineer.
      a. Item includes pavement removals, excavation, backfilling and dewatering.
      b. Item includes bolting of bollard to embedded anchors, grouting of base, filling bollard with concrete, filling of bolt holes with grout and constructing reinforced concrete bases.
      c. Item includes rigid insulation.
      d. Steel Piles will be measured and paid for separately in accordance with Section 32 42 13.19 - Steel Piles.

1.03 REFERENCES

A. ASTM A 27 (1991) Steel Castings, Carbon, for General Application.

B. ASTM A 53 (1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

C. ASTM A 123 (1989) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A 449 (1993) Quenched and Tempered Steel Bolts and Studs.

1.04 SUBMITTALS

A. Pre-Manufacture. Contractor to submit the following manufacturer's information for approval prior to manufacturing of bollards and hardware.
   1. Shop drawings for bollard.

2. Design calculations demonstrating proposed bollard meets loading requirements of Section 2.1 signed by a licensed professional engineer.
3. Grout.
4. Bolts, Nuts, & Washers.
5. Coating system data sheets.
6. Pipe Sleeves.

B. Post-Manufacture. Contractor to submit the following information after manufacture of bollards and hardware.
1. Certified weight tag for each bollard verifying bollard is greater than minimum weight.
2. Mill test certificates.
3. Certificate of conformance for line pull rating.

PART 2 PRODUCTS

2.01 BOLLARDS

A. Bollard shall be a new staghorn cast steel bollard as shown on the drawings
1. Bollard material shall be stress-relieved cast steel conforming to Grade 65-35 of ASTM A27.
2. Bollards shall have a load rating of 100 KIPS or 50 tons in the direction of 0 degrees to 70 degrees relative to horizontal and 0 degrees to 180 degrees relative to dock front. The theoretical point of loading for the line pull shall be the intersection of the bollard vertical axis centerline and the horizontal axis running through the center of the horns.
3. The factor of safety against yielding shall be 2.2.
4. The minimum height of the bollard shall be 2'-6".
5. Bollard shall have a sufficiently sized hole through the top through which grout will be deposited after placement and bolting of bollards.
6. Bollards shall be delivered to the site in a primed condition. Primer to be that or equal to primer listed in the section "Finish".

2.02 ANCHORAGE HARDWARE

A. The proposed bollard shall be anchored to the concrete with a minimum of seven 1 1/4 inch diameter bolts conforming to ASTM F1554 Gr 105. Bollard anchor hardware to be supplied by the bollard manufacturer to ensure proper fit. All anchorage hardware shall be hot dipped galvanized to ASTM A123. If used, pipe sleeves shall conform to ASTM A53 and be hot dipped galvanized.

B. Bollard manufacturer is responsible to size the anchor diameters to adequately resist the mooring loads for the bollard

2.03 GROUT

A. Grout used for around base and inside of bollard shall have a minimum 5000 psi compressive strength and a maximum aggregate size of 3/8 inch.

B. Contractor shall follow all manufacturers' recommendations of pot life and temperature requirements during mixing and placing of product.

C. Water used in mixture shall be potable and free of oil, grease, and debris.

D. Follow the manufacturer's recommendations for the use of admixtures.

E. Fine aggregates shall meet the requirements of ASTM C33.

F. Surfaces must be cleaned of all oils, greases, dirt, wax solutions, and old coatings.

G. Metal surfaces shall be cleaned to a bare metal surface and concrete surfaces shall be free of weak and loose concrete by chipping down to sound concrete.

H. Grout shall be air entrained 6% ± 1.5%.

2.04 FINISH

A. Bollard shall be blasted to SSPC-SP10 and cleaned of any grease or other foreign matter with suitable degreaser before applying any coatings. Bollard shall be finished with (2), 2 Mil DFT coats of Dura-plate 235 PW epoxy primer & (1), 2 Mil DFT coat of Acrolon 218 HS Acryl- ic polyurethane by Sherwin Williams. Bollards shall be Sherwin Williams Safety Yellow SW4084 or approved equal.

2.05 CONCRETE BOLLARD BASE

A. See Section 03 30 10 – Reinforced Cast-In-Place Concrete for products.

2.06 BACKFILL

A. Furnish backfill material of a quality acceptable to the engineer and free from frozen lumps, wood, or other extraneous or perishable material. The contractor may use engineer-approved material obtained from excavation.

PART 3 EXECUTION

3.01 BOLLARDS

A. Anchor bolts and sleeves shall be held in place with templates that match specified bolt pat- tern in construction drawings. Templates shall ensure proper location of bolts and sleeves during placement of concrete. Bollards shall be leveled using leveling nuts on exposed bolts and secured to bolts using additional nuts and washers within bollard base. Nuts shall be hand tight before grouting of base. After grouting has cured for seven days nuts shall be tightened to the snug condition. Areas around nuts in bollard base shall be filled with epoxy so as to prevent standing water. To prevent damage to vessel mooring lines, no sharp edges around bolting area shall exist after installation.

B. Bollard shall be primed & painted in accordance with section 2.4 above after installation is complete.

C. Approved manufactures for bollards and hardware include:

Schoellhorn-Albrecht Machine Co. Inc.
1141 Reco Avenue

St. Louis, MO 63126
PHONE: 314-965-3339

FAX: 314-965-3341

Email: brianpav@schoellhorn-albrecht.com

3.02 EXCAVATION AND BACKFILLING

A. Excavate material of whatever nature encountered. Remove logs, stumps, and other materials and obstructions necessary to place the foundations and structure. Dispose of material obtained from excavation in accordance to the materials management plan. Backfill, compact, shape, slope, and clean the site.

B. Construct, and subsequently remove, necessary cofferdams and cribs or well-point systems, and the necessary sheeting, shoring, bracing, draining, and pumping to allow constructing the substructure, above the seal, in the dry.

C. The elevation of the bottoms of footings, as the plans show, is approximate only. The engineer may order, in writing, changes in dimensions or elevation of footings necessary to secure a satisfactory foundation.

D. Do not place backfill against any portion of any substructure unit until completing the required curing, surface preparation, dampproofing, and waterproofing of the work to be backfilled.

E. Backfill spaces excavated and not occupied by the new structure to the elevation and section existing before excavation. Do not place backfill above the required section for the finished work. If placing backfill, provide allowance for settlement

F. Unless specified otherwise, place backfill in continuous horizontal layers no more than 8 inches thick. If practicable, uniformly raise layers on all sides of each substructure unit or culvert. Surround the stone used in backfilling by finer material. Compact each layer, before placing the next layer, by using engineer-approved rollers or portable mechanical or pneumatic tampers or vibrators.

3.03 DEWATERING

A. If possible, dewater foundation excavations before depositing concrete within. Dewater in accordance to the erosion and sediment control plan.

B. Pump from the interior of foundation enclosures in a manner to preclude, if practicable, removing foundation material or concrete ingredients.

3.04 CONCRETE BOLLARD BASE

1. See Section 03 30 10 – Reinforced Cast-In-Place Concrete

END OF SECTION