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ARCHITECTS

PROJECT MANUAL FOR:

City of Bottineau
New Fire Station

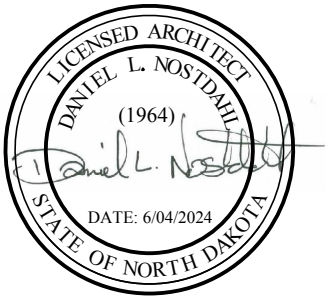
115 6th Street West
Bottineau, North Dakota

Owner/Developer:

City of Bottineau

Construction Documents for Public Bidding & Permit Submittal:

June 4th, 2024



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PART 1 - GENERAL:

1.01 PROJECT DESCRIPTION:

A. City of Bottineau - New Fire Station
Bottineau, North Dakota

1.02 CONDITIONS:

A. General Conditions and other contractual documents apply to each Division of the Specifications.
1. Provisions contained in this Division apply to each Division of the Specifications.

B. Comstock Construction, Fargo North Dakota, will be the Construction Manager of this Project.

1.03 WORKMEN:

A. Contractor shall at all times enforce strict discipline and good order among his workmen and shall not employ on the Work any unfit person or anyone not skilled in the work assigned to him.

1.04 SMOKING:

A. There shall be no smoking on buildings or grounds. Contractor shall post no smoking signs to this effect and enforce the above provision.

1.05 RADIOS:

A. Due to the fact that the remainder of the existing building is occupied, during the remodeling process, radios, tape players, noise generators, etc. are banned from use.

1.06 EATING & BREAKS:

A. No food or drink, except water is allowed on the jobsite at specified areas only.

1.07 SUNDAY WORK:

A. Some Sunday Work may be required. It will be scheduled thru the Construction Manager.

1.08 DESCRIPTION OF CONTRACTOR'S OPERATIONS:

A. Except as specifically noted, Provide and pay for:
1. Labor, materials, and equipment.
2. Tools, construction equipment and machinery.
3. Water, heat and utilities required for construction (per Section 01 5000).
4. Other facilities and services necessary for proper execution and completion of Work.

B. Taxes:
1. Pay all legally required sales, consumer and use taxes which are or become effective.
2. Comply with the applicable statutory provisions relating to withholding of income taxes at the source.
3. Secure and pay for, as necessary, proper execution and completion of Work, and as applicable to Project:

a. Permits
b. Government Fees
c. Licenses

C. Enforce strict discipline and good order among employees; do not employ on Work:
1. Unfit persons: Persons not skilled in assigned task

D. Layout of Work:
1. Take measurements and verify dimensions of existing or old Work, if any, that affect current Work or to which current Work is to be fitted.
2. Contractor alone is responsible for correctness of measurements and for verification of grades, lines, levels, elevations, or dimensions shown on Drawings.
3. Report errors or inconsistencies promptly to Architect.

E. Protection:
1. Construct safety barricades, fences, temporary walks, and signals in compliance with local regulations.
2. Provide temporary closures at openings which may admit rain or snow.
3. Be responsible for temporary and permanent weathertightness of walls and roof.
4. Provide necessary temporary bracing to hold walls plumb and true against wind or other loading.

F. Labor Coordination:
1. Conform to applicable labor laws of federal, state and local governments.
2. Coordinate Work to keep it segregated into the proper trade organized to have jurisdictions; no responsibility is assumed by Owner or Architect for jurisdictional disputes arising from alleged arrangement of the Work or different trades in this Project Manual.
3. Should a labor dispute of any nature result in a Work stoppage affecting the Work, no other subcontractors may proceed with any portion of his Work which will cover unfinished portions of or cause financial injury to the Work.

END OF SECTION

PART 1 – GENERAL:

1.01 SUMMARY:

A. This Section includes Alternate descriptions, *& Unit Pricing*

1.02 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including the General, Supplementary Conditions, and other Division 1 specification sections apply to this Section.

1.03 DEFINITIONS:

A. Alternate: An amount proposed by bidders and stated on the Bid Form, for certain work defined in the bidding requirements that may be add to the Base Bid amount, if the Owner decides to accept a corresponding change either in the amount of construction to completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost for each alternate is the net Add or Deduct to the Contract Sum to incorporate Alternate into the Work. No other adjustments are made to the contract sum.

B. UNIT PRICING: An amount proposed by bidders and stated on the Bid Form, for certain work defined in the bidding requirements, that may be added to the Base Bid amount. If the Owner decides to accept a corresponding change either in the amount of construction to completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost for unit price is based on the verified quantity x the cubic Yard unit price. No other adjustments are made to the contract sum, and this will be added per change order.

1.04 PROCEDURES:

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the Alternate into or deleted from the Project.

1 Include as part of each alternate, miscellaneous devices, accessory objects and similar items, Incidental to, or required for a complete installation.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternate have been accepted or rejected.

C. Execute the accepted alternates under the same conditions as the remainder of the Work in Contract.

1.05 SCHEDULE:

A. The list of alternates *& unit pricing* is provided below.

Alternate No. 1 - TBD
Alternate No. 2: - TBD

UNIT PRICING:
Unit Price No. 1 – Additional Excavation/Backfill :
*State the amount to be added to Base Bid to provide additional "excavation /*removal and hauling away poor soils/buried debris,etc. and *to import, place and compact SubBase/ granular fill as defined in Section 32 2325 Structure Excavation and Backfill*

Cost $_____per/Cubic Yard.

END OF SECTION

SECTION 01 2600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL:

1.01 RELATED REQUIREMENTS:

A. General Conditions: Governing requirements for changes in Contract Cost & Contract Time.
B. Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
C. Section 01 2900 - Applications for Payment.
D. Section 01 3300 - Submittals: Progress Schedule and Schedule of Values.
E. Section 01 7700 - Contract Closeout.

1.02 SUBMITTALS:

A. Submit name of individual authorized to accept changes and to be responsible for informing others in Contractor's employ of changes in Work.
   1. Use form furnished by Architect.

1.03 PRELIMINARY PROCEDURES:

A. Architect may submit Proposal Request which includes detailed description of change with supplementary or revised Drawings and Specifications.

B. Contractor may initiate a change by submittal of request to Architect describing proposed change with a statement of the reason for change, effect on Contract Sum and Contract Time with full documentation.

1.04 CONSTRUCTION CHANGE AUTHORIZATION:

A. Architect may issue a directive, signed by Owner, instructing Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. Directive will describe changes in the Work and will designate method of determining any change in Contract Sum or Contract Time.

C. Promptly execute change in Work.

1.05 LUMP SUM CHANGE ORDER:

A. Will be based on Proposal Request and Contractor's lump sum quotation or Contractor's request for Change Order.

1.06 UNIT PRICE CHANGE ORDER:

A. For predetermined unit prices and quantities, Change Order will be executed on a lump sum basis.

B. For unit costs or quantities of units of work which are not predetermined, execute Work under a construction change authorization. Changes in Contract Sum or Contract Time will be computed as specified for time and material Change Order.

1.07 TIME AND MATERIAL CHANGE ORDER:

A. Submit itemized account and supporting data after completion of change, within time limits in Conditions of the Contract.

1.08 DOCUMENTATION OF CHANGE IN CONTRACT SUM:

A. Maintain detailed records of work done on a time and material basis. Provide full information required for evaluation of proposed changes and to substantiate costs of changes in the Work.

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

C. On request, provide additional data to support computations:
   1. Quantities of products, labor and equipment.
   2. Taxes, insurance and bonds.
   3. Overhead and profit.
   4. Justification for any change in Contract Time.
   5. Credit for deletions from Contract, similarly documented.

D. Support each claim for additional costs, and for work done on a time and material basis, with additional information:
   1. Origin and date of claim.
   2. Dates and times work was performed and by whom.
   3. Time records and wage rates paid.
   4. Invoices and receipts for products, equipment and subcontracts, similarly documented.

1.09 DOCUMENTATION OF CHANGE IN CONTRACT TIME:

A. A change solely in the Contract time shall only be considered under the circumstances defined in the “Supplementary Conditions”.

1.10 Post Bid SUBSTITUTIONS:

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change.
   1. Conditions: A/E of Record will consider Subcontractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, A/E of Record will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      e. Requested substitution has received necessary approvals of authorities having jurisdiction.
      f. Requested substitution is compatible with other portions of the Work.
      g. Requested substitution has been coordinated with other portions of the Work.
      h. Requested substitution provides specified warranty.
      i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED REQUIREMENTS:

A. Owner-Contractor Agreement: Contract sum.

B. General Conditions: Progress payments and final payment.

C. Supplementary Conditions: Retainage and payment for materials stored off-site.

D. Section 01 2600 – Contract Modification Procedures.

E. Section 01 3300 - Submittals: Schedule of Values, Construction Schedule.

F. Section 01 7700 - Contract Closeout: Contract closeout procedures and final payment.

1.02 FORMAT:

A. Use AIA form G702, Application for Payment Forms, or Forms Furnished by Construction Manager.

B. Use data and format from accepted Schedule of Values.

1.03 PREPARATION OF APPLICATIONS:

A. Type required information.

B. Execute certification by signature of authorized officer.
   1. Provide dollar value in each column for each line item for portion of Work performed.

C. List each authorized Change Order as extension on continuation sheet, listing Change Order number and dollar amount as for original item of Work.

D. Prepare Application for Final Payment as specified in Section 01 7700.

1.04 SUBMITTAL PROCEDURES:

A. Submit four (4) copies of each Application for Payment at times agreed upon at Pre-construction meeting.

1.05 SUBSTANTIATING DATA:

A. First Pay Request cannot be processed, until the construction schedule, Subcontractors, Suppliers, and Manufacturer's list, completed Schedule of Values, and Building Permit where applicable.

B. When Owner requires any other substantiating information, submit data justifying line item amounts in question. Furnish one copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

END OF SECTION

SECTION 01 3100
PROJECT MEETINGS

PART 1 - GENERAL:

1.01 REQUIREMENTS INCLUDED:

A. CM shall schedule and administer periodic progress meetings, and specially called meetings throughout progress of the Work. CM will schedule and administer pre-construction meeting.

B. He shall:
1. Prepare agenda for meetings.
2. Distribute written notice of each meeting four days in advance of meeting date.
3. Make physical arrangements for meetings.
4. Preside at meetings.
5. Record the minutes; include significant proceedings and decisions.
6. Reproduce and distribute copies of minutes within three days after each meeting to participants in the meeting, and parties affected by decisions made at the meeting.

C. Representatives of Contractors, Subcontractors and Suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

D. Owner's representative and Architect will attend meetings to ascertain that Work is expedited consistent with Contract Documents and Project Schedule.

1.02 PRE-CONSTRUCTION MEETING:

A. CM will schedule and administer meeting.

B. Location: Project Site

C. Attendance:
1. Owner's Representative
2. Architect and his professional consultants
3. Contractor's Superintendent
4. Major Subcontractor's
5. Major Suppliers
6. Others as Appropriate

D. Suggested Agenda:
1. Distribution and discussion of:
   a. Projected Project Schedule.
   b. Critical Work sequencing.
   c. Major equipment deliveries and priorities.
   d. Project Coordination. Designation of responsible personnel.
2. Procedures and processing of:
   a. Field decisions.
   b. Proposal Requests.
   c. Submittals.
   d. Change Orders.
   e. Applications for Payment.
3. Adequacy of distribution of Contract Documents.
4. Procedures for maintaining Record Documents.
5. Use of premises:
   a. Office, Work and storage areas.
   b. Owner's requirements.
6. Construction facilities controls and construction aids.

7. Temporary utilities.
8. Safety and first-aid procedures.
9. Security procedures.
10. Housekeeping procedures.

1.03 PROGRESS MEETINGS:

A. Schedule regular weekly meetings.

B. Hold called meetings as required by progress of Work.
   a. Location of Meetings: Project site.

C. Attendance:
   1. Architect and his professional consultants as needed.
   2. Contractors, Subcontractors and Suppliers as appropriate to the agenda.
   3. Others.

D. Suggested Agenda:
   1. Review, approval of minutes of previous meeting.
   2. Review of Work progress since previous meeting.
   3. Field observations, problems, conflicts.
   4. Problems which impede Project Schedule.
   5. Review of off-site fabrication, delivery schedule.
   6. Corrective measures and procedures to regain projected schedule.
   7. Revisions to Project Schedule.
   8. Progress, schedule, during succeeding Work period.
   9. Coordination of schedules.
   10. Review submittal schedules; expedite as required.
   11. Maintenance of quality standards.
   12. Pending changes and substitutions.
   13. Review proposed changes for:
   14. Effect on Project Schedule and on completion date.
   15. Effect on other contracts of the Project.
   16. Other business.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED REQUIREMENTS:

A. General Conditions of the Contract: Definitions and basic responsibilities of entities.

B. Section 01 4500 - Testing Laboratory Services: Testing Laboratory reports.

C. Section 01 7700 - Contract Closeout.

D. Section 01 7839 - Project Record Documents.

E. Section 01 7823 - Operation and Maintenance Data.

1.02 CONSTRUCTION PROGRESS SCHEDULE:

A. Construction Manager will be producing the Progress Schedule with subcontractor input. As a minimum a horizontal bar chart with separate bar for each major trade or operation, identifying first work day of each week is acceptable.

B. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities.

1.03 ELECTRONIC SUBMITTAL PROCEDURES:

A. Summary:
1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format.
2. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
3. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

B. Procedures:
1. Submittal Preparation - Contractor may use any or all of the following options:
   a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor.
   b. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. Contractor shall transmit each submittal to Architect.
4. Architect / Engineer review comments will be attached to the PDF's. Contractor will receive emailed copies of the shops.
5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
6. Submit paper copies of reviewed submittals at project closeout for record purposes in accordance with Section 01 7839 – Closeout Submittals
7. Internet Service and Equipment Requirements:
   a. Email address and Internet access at Contractor's main office.
   b. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for

applying electronic stamps and comments.

1.04 SUBCONTRACTORS, SUPPLIERS AND MANUFACTURERS LIST:

A. Submit in accordance with Section 01 6000.

1.05 SCHEDULE OF SUBMITTALS:

A. As soon as possible after award of contract, submit schedule of submittals based upon list of required submittals furnished by the Architect.

1.06 SCHEDULE OF VALUES:

A. Each Contractor shall submit typed schedule on Request for Payment form furnished by CM.

B. List separate "labor" and "materials" value for each Specification Section, except where only labor is involved. Each value shall include directly proportional amount of Contractor's overhead and profit.

C. List separate value item for Temporary Facilities, Insurance, Supervision, Bond, etc.

D. Sum of all values listed in Schedule shall equal total Contract Sum.

E. Revise Schedule to list Change Orders for each request for payment.

1.07 SHOP DRAWINGS:

A. Present in clear and thorough manner. Title each Drawing with Project name and number; identify each element of Drawing by reference to sheet number and detail, schedule or room number of Contract Documents.

B. Identify field dimensions; show relation to adjacent or critical features of Work or products. Identify product. Indicate applicable standards such as ASTM or Federal Specification numbers. Identify deviations from Contract Documents.

C. Owner Review:
   1. Provide the Owner with one copy of Shop Drawings for review when forwarded to Consultant from Contractor. The Department will review each submittal and reply to appropriate Consultant if modifications need to be made; if no reply is made within two-business days from Owner, then no changes should be considered.
   2. Shop drawings for review and “For Construction” shall be submitted to the Architect and Owner in digital format, with hard copies provided in the Operation & Maintenance Manuals only.

1.08 PRODUCT DATA:

A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specifications Section, page and line number. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

B. Modify manufacturer's standard schematic Drawings and diagrams to supplement standard information and to Provide information specifically applicable to the Work. Delete information not applicable. Identify deviations from Contract Documents.

C. Provide manufacturer's preparation, assembly and installation instructions.

1.09 SAMPLES:

A. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures and patterns for Architect's selection.
   1. Submit samples to illustrate functional characteristics of products, including parts and attachments.

B. Approved samples which may be used in the Work are indicated in the Specifications Section.

C. Label each sample with identification required for transmittal letter.

D. Provide field samples of finishes at Project site at location acceptable to Architect, as required by individual Specification Section. Submit samples with delivery costs prepaid. Install each sample complete and finished. Applicable finishes in place may be retained in completed Work. Remove other samples at conclusion of Work or when acceptable to Architect.

1.10 TEST REPORTS:

A. Reports of field testing as required by individual Sections.

1.11 CERTIFICATIONS:

A. Definition: Certifications are manufacturer's testimonials prepared by him or by an independent testing agency which certify conformance with specified requirements.

B. Content: Identify product by reference to Specification Section, and by reference to applicable Drawings. Clearly mark each copy to identify pertinent model, if more than one certification is required.

1.12 CONTRACTOR REVIEW:

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers and conformance of submittal with requirements of Contract Documents.

B. Coordinate submittals with requirements of Work and of Contract Documents.

C. Sign or initial each sheet of Shop Drawings and Product Data and each sample label to certify compliance with requirements of Contract Documents. Notify Architect in writing at time of submittal of any deviations from requirements of Contract Documents.

D. Do not fabricate products or begin Work which requires submittals until return of submittal with Architect's acceptance.

1.13 SUBMITTAL REQUIREMENTS:

A. Provide 8"x3" blank space on each submittal, or cover sheet of a series of 8-1/2"x11" submittal sheets, for Contractor's and Architect's stamp.

B. Submit a minimum of 4 copies of Shop Drawing and Product Data submittals. Normally the Architect will retain 1 copy and return the remaining copies to the Contractor. On

Mechanical and Electrical items, Consulting Engineers will also retain a copy. Contractors shall also keep a minimum of 2 copies needed for the Operation & Maintenance Data submittals.

C. Submit number of samples required by individual Specification Section.

D. Transmit each Submittal under separate transmittal form. Identify Project, Contractor, Subcontractor, major supplier; identify pertinent Drawing Sheet and detail number and Specification Section number, as appropriate. Identify deviations from Contract Documents. Provide space for Contractor and Architect review stamps.
   1. Comply with Progress Schedule for submittals related to Work progress. Coordinate submittal of related items.

E. Coordinate submittals into logical groupings to facilitate interrelation of several items:
   1. Finishes which involve Architect's selection of colors, textures, or patterns;
   2. Associated items which require correlation for efficient function or for installation.

1.14 RESUBMITTALS:

A. Make resubmittals under procedures specified for initial submittals; identify changes made since previous submittal.

1.15 DISTRIBUTION:

A. Duplicate and distribute reproductions and/or copies of Shop Drawings and copies of Product Data and Samples which bear Architect's stamp of approval to job site file, Record Documents file, Subcontractors, Suppliers and other entities requiring information and for inclusion in Maintenance Manual (See Close Out Submittals – Section 01 7823) when required by individual Section.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED REQUIREMENTS:

A. Inspections and Testing Required By Laws, Ordinances, Rules, Regulations, Orders or Approvals of Public Authorities: Conditions of The Contract.

B. Certification of Products: Respective Specification Sections.

C. Test, Adjust and Balance of Equipment: Respective Specification Sections.

D. Laboratory Tests Required and Standards for Testing: Each Specification Section listed.

E. Testing Laboratory shall be protected by Professional Liability Insurance (errors and omissions) from an independent carrier.

F. Section 01 3300 - Submittal Requirements

G. Section 01 7823 - Closeout Submittals; Operations and Maintenance Data

1.02 TESTING LABORATORY:

A. **OWNER shall employ and pay** for services of independent testing laboratory to perform specified services and testing. Contractor shall cooperate with laboratory to facilitate execution of its required services.

B. Employment of laboratory shall in no way relieve Contractor's obligations to perform Work of the Contract.

C. Approved Testing Laboratories: AET/Northern Technologies Inc., Terracon Inc., & Braun Intertec Engineering Inc.;

1.03 TESTING LABORATORY INSPECTION, SAMPLING AND/OR TESTING IS REQUIRED FOR:

A. General Construction Work:
1. Rebar, Section 03 2000 and Cast-In-Place Concrete: Section 03 3300.
2. Building/Structure Excavating and Backfilling: Section 31 2325

B. Civil Work:
1. Division 31, Earthwork, involving the following: Subgrade Modifications, Excavation and Fill (site)Subgrade Preparation, Trenching and backfill for piping, etc.
2. Division 32, Exterior Improvements, involving: Such as Site Concrete work, (or Asphaltic Paving Work, or both), and Aggregate Base Courses, etc.
3. Division 33, Utilities: Bedding for piping, manholes, etc.

C. Plumbing Work Backfill: Division 22/23

D. Electrical Work Backfill: Division 26/28.

1.04 QUALIFICATION OF LABORATORY:

A. Meet "Recommended Requirements for Independent Laboratory Qualifications," published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E 329, "Standards of Recommended Practices for Inspection and Testing Agencies for Concrete and Steel as Used in Construction."

C. Authorized to operate in North Dakota.

D. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection, with memorandum of remedies of any deficiencies reported by inspection.

E. Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to either National Bureau of Standards or Accepted Values of Natural Physical Constants.

1.05 LABORATORY DUTIES:

A. Cooperate with Architect and Contractor; provide qualified personnel after due notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction:
1. Comply with specified standards.

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

D. Promptly notify Architect and Contractor of observed irregularities or deficiencies of Work or products.

E. Promptly submit two copies of written report of each test and inspection to Architect within four days of test. Each report shall include:
1. Date issued.
2. Project title and number.
3. Testing laboratory name, address and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions.
7. Date of test.
8. Identification of product and Specification Section.
9. Location of sample or test in the Project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by Architect.

1.06 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY:

A. Laboratory is not authorized to:
1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of Work.
3. Perform any duties of Contractor.

1.07 CONTRACTOR'S RESPONSIBILITIES:

A. Cooperate with laboratory personnel, Provide access to Work, to manufacturer's operations.

B. Secure and deliver to laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to laboratory preliminary design mix proposed to be used for concrete, and other materials mixes which require control by testing laboratory.

D. Furnish copies of Products test reports as required.

E. Furnish incidental labor and facilities:
1. To provide access to Work to be tested.
2. To obtain and handle samples at the Project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

G. Make arrangements with laboratory and pay for additional samples and tests required for Contractor's convenience and to perform additional inspections, sampling and testing required when initial tests indicate Work does not comply with Contract Documents.

1.08 TESTS TO DEMONSTRATE QUALIFICATION:

A. In addition to tests specified, should the Contractor propose a product, material, method or assembly that is of unknown or questionable quality, the Owner or his representative may require and order suitable tests to establish a basis for acceptance or rejection.

B. Such tests shall be paid for by the Contractor, or by the Subcontractor proposing or requesting approval. Standard test reports on “similar” material will not be acceptable.

C. The Owner and Architect reserve the right to require certification or other proof that the material, assembly, equipment, system, or other product furnished or proposed to be furnished, for this Project is in compliance with any test of standard called for.
   1. The certificate shall be signed by a representative of the independent testing laboratory.

D. Any tests required to qualify the Contractor or any of his workmen for any phase of the work, and any test of a method, system or equipment that may be required by specification or law to qualify the item for use, shall be made or taken without additional reimbursement, and all costs for such testing shall be the Contractor’s responsibility.

E. If exploratory work is required to determine the cause of defects, the cost of such work shall be borne by the Contractor responsible for such work, if the work is found, in the judgment of the Architect, to be defective. If the contractor responsible for the work is adjudged to be not at fault, the exploratory work and testing shall be paid for by the Owner.

1.09 NOTICE of INSPECTIONS:

A. Should the specifications, Architect’s instruction, laws, ordinances or any public authority require any work to be inspected or approved, the Contractor shall provide a minimum of 5 working days notice to the appropriate firms before starting work requiring observation or inspection, and a minimum of 3 working days notice thereafter for each inspection and observation for the continuation of that work item. If any work requiring inspection should be covered up without approval or consent of the approving agency, it must be uncovered for examination at Contractor’s expense.

1.10 CERTIFICATES:

A. Except for test reports provided and signed by approved independent testing laboratories, all certificates required by the specification shall be signed by an authorized official of the firm providing the certificate. Provide complete with notarized signatures, when such certificates by the producer are acceptable to the Architect.

Special Structural Testing and Inspection Program Summary Schedule

Project Name _____ Project No. _____
Location _____
_____ Permit No._____(1)

Technical (2)		Description (3)	Type of Inspector (4)	Report Frequency (5)	Assigned Firm (6)
Section	Article				

Note: **This schedule shall be filled out and included in a Special Structural Testing and Inspection Program.** (If not otherwise specified, assumed program will be "Guidelines for Special Inspection & Testing" as contained in the State Building Code.)

(1) Permit No. to be provided by the Building Official
(2) Referenced to the specified technical scope section in the program.
(3) Use descriptions per IBC Chapter 17, as adopted by State Building Code.
(4) Special Inspector – Technical, Spec Inspector – Structural.
(5) Weekly, monthly, per test/inspection, per floor, etc.
(6) Firm contacted to perform services.
(7)

ACKNOWLEDGEMENTS
(Each appropriate representative shall sign below)

Owner: _____ Firm: _____ Date:_

Contractor: _____ Firm: _____ Date: _____

Architect: _____ Firm: _____ Date: _____

SER _____ Firm: _____ Date: _____

SI-S: _____ Firm: _____ Date: _____

TA: _____ Firm: _____ Date: _____

F: _____ Firm: _____ Date: _____

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified as an attachment.

Legend: SER = Special Engineer of Record SI-T = Special Inspector – Technical TA = Testing Agency
SI-S = Special Inspector – Structural F = Fabricator

Accepted for the Building Department by_____Date _____

END OF SECTION

PART 1 - GENERAL:

1.01 GENERAL:

A. Provide and maintain during construction period facilities and temporary controls specified herein. Locate as directed and, prior to final payment, remove from site. Repair damage caused by installations and restore to condition acceptable to Architect and Owner.

1.02 FIELD OFFICE:

A. Existing space inside the facility will be used as a field office. Office shall be approximately 100 square feet in area, and equip with heat, lights, plan desks, plan files.

1.03 TEMPORARY TELEPHONE:

A. All contractors, subcontractors shall be accessible via cell phone. CM/General Contractor shall receive contacts and phone numbers prior to work initiation.

1.04 TEMPORARY TOILET:

A. Facilities in existing building may be used as directed by Owner. Keep facilities clean and sanitized.

1.05 TEMPORARY POWER AND LIGHT:

A. Electrical subcontractor: Arrange for and maintain single-phase temporary service from existing system. Free use of power from existing system is allowed.

B. Electrical subcontractor: Provide temporary disconnect panels, lines and 115-volt power outlets to within 50 feet of any interior part of building.

C. Electrical subcontractor: Provide lighting of at least 1-500-watt lamp, including initial and replacements, for each 900 square feet of building or for each room with area under 900 square feet, minimum 60 watt per 100 sf room.

D. Used materials may be used for temporary power and light but not for permanent electrical Work.

E. Contractors Requiring Additional Temporary Power or Light: Arrange to have Electrical subcontractor make proper connections to temporary system. Electrical Subcontractor shall be reimbursed by Contractor requesting such special connections and subsequent removal of same.

F. Contractors Requiring Special Power Loads: Make arrangements for these facilities and pay energy costs for same. Remove such facilities immediately after Work involved is completed.

G. Each Contractor Requiring Supplemental Lighting: Provide same using suitable portable lighting cords and plugs for use with temporary receptacles provided.

H. Use temporary power and light system under direction of Electrical Contractor to extent that, in event of heavy overloading, designate where loads may be connected so as to prevent overloading of circuits. Coordinate use of temporary power so demand does not

exceed service available. Contractor responsible for damage shall pay costs to repair any damage to system, including replacement of blown fuses, resulting from misuse or from connecting faculty equipment into system.

1.06 TEMPORARY WATER:

A. Connections may be made to existing facilities with free use of water allowed.

1.07 TEMPORARY ENCLOSURES:

A. General Contractor/CM:
   1. Provide and maintain dustproof separation between areas of demolition / construction, and other portions of the building, preventing the spread of dust and fumes outside the areas of demolition and construction. This includes covering return air vents, intake louvers, stairwells, etc.
   2. Provide separation of such quality so as to ensure computers and other sensitive equipment are not disrupted or damaged.
   3. If dustproof separation is damaged or disrupted, the General Contractor shall promptly correct the problem, and shall clean all resulting spaces which have been soiled. If disruption is caused by a contractor other than the General Contractor, that Contractor shall reimburse the General Contractor for required cleaning and corrective work. If disruption caused damage to computers or other equipment, the responsible Contractor shall reimburse Owner for repair/cleaning or replacement.

1.08 STORAGE OF MATERIALS:

A. Exterior Storage is allowed on this project. Storage of materials in weather tight trailers is allowed.
   1. Coordinate with Owner as to boundary of and access to areas where materials and other apparatus may be stored in the building, and on site in adjacent parking areas.
   2. Each Contractor shall provide temporary exterior storage trailers or bring materials to site daily on an as needed basis.

1.09 PARKING:

A. Parking for construction personnel will be limited to a designated area on project site, as recommended by CM/Contractor.

1.11 GARBAGE/DEMOLITION MATERIALS:

A. CM/l Contractor shall provide a garbage truck or dumpster roll off on site. Every effort will be made to recycle as much as possible. Contractors will be required to separate materials and load them accordingly in the garbage truck.

B. Disposal fees will be paid by the General Contractor/CM

1.13 STORAGE OF MATERIALS:

A. Exterior Storage is allowed on this project, but in designated areas. Coordinate with Owner as to boundary of and access to areas where materials and other apparatus may be stored on, or off site. Storage of materials in Exterior

weathertight trailers is allowed. Each Contractor shall provide temporary exterior storage or bring materials to site on a daily as needed basis.

B. Coordinate with Construction Manager specific boundary of and access to areas where materials and other apparatus may be stored.

1.14 TEMPORARY FENCES:

A. CM/General Contractor shall provide neatly constructed fences which will exclude unauthorized persons from construction site and material storage areas.

B. Fences shall consist primarily of used chain link fencing, 6 ft. tall minimum, with posts installed at 10 ft maximum spacings. Note: The fence shall be of sufficient height and security to keep non-construction personnel from entering the project site, within the construction limits. GC to provide fencing with lockable gates, quantity and size as determined for the proper completion of the Work.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Section 01 3300 – Submittal Procedures.

1.02 PRODUCTS:

A. Products include material, equipment and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within Specification section shall be same and shall be interchangeable.

D. Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

E. No products or building materials used as a temporary or permanent element in the construction of a building will be allowed which have any form of asbestos containing or lead containing material.
   1. Contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building, and to remind material suppliers that their products must not contain asbestos or lead.
   2. Contractors shall notify the Architect immediately of any materials which are suspected of containing asbestos, and shall not disturb or attempt to abate any asbestos containing material. The Architect will contact the Owner and inform the Owner of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos or lead removal.

1.03 TRANSPORTATION AND HANDLING:

A. Require supplier to package products in boxes or crates for protection during shipment, handling and storage. Protect sensitive products against exposure to elements and moisture.

B. Protect sensitive equipment and finishes against impact, abrasion and other damage.

C. Arrange deliveries of products in accordance with Construction Progress Schedules. Allow time for inspection prior to installation.

D. Coordinate deliveries to avoid conflict with Work and conditions at site.

E. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.

F. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.

G. Immediately on delivery, inspect shipment to assure:
   1. Product complies with requirements of Contract Documents and reviewed submittals.
   2. Quantities are correct.
   3. Accessories and installation hardware are correct.
   4. Containers and packages are intact and labels eligible.
   5. Products are protected and undamaged.

H. Provide equipment and personnel to handle products by methods to prevent soiling and damage.

I. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging and surrounding surfaces.

J. Handle product by methods to avoid bending or overstressing. Lift large and heavy components only at designated lift points.

1.04 STORAGE, GENERAL:

A. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

B. Arrange storage in manner to provide access for maintenance of stored items and for inspection.

1.05 ENCLOSED STORAGE:

A. Store products, subject to damage by the elements, in substantial weathertight enclosures.

B. Maintain temperature and humidity within ranges stated in manufacturer's instructions.

C. Provide ventilation for sensitive products as required by manufacturer's instructions.

D. Store unpacked and loose products on shelves, in bins or in neat groups of like items.

1.06 EXTERIOR STORAGE:

A. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.

B. For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.

C. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

D. Provide surface drainage to prevent erosion and ponding of water.

E. Prevent mixing of refuse or chemically injurious materials or liquids.

1.07 MAINTENANCE OF STORAGE:

A. Periodically inspect stored products on a scheduled basis.

B. Verify that storage facilities comply with manufacturer's product storage requirements.

C. Verify that manufacturer required environmental conditions are maintained continually.

D. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

END OF SECTION

SECTION 01 7400
CLEANING

PART 1 - GENERAL:

1.01 REQUIREMENTS INCLUDED:

A. Cleaning during progress of the Work and at completion of Work.

1.02 RELATED REQUIREMENTS:

A. Conditions of the Contract and individual Specification Sections.

1.03 DISPOSAL REQUIREMENTS:

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 - PRODUCTS:

2.01 CLEANING MATERIALS:

A. Use materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only materials and methods recommended by manufacturer of material being cleaned.

PART 3 - EXECUTION:

3.01 DURING CONSTRUCTION:

A. Each contractor/subcontractor shall be responsible for daily cleanup and removing from the building and site, any boxes, excess materials, and other debris caused by his work which is easily assignable to the respective contractor or subcontractor. This material shall be removed from the site by the contractor (and his subs) or it may be placed in the GC/CM furnished truck previously listed elsewhere. The construction site, parking lot must be kept in a clean and neat state.

B. **GC/CM** shall be responsible for a thorough clean-up of the construction jobsite both inside and outside of the structure twice weekly--Wednesday and Friday. This clean-up will be for the purpose of removal of the many misc. items of construction materials, wire, screws, nails, small empty containers, and other such items that are difficult to assign to the responsible contractor or subcontractor. This clean-up shall include sweeping floors, picking up debris from the working areas to place them in a neat clean manner, and the removal of debris from the site.

C. **GC/CM** shall remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL:

A. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING:

A. Prior to final cleaning each contractor or subcontractor shall make special effort to remove all debris caused by his work and to clean any soiling he has caused to the work of others.

B. Thereupon, the GC/CM, Mechanical subcontractor and the Electrical subcontractor shall make the final clean-up which shall include at least the following:

3.04 GENERAL (CM) CONTRACTOR shall clean:

A. Clean transparent and glossy materials to a polished condition; remove foreign substances.

B. Remove waste, debris and surplus materials from site. Clean grounds; remove stains, spills and foreign substances from paved areas and sweep clean. Rake clean other exterior surfaces.

3.05 Electrical Contractor shall:

A. Clean light fixtures and lamps, as well as electrical equipment.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED REQUIREMENTS:

A. Fiscal provisions, legal submittals and additional administrative requirements are defined in the Conditions of Contract.

B. Final cleaning requirements are defined in Section 01 7400.

C. Submittal requirements prior to closeout are defined in Sections 01 7823 Maintenance Manuals and 01 7839, Project Record Documents.

1.02 SUBSTANTIAL COMPLETION:

A. When Contractor considers the Work is Substantially Complete, he shall submit to Architect a written notice that the Work, or designated portion thereof, is Substantially Complete and a list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, Architect will make an inspection to determine the status of completion.

C. Should Architect determine that the Work is not Substantially Complete: Architect will promptly notify the Contractor in writing, giving the reasons therefore. Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect. Architect will re-inspect the Work.

D. When Architect concurs that the Work is Substantially Complete he will:
1. Prepare a Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect. Submit the Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

1.03 FINAL INSPECTION:

A. When Contractor considers the Work is complete, he shall submit written certification that:

B. Contract Documents have been reviewed.
1. Work has been inspected for compliance with Contract Documents.
2. Work has been completed in accordance with Contract Documents.
3. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
4. Work is completed and ready for final inspection.

C. Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

D. Should Architect consider that the Work is incomplete or defective:

E. Architect will promptly notify the CM/Contractor in writing, listing the incomplete or defective Work. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Architect that the Work is complete. Architect will re-inspect the Work.

F. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.04 REINSPECTION FEES:

A. Should Architect perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
   1. Owner will compensate Architect for such additional services.
   2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.05 CONTRACTORS' CLOSEOUT SUBMITTALS:

A. Project Record Documents: To requirements of Section 01 7839.

B. Operating and Maintenance Data, Instructions to Owner's Personnel: To requirements of Section 01 7823.

C. Warranties and Bonds: To requirements of Section 01 7823.

D. Keys and Keying Schedule: To requirements of Section 08 7100.

E. Evidence of Payment and Affidavit of Contractor: To requirements of General and Supplementary Conditions, including consent of surety. The consent of surety must be obtained prior to any reduction in retained percentages and prior to final payment.

F. Maintenance Materials: Deliver extra materials specified in various technical sections. These materials shall not be allowed to collect in various parts of the building, but shall be delivered to the Owner at one time. Receipt of received materials shall be obtained by the Contractor when delivering these maintenance materials.

G. Identification of Equipment: Prior to substantial completion, the contractor shall provide the identification tags or plates, or other identification means, as specified under the Technical Sections of the specifications, such as valves, panelboards, and similar items. Plates with directions, circuit data and similar information shall also be affixed.

H. Construction Cores: If removable core cylinders are specified in this project, and construction cores are furnished, the contractor shall replace and install permanent cores, just prior to occupancy. Thereafter, access to the spaces, will be by the Owner personnel opening doors, or other arrangements.

1.06 INSTRUCTIONS TO THE OWNER:

A. Requirements herein supplement any specific requirements provided under individual specification sections. The Contractor shall thoroughly and properly instruct the Owner in the use, operation, care and maintenance of the Project, especially various systems and equipment installed under the Contract. The instructions shall be methodically given, cover various phases of work, and be in sufficient detail so Owner fully understands the entire Work.

B. The Contractor shall permit and assist designated representatives of the Owner to become familiar with the locations, methods, materials, uses and operation of the systems and equipment, as well as any specialized materials installed under this Contract. The explanations and instructions shall be provided by qualified representatives of the Contractor(s) or their subcontractors.

C. As work nears completion, the Contractor shall instruct (and demonstrate to) the Owner in the full use and sequence of function and similar information to fully acquaint the Owner in

the proper use, Care and control of all equipment, systems and devices under the Contract. Precautionary measures and dangers of misuse shall be specifically explained. To qualify for completion of this phase of instructions, specific and agreed upon periods of time shall be established with the Owner and the Owner will record length of time and number of days spent in the instructions.

D. When the foregoing instructions are being provided, the Contractor shall provide 2 copies of neatly edited and typed manuals of instructions, organized by classes or types of equipment and systems, to explain the use, function, and control of equipment and systems. Printed information shall cover all instructions and explanations and shall enumerate common errors made, which will “abuse” the equipment or system. Contractor shall keep and turn over to Owner clean installation data and pamphlets, which are not to be left at the equipment, but collected and put in the manuals. Manuals shall also include maintenance instructions. Refer to Section 01 7823, for additional information and data for maintenance manuals.

1.07 SYSTEMS and EQUIPMENT TESTING:

A. The Contractor is responsible for testing all equipment and systems and demonstrating they are correctly installed and operating properly. Provide a written record of the tests and the results.

B. After operation and testing of systems, instruct the Owner’s representatives, provided a representative of the Architect is present.

1.08 FINAL ADJUSTMENT OF ACCOUNTS:

A. Submit a final statement of accounting to Architect.

B. Statement shall reflect all adjustments to the Contract Sum:
1. The original Contract Sum.
2. Additions and deductions resulting from:
3. Previous Change Orders.
4. Allowances.
5. Unit Prices.
6. Deductions for uncorrected Work.
7. Penalties and Bonuses.
8. Deductions for liquidated damages.
9. Deductions for reinspection payments.
10. Other adjustments.
11. Total Contract Sum, as adjusted.
12. Previous payments
13. Sum remaining due.

C. Architect will prepare a final Change Order reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.09 FINAL APPLICATION FOR PAYMENT:

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION

SECTION 01 7823
OPERATION AND
MAINTENANCE DATA

PART 1 - GENERAL:

1.01 RELATED REQUIREMENTS:

A. Section 01 7700 - Contract Closeout.

B. Section 01 7839 - Project Record Documents.

C. Individual Specifications Sections: Specific requirements for operation and maintenance data, care and maintenance data and instruction of Owner personnel.

1.02 FORMAT:

A. Prepare data in the form of an instructional manual.

B. Organize in commercial quality, 8-1/2"x11" three-ring binders with hardback, cleanable, plastic covers. When multiple binders are used, correlate data into related consistent groupings.

C. Identify each binder on cover with typed or printed title "OPERATION AND MAINTENANCE INSTRUCTIONS"; list title of Project and identify subject matter of contents.

D. Arrange contents by Section numbers and sequence of Table of Contents of this Project Manual.

E. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

F. Text: Manufacturer's printed data or typewritten data on 20-pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text. Fold larger drawings to size of text pages.

1.03 CONTENTS OF EACH VOLUME:

A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect and Contractor and listing of products and systems indexed to tabbed flyleafs.

B. Updated Subcontractor, Supplier and Manufacturer List: Indicating any changes made after original submission at start of Project.

C. Include description as to type and quantity of maintenance materials turned over to Owner in accordance with individual Sections.

D. Warranties and Bonds: Include all.

E. Shop Drawings and Product Data: Include all.

F. Operation and Maintenance Data for Equipment and Systems: Where required by individual Sections, Provide manufacturer's recommended operation procedures and maintenance requirements including guide for troubleshooting, disassembly, repair and reassembly instructions and alignment, adjusting, balancing and checking instructions.

G. Care and Maintenance Data for Finishes: Where required by individual Sections, Provide manufacturer's recommendations for cleaning agents and methods, precautions against

detrimental agents and methods and recommended schedule for cleaning and maintenance.

1.04 SUBMITTALS:

A. Submit copy of preliminary draft or proposed formats and outlines of contents to Architect.
   1. Architect will review draft and return one copy with comments.

B. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Architect's comments. Revise content of documents as required prior to final submittal.

C. Submit two copies of revised volumes of data in final form to Architect within ten days after final inspection.

D. Submit also, a flash drive or a computer disk with PDF files of the O & M manuals.

END OF SECTION

PART 1 - GENERAL:

1.01 REQUIREMENTS INCLUDED:

A. Maintain at the site for the Owner one record copy of following:
1. Drawings
2. Specifications
3. Addenda
4. Change Orders and other Modifications to the Contract
5. Architect Field Orders or Written Instructions
6. Approved Shop Drawings, Product Data and Samples
7. Field Test Records
8. Construction Photographs

1.02 RELATED REQUIREMENTS:

A. Section 01 3300 - Submittals.

B. Section 01 7823 - Operation and Maintenance Data.

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES:

A. Store documents and samples in Contractor's field office apart from documents used for construction.

B. Provide files and racks for storage of documents.
1. Provide locked cabinet or secure storage space for storage of samples.

C. File documents and samples in accordance with CSI format.
1. Maintain documents in a clean, dry, legible condition and in good order.

D. Make documents and samples available at all times for inspection by Architect.

1.04 SUBMITTALS:

A. One copy of field noted, construction drawings (“Red Line Drawings”) shall be delivered to Owner.

1.05 RECORD DRAWINGS:

A. Label each document "PROJECT RECORD" in next large printed letters.

B. Two (2) complete printed sets of AS-BUILT record drawings:
1. May not be sized larger than 30”H x 42”W (ARCH E1)
2. Drawings must be updated to reflect all change orders, field changes and revisions. Handwritten notations and field notations are not acceptable.
3. A painting schedule noting all paints and stains used on the project. Designate this information by using the room number.
4. A valve chart for all valves will be provided with valve enumeration, location, and type identified (i.e. Main Shut-Off, Return Valve, etc.).

END OF SECTION

SECTION 02 3000
SUBSURFACE INVESTIGATION

PART 1 - GENERAL:

1.01 INVESTIGATION:

A. Soil and subsurface investigations have **not** been conducted at Project site.

B. There are NO Reports or log of borings available for Contractor's information.

C. For additional investigation, Contractor should visit site and acquaint himself with site conditions.

D. Prior to bidding, Contractor may make his own subsurface investigations to satisfy himself with site and subsurface conditions.

END OF SECTION

PART 1 - GENERAL:

1.01 WORK INCLUDED:

A. Reinforcing steel bars, weldable and non-welded steel bars
B. Support chairs, bolster, bar supports, ties, spacers for supporting reinforcement.
c. Welded wire Fabric.

1.02 RELATED WORK:

A. Concrete is by Section 03 3000.

1.03 SUBMITTALS:

A. Shop Drawings:
   1. Submit in accordance with Section 01 3300. Submit a minimum of 5 copies. Allow a minimum of 7 calendar days for processing not including shipping times.
   2. Provide layout, details and lists with grid line coordinates, and details in accordance with ACI publication SP-66/315R-04 (latest edition please) and 315-99 detailing manual.
   3. Indicate sizes, spacings, locations, and quantities of reinforcing steel, concrete cover, cutting and bending lists/schedules complete, and indicated cut thru/section concrete details.
   4. Supporting devices are part of the work, and must be shown on the submittal.

1.04 REFERENCES

A. American Concrete Institute ACI 301 - Specifications for Structural Concrete for Buildings.
   ACI 318 -Building code Requirements for structural concrete.
B. ASTM International (ASTM):
   1. A185/A185M - Standard Specification for Welded Steel Wire Reinforcement, Plain, for Concrete.
   2. A615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. A767 - Standard Specification for Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
   4. D3963 - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel.

C. American Welding Society (AWS) D1.4 - Structural Welding Code - Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. Manual of Practice.

1.05 QUALITY ASSURANCE:

A. Perform concrete reinforcement work in accordance with CRSI's (CA-4) Manual Standard Practice, and Documents 63 and 65.

B. Erection of rebars in this Section shall be performed by experienced rebar erectors having a minimum of 6 years experience. Submittals: If requested by the Architect, submit copies of experience record for review showing jobs of comparable size on which steel erection was performed.

C. Reinforcement inspection by local authority and testing laboratory per Division 1 requirements.

PART 2 - PRODUCTS:

2.01 PRODUCTS:

A. Conform to requirements of Chapter 5, ACI 301 (latest revision), "Specifications for Structural Concrete for Buildings," except as modified by General Notes on Structural Drawings.

B. Reinforcing Bars:
1. ASTM A615/A615M, deformed billet steel, Grade [60 Unless indicated otherwise on Drawings.
2. Finish:Plain
3. Welded Steel Wire Fabric: ASTM A185 plain type; uncoated finish. Where size not noted, use 6 x 6 W2.1 x W2.1.

C. Welded Wire Fabric:
1. ASTM A185/A185M. [Furnish in flat sheets only].
2. Finish: Plain

2.02 ACCESSORIES:

A. ACI 315; Spacers, Chairs, Bolsters, and Bar Supports:
1. Sized and shaped for strength and support of reinforcement during concrete placement.
2. Galvanized or plastic coated steel for surfaces exposed to weather.
3. Use non-penetrating chairs when pouring over critical floor slab vapor retarders.

B. Tie Wire: ASTM A82, Annealed steel, minimum16 gage.

2.03 FABRICATION:

A. Detail Reinforcing Steel: Conform to ACI 315 and ACI 318.
1. Number, type, and Spacing of Supports and other accessories: Conform to ACI 315
2. Support and tie all reinforcing steel.
3. Shop fabricate reinforcing steel to size, shape and dimensions.

B. Defects not permitted:
1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bend or kinks not indicated on drawings or final Shop Drawings.
3. Bars with reduced cross section due to excessive rusting or other cause.

2.04 EPOXY GROUT for DOWELS:

A. Epoxy Grout for dowels: Simpson SET-3G adhesive, or equivalent.

PART 3 - EXECUTION:

3.01 INSTALLATION:

A. Conform to requirements of Chapter 5, ACI 301, (latest revision) "Specifications for Structural Concrete for Buildings," except as modified by General Notes on Structural Drawings.

B. Before placing concrete, clean reinforcement of foreign particles or coatings. Remove flakey rust, mud, oil and other foreign matter.

C. Place, support and secure reinforcement against displacement. Do not deviate from alignment or measurements.
   1. Do not displace or damage vapor barrier required by Section 03 3000.

D. Place in accordance with the approved Shop Drawings.

E. Beams: Place straight and bent bars, stirrups and accessories as indicated on shop drawings.

F. Minimum concrete cover , unless otherwise indicated on the Drawings:
   1. Concrete against ground without the use of forms: 3" for bars, 2" for mesh
   2. Concrete against earth, but placed in forms: 3 inch
   3. Concrete exposed to weather: 2 inch
   4. Walls not exposed to ground or weather (#11 bars and smaller): 3/4 inch
   5. Walls not exposed to ground or weather (#14 through #18 bars): 1 1/2 inch

G. Place temperature reinforcing for slabs on grade at the center of the slab.
   1. Splice reinforcing bars only where indicated on the drawings.

H. Do not bend bars after partially embedded in hardened concrete, except as shown on the structural drawings.

I. Place all slab reinforcing (bars or fabric) on chairs or pins to prevent the reinforcing from ending up on the bottom 1/4 of the slab on grade.

3.02 ACCESSORIES:

A. Provide and install chairs, chair bars in sufficient quantity and strength to support and prevent displacement of reinforcing.

3.03 INSPECTION:

A. Provide inspection as specified (Division 1 requirements). Inspect reinforcement in all cast in place concrete, excluding slabs on grade, footings without transverse reinforcement, and topping slabs. (Structural I)
   1. In no case shall any reinforcing steel be covered with concrete until amount and position of reinforcement was checked by Engineer/or His representative and his permission was given to proceed with concreting. Engineer/or His representative shall be given ample prior notice of availability of installed reinforcement for review.
   2. Verify grade of reinforcement
   3. Verify reinforcement bars are free of dirt, excessive rust and damage
   4. Verify bars are adequately tied, chaired, supported.
   5. Verify proper clear distances between bars and surfaces of concrete
   6. Verify reinforcing bars and placement
   7. Verify splicing of bars, in accordance with plans, specifications, shop drawings.
   8. Verify laps for proper length and stagger and bar bends for minimum diameter.

END OF SECTION

PART 1 - GENERAL:

1.01 WORK INCLUDED:

A. Cast-in-place concrete, including but not limited to piers, footings, equipment pads shown on structural plans, floors, foundation walls, slabs on grade, aprons.
B. Joint devices associated with concrete work.

1.02 RELATED WORK:

A. Foundation Rigid Insulation: By Division 7. (07 2000)
B. Underfloor Heating: Division 22/23 Mechanical.

C. Testing laboratory services are by Division 1, Section 01 4500.

D. Concrete reinforcement is by Section 03 2000.

E. Linear Trench Floor Drains: Division 22/23, Mechanical. Coordinate setting of \ drains with Plumber.

F. Sitework Concrete, such as Concrete Paving, Concrete Sidewalks, & Curb and Gutter: See Division 32.

1.03 REFERENCE SPECIFICATION:

A. ACI 301 (latest revision) "Specification for Structural Concrete for Buildings". Referred Chapters, in total or as supplemented and/or modified, are made part of Specification.
1. Maintain one copy of Reference Specification at job site.

B. Copies can be obtained from American Concrete Institute, 38800 Country Club Drive, Farmington Hills, Michigan 48331, phone #248-848-3700. http://www.concrete.org/

1.04 QUALITY ASSURANCE:

A. Acquire cement from same source, and aggregate from same source, for entire project.

B. Follow hot weather and cold weather requirements of ACI 305.1 and ACI 306.1 when concrete work occurs during hot or cold weather.

1.05 PRE-INSTALLATION CONFERENCE: (Slabs)

A. At least 7 days prior to the beginning of the concrete construction work, the contractor shall conduct a meeting to review the proposed mix designs, and to discuss the required methods and procedures to achieve the required concrete work. The contractor shall send a preconstruction meeting agenda to all attendees, not later than 14 days prior to the meeting.

B. In attendance:
1. Architect/Owner’s representative (Engineer)
2. Contractor’s Superintendent and office manager for the project
3. Concrete Finishing contractor/subcontractor
4. Ready Mix producer and Pumping subcontractor.
5. Testing lab personnel, responsible for field quality control.
6 Admixture manufacturer representative.

C. Review and Recording of Minutes:

1. Review proposed mix designs, special inspection, testing, and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot weather concreting procedures, curing procedures, construction, contraction and isolation joints, joint filler strips, semi rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures and concrete protection.
2. The GC/CM shall run the meeting and shall record, type and submit copies of the meeting notes. Copies of the meeting notes shall also be distributed to the Structural Engineer and the Owner.
3. The concrete contractor/subcontractor shall review the proposed mix design(s) and placing, finishing and curing procedures, and certify that he can produce the concrete quality required by the specifications.

1.07 REFERENCES: (use latest editions available)

A. ACI 301 – Specifications for Structural Concrete for Buildings. (American Concrete Institute International)

B. ACI 305.1 – Specification for Hot Weather Concreting.

C. ACI 306.1 – Standard Specification for Cold Weather Concreting.

D. ACI 308.1 – Standard Specification for Curing Concrete

E. ASTM C33 – Standard Specification for Concrete Aggregates.

F. ASTM C94 – Standard Specification for Ready-Mixed Concrete.

G. ASTM C150 –Standard Specification for Portland Cement.

H. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

I. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

J. ASTM C309- Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

K. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

L. ASTM C618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

Q. ASTM E1155 – Test method for determining Floor Flatness & Floor Levelness.

R. ASTM E 1745 – Standard Specification for Plastic Water Vapor Retarders used in contact with Soil or Granular Fill under Concrete Slabs.

S. NRMCA – National Ready Mix Concrete Association

T. PCA – Portland Cement Association.

PART 2 - PRODUCTS:

2.01 MATERIALS FOR CONCRETE: Chapter 2

A. Cement Type: ASTM C150, Type **I** - low alkali; Provide Type III High Early where required.

B. Air Content: For exterior exposed concrete platforms, sidewalks, curbs, etc., use air-entrained Concrete, or where concrete is required to be watertight.
   1. The Air entraining admixture shall conform to the "Standard Specifications for Air-Entraining
   2. Admixture for Concrete" (ASTM C-260), Euclid Chemical Airmix, or AEA 92 series; WR Grace Darex,
   3. Protex, Sika AEA, A-E Toxement ARA, Sealtite. Air content: Range of 4.5 to 7.5%

C. Water: Fresh, clean and drinkable (potable).

D. Aggregates: Concrete aggregates shall conform to the "Standard Specifications for Concrete Aggregates" (ASTM C-33) or ASTM 330 Standard Specification for Lightweight Aggregates for Structural Concrete, except that aggregate's that have been shown on test or actual service to produce concrete of require strength, durability, density, and wearing qualities may be used when authorized by Architect. Use of pit run or ban run grave is prohibited. Limitations for deleterious substances in coarse aggregate as shown in Table III of ASTM C-33 shall include iron oxide in maximum contents of 1%.

E. Combined aggregate gradation for slabs, and other designated concrete shall be 8% - 18% for large top size aggregates (1-½") or 8% - 22% for smaller tops size aggregates (1" or ¾") retained on each sieve below the top size and above the No. 100 sieve. In no case shall maximum size of coarse aggregate be larger than ¾ of minimum clear distance between reinforcing bars or no larger than 1/5 the narrowest dimension between forms of member for which concrete is to be used

F. Fine aggregates shall be well-graded, clean, sharp, washed free from deleterious amount of loam, clay or organic materials. Maximum shale content shall be .3%. Coarse aggregate shall be well-graded, crushed rock containing clean, hard, uncoated particles of sizes specified, free from soft, friable, thin laminated pieces. Not more than 10% shall pass a #4 sieve of aggregate with maximum size of ¾" and not more than 5% shall pass a #4 sieve of aggregate with a maximum size of 1-1/2". Allowable amount of shale in coarse aggregate may be a maximum of .3%.

G. Maximum Size of coarse aggregate shall be 1-½" for footings and a 1" for general use slabs (except where noted), ¾" for walls, and ½" for topping, stair tread fill, or masonry bond beam fill. In no case shall maximum size of coarse aggregate be larger than 1/3 the depth of slab, ¾ of minimum clear distance between reinforcing bars or no larger than 1/5 the narrowest dimension between forms of member for which concrete is to be used.

H. Chloride Ion Level: Chloride Ion content of aggregate shall be tested by the Laboratory making the trial mixes. The total chloride ion content of the mix, including all constituents shall not exceed limitations as set forth in Table 4.5.4 of ACI 318-05, for concrete subjected to deicers of to chloride in service (015 chloride ions by weight of cement.)

2.02 PROPORTIONING: Chapter 3

A. Mix concrete in accordance with ASTM C94.
   1. Compressive Strength: See Plans for design strengths required

B. Normal Weight Concrete: (Unless otherwise noted-On drawings):
   1. 28-Day Compressive Strength ASTM C39: Exterior Flatwork: 4,000 psi.
      Interior Flatwork: 4,000 psi.
      Footings,Foundations: 3,000 psi.
   2. Concrete Exposed to Weather: (exterior flatwork, foundations, footings) air-entraining admixture

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

D. Use accelerating admixtures cold weather only when approved by Architect/Engineer. Use of admixture will not relax cold weather placement requirements. (No products containing calcium chloride in the content of 0.05% chloride ions or thiocyanates will be permitted.)

E. SLUMP: Note: Maximum of 4" for all mixes except those containing super plasticizer. Slump shall be determined by "Test for Slump of hydraulic cement concrete" (ASTM C143). Where field conditions or workability considerations dictate higher slump, this increased slump shall be obtained only by use of super plasticizer. Concrete shall arrive on jobsite with a water slump of 2" to 3", (3 to 4" for concrete receiving a "Dry Shake Hardener") Super plasticizer then added to increase the slump to level indicated on approved mix design. Maximum slump of concrete containing high range water reducers (superplasticizer) shall be 8", and 6" for concrete containing a mid-range water reducing admixture, unless noted otherwise by Architect.

2.03 ADMIXTURES: ASTM C 494.

A. Do not use without Architect's written approval.
   1. Use water reducing and retarding mixtures when required by high temperatures, low humidity or other adverse placement conditions. Use water-reducing or high-range water reducing admixture in concrete, as required, for placement and workability.

B. Use high range water-reducing admixture in pumped concrete, concrete for heavy use industrial slabs, fiber reinforced concrete, parking structure slabs, watertight concrete, or concrete with a water-cement ratio below 0.50.

C. Use non-corrosive accelerator for all concrete, less than 8" thick, placed at air temperatures below 50 degrees.

D. Use high range water reducing mixture and viscosity modifying admix, where required, in Self-consolidating concrete, SCC.

E. Water Reducing Admixture: AASTM C494/C; 494M, Type A. Euclid's Eucon Series, BASF, Pozzilith Series, and WR Grace's WRDA hycol also approved.

G. Retarding Admixture: AASTM C494/C; 494M, Type B. Euclid's Eucon Series, BASF, Pozzilith Series, and WR Grace's WRDA hycol also approved.

H. Water Reducing and Retarding Admixture: AASTM C494/C; 494M, Type D. Euclid's Eucon Series, BASF, Pozzilith Series, and WR Grace's WRDA hycol also approved.

I. High Range Water Reducing Admixture: AASTM C494/C; 494M, Type F. Euclid's Eucon 537 or Plastol Series, BASF, Rheobild 1000 or Glenium Series, and WR Grace's Daracem or Adva series also approved.

J. Plasticizing and Retarding Mixture: ASTM C 1017/C or 1017/M Type II products. Euclids Eucon #537, BASF's Rheobuild series, or WR Graces Daracem series.

L. Water Cement Ratios:
   1. Maximum for concrete exposed to freezing and thawing = .45
   2. Maximum for all other conditions, table 5.2.4 (1) AC1 211.1-70, with maximum up to .55.

M. Paragraph 3.8.5, "Concrete for Floors", does not apply.

2.04 FLYASH:

A. General: Allow only in footings and foundations, and not to be used in any concrete after October 15th or prior to April 15th.
1. Fly Ash: ASTM C 618 Class C or F; maximum of 15% substitution of portland cement

B. Fly ash **shall not** be used in floor slab concrete. (especially at dry shake hardened or polished concrete slabs.)

2.05 FORMWORK: Chapter 4

A. Form materials: Contractor's choice of standard products with sufficient strength to withstand the hydrostatic head with distortion in excess of permitted tolerances. Form facing shall provide smooth stain free final appearance, except where textured form liners are required.

B. Form ties: Cone snap or type that will leave no metal within 1.5” of concrete surface.

C. Do not use earth cuts as forms for vertical surfaces without Architect's approval.

D. Shore combined concrete form and reinforcement in accordance with manufacturer's recommendations, and as indicated on the plans.

E. Keep shoring in place until concrete has reached 80% of design strength.

F. Keep non-load-carrying form facing material in place as follows:
1. Walls: 48 hours.

G. Reshoring is permitted.

2.06 VOID FORMS:

A. Void Forms such as Sure Void Products, Englewood Co. 800-458-5444, or Void Form International's Products may be used.

2.07 JOINTS AND EMBEDDED ITEMS: Chapter 6

A. See Structural Drawings for key and dowel requirements.

B. Bond required only as specified in paragraphs 8.5.2 and 8.5.3.

C. Expansion Joint Material: Thermosetting, closed cell plastic material; compatible to all joint sealing compounds. Equal to Sentinel Stuff-Itt, Ceramar by W.R. Meadows or Everlastic EJ200 by Williams products.

2.08 ANCHOR BOLTS:

A. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) diameter unless shown otherwise. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches), unless indicated otherwise. See Structural Dwgs.

B. Non-Headed coarse threaded anchor rods: ASTM F1554, Grade 36, 50, 105

PART 3 - EXECUTION:

3.01 PRODUCTION OF CONCRETE: Chapter 7

A. No site mixed concrete is permitted.

3.02 MIXING and TRANSPORTING:

A. Mix concrete shall be ready mix concrete in accordance with ASTM C94. No water shall be added to the concrete at the site. Delivery trucks shall deliver the concrete to the site with minimum drum revolutions. No concrete older than 90 minutes from time of introduction of cement and other materials in the truck shall be used for the project. In the event these standards are not followed, or that improper mix, slump, or air content is found; the truck number shall be recorded and shall not be permitted to unload concrete at this site for 2 hours. The concrete on the truck will have to be unloaded by the ready mix company at a location other than this jobsite.

3.03 PLACING: Chapter 8

A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

B. Notify Architect/Engineer minimum 24 hours prior to commencement of concerning operations.

C. Place concrete in accordance with ACI 301.1.
1. Hot Weather Placement: ACI 305.1.
2. Cold Weather Placement: ACI 306.1.

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

E. Maintain concrete cover around reinforcing as follows:

ITEMS	COVERAGE
Column Ties	1-1/2”
Walls (Expose to Weather or Backfill)	1-1/2”
Footings and Concrete	3” Formed against Earth
Slabs on Fill	1-1/2”

F. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.

G. Control Joints:
1. A Soff Cut saw shall be used to cut control joints to a depth of 1-¼” immediately after final finishing, when cutting action will not tear, ravel, abrade, or otherwise damage surface, and before concrete develops random contraction joints. Conventional saws may be used, but cutting to depth of ¼ the slab thickness or 1/3 slab thickness where structural synthetic macro fiber reinforcement is used.
2. Sawcut/control joint plan must be reviewed and approved by Engineer.

H. Separate exterior slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within ½ of finished slab surface.

3.04 REPAIR OF SURFACE DEFECTS: Chapter 9.

A. Repair surface defects, including tie holes immediately after removing formwork. Fill all voids, imperfections with grout or mortar specifically manufactured for concrete repair. Sika products repair mortars are approved.

3.06 FINISHING OF FORMED SURFACES: Chapter 10

A. Concrete Surfaces Not Exposed to View: SF-1 finish.

B. Concrete Surfaces Exposed to View: SF-2 finish as listed below

C. Produce as-cast formed finishes in accordance with A CI 301 and as follows:
   1. Surface Finish 1.0 (SF-1):
      a. Patch voids larger than 1-1/2 inch wide or 1/2 inch deep.
      b. Remove projections larger than 1 inch.
      c. Tie holes to remain unpatched.
      d. Provide surface tolerance Class D in accordance with ACI 117.
      e. Apply to concrete surfaces [not exposed to public view] <Insert locations>.
   2. Surface Finish 2.0 (SF-2):
      a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      b. Remove projections larger than 1/4 inch.
      c. Patch tie holes.
      d. Provide surface tolerance Class B in accordance with ACI 117.
      e. Apply to concrete surfaces exposed to public view.

3.07 SLABS: Chapter 11

A. Vapor Barrier: Meeting ASTM E 1745, Class “A” requirements, Raven Industries VB15 or StegoWrap 15 mil with the following characteristics:
   1. Tensile Strength, per ASTM E154, MD&TD; New material: 78 lbs/in
   2. Puncture Resistance: ASTM D 1709, Method B: > 3300 G.]
   3. Permanence, Per ASTM E154, Sect.7: 0.1 Perm Max

3.09 CONCRETE FLOOR FINISH:

A. All concrete floor slabs shall be full depth, screened, floated and troweled to a level, smooth, hard uniform surface, free from blemishes or other marks.

B. Contractor shall take every precaution to protect finished concrete floors from damage, and shall be responsible for any damage to such floors. Cure and harden same as previously specified.

C. Floor Finishing:
   1. The concrete shall be floated when the water sheen has disappeared and when the surface has stiffened enough to permit the operation. Then, consolidate concrete by power driven trowel. Perform a minimum of 3 separate passes and restraighten until surface is free of trowel marks. Slope surface to drains as shown on plans or details.

D. The interior finished surface shall have a flatness and levelness tolerance of F/f F/l = 45/28 as measured by ASTM E1155 methods for a flat floor. Local F/f,F/l shall not be less that 35/20 (67% of overall) locally on the floor.

E. Provide a "light broom" finish on exterior steps, landings and ramps. Flatness tolerances shall be F/f,F/ l=15/13.

F. Remedies for Out of Tolerance Work:

1. If required: The contactor shall remedy any floor section measuring below the minimum local Ff number or Fl number. Remedial measures (grinding, filling, etc.) shall be approved by the Engineer.

K. Equivalency of Ff numbers and Straight edge measurements:

Ff number:	Gap under 10'-0" straightedge
12	1/2"
20	5/16"
25	1/4"
32	3/16"
50	1/8"

3.10 SCREEDING:

A. The use of a laser screed is recommended on all Slab on grade floors. Laser screed systems such as CopperHead S-921- Laser Screed by Somero Enterprises may be used on this project. Screed stakes are not to be used on this project.

A. Bull Float at 90 degrees to the Screed pull direction, vibrate and consolidate, and level to a specified elevation.

B. When placing concrete mix at edges, use a 36" long metal or wood edged screed and run parallel with formwork, or edge after the initial screeding and before bull floating. Hand floating should be parallel to the edge and performed in 24" increments to avoid lifting or depressing the surface, Avoid pulling excessive amounts of concrete mix to the edges by either not using hand tools more than 24" from the edge or floating in a fan direction.

3.11 CURING AND PROTECTION: Chapter 12

A. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching ***0.2*** *lb/sq. ft. x h* before and during finishing operations. Apply according to manufacturer's written instructions *one or more times* after placing, screeding, and bull floating or darbying concrete, but before float finishing

1. Products:
   a. Euclid Chemical Company (The); Eucobar.
   b. BASF; Confilm.

B. CURING: Immediately after conclusion of concrete finishing operations, cure newly placed concrete slabs in accordance with ACI 308.1 utilizing one or a combination of the following methods.

1. Water Cure continuously for seven days utilizing sprinklers, soaker hoses, ponding, or fog spray. Take care to prevent erosion damage to the surface of the concrete.
2. Absorbent Cover: Water saturated and kept continuously wet. Cover concrete surfaces and edges with *12-inch* (300-mm) lap over adjacent absorptive covers when placing. Provide continuous supply of moisture such as sprinklers or soaker hoses when high temperature, low humidity, or windy conditions prevail. Do not allow Absorbent Cover materials to dry out during specified curing period.
3. Moisture Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover meeting ASTM C 171 as soon as possible after final finishing without marring the surface. Place in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. On flat surfaces such as pavements, the cover shall extend beyond the edges of the slab at least twice the thickness of the slab. The cover shall be placed flat on the concrete surface, avoiding wrinkles, to minimize mottling immediately after wetting the slab to rejection. It shall be placed and weighted so that it remains in contact with the concrete during the

specified duration of curing. Windrows of sand or earth, or pieces of lumber shall be placed along all edges and joints in the film to retain moisture and prevent wind from getting under the film and displacing it. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

4. Moisture Retaining Fabric shall be installed in accordance with manufacture's written recommendations, in largest practical widths. Wet the slab to rejection then thoroughly wet fabric side of cover and install with poly side up. Lap over adjacent covers a minimum 18". Weight all laps and outside edges to prevent displacement and to ensure intimate contact with concrete and adjacent covers. Rewet as necessary and protect covers from damage during curing process.
   a. Moisture Retaining Fabric: Conforming to ASTM C171: A naturally colored, non-woven polypropylene fabric with a 4-mil non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention.
      1) Products:
         a) PNA Construction Technologies, Inc.; Hydracure M15.
         b) Reef Industries Incorporated; Transguard 4000.

5. Dissipating Resin Curing Compound: Apply dissipating resin curing compound meeting ASTM C 309 according to manufacturer's instructions using spray equipment. Apply curing compound as soon as finishing operations are complete, and water on surface has disappeared and no water sheen can be seen. However, such curing compound must be completely removed prior to application of subsequent treatments. Contractor shall submit written plan detailing procedure for such removal to architect.
   1. Products:
      a. Euclid Chemical Company (The); Kurez DR VOX.
      b. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
      c. L&M Construction Chemicals, Inc.; L&M Cure R.

E. SEALING FINISH: Cure unformed concrete surfaces not scheduled to receive, interior concrete penetrating sealer/hardener, ceramic tile, or quarry tile or other subsequent flooring finishes or treatments with specified liquid curing compound meeting ASTM C 309. Product shall be applied in a uniform, continuous operation by power spray or roller according to manufacturer's written instructions.
   1. Products:
      a. Euclid Chemical Company (The); Kurez W VOX.
      b. L&M Construction Chemicals, Inc.; Dress & Seal WB.
      c. Meadows, W. R., Inc.; Vocomp-20**.**

3.12 GROUT FOR DOWELS:

A. Non- Shrink: DAREX IN-PAKT by W. R. Grace, N-S Grout by The Euclid Chemical Company, Set by Set Products, Sikagrout 328 by Sika Products, Duragrout by L&M Products.

B. Epoxy Grout: Hilti's HIT HY Series; Sikadur Grouts by Sika, or Set/XP or ET-HP equivalent by Simpson/Strong-tie

3.13 TEST REPORT:

A. Product aggregate and mix design testing is to be paid for by Contractor or material supplier.

B. Concrete Aggregate Test:
   1. By independent testing laboratory per ASTM C-33, made no sooner than 4 months prior to submittal. Mix no concrete until approval of report by Architect.

C. Concrete Mix Designs: By independent testing laboratory for each herein specified concrete strength. Mix no concrete until approval of report by Architect/Engineer.

E. The mix design shall include the following information:
1. Fine and coarse aggregate gradations per ASTM C33
2. Method of determination the mix design proportions.
3. Water/Cement Ratio
4. Air content of plastic and hardened concrete
5. Compressive strengths at 7 and 28 days per ASTM C39
6. Chloride ion content of the concrete per ASTM C 1218
7. The proportions and types of all materials.
8. The shale content of all aggregates used.

3.14 FIELD TESTING:

A. Concrete Cylinder Compression Tests:
1. Securing Cylinders: During process of concrete Work per ASTM C-31.

B. Quantity of Cylinders: No less than 4 cylinders per test. Additional may be required by Architect if there is possibility of surrounding air temperature falling below 40 degrees F. Because concrete must reach 80% of design strength before shoring can be removed. Contractor may choose to take additional job cured cylinders to ascertain when this strength has been reached.

C. Quantity of Tests: Take one test (4 cylinders) from each part of structure (including sitework) placed on any one day. If daily pour exceeds 50 cubic yards, take additional tests for each 50 cubic yards or fraction thereof.

D. Curing of Cylinders: ASTM C-31, average of one 7-day and two 28-day lab cured. Curing cylinders for determining form removal shall be stored as near as possible to portion of structure they represent and receive same protection.

E. Testing of Cylinders: ASTM C-39.
1. Average Strength of Laboratory Cured Cylinders: Section 504 of ACI-311.

3.15 BOND BREAKER:

A. 30# felt. Provide at all joints between floor slab and walls.

3.16 CONCRETE ANCHORS:

A. KWIK BOLT by McCullouh Industries or equal. Install in strict accordance with manufacturer's recommendations. This includes, but is not limited to, minimum embedment unless otherwise noted and applying the proper torque.

B. Miscellaneous Concrete Items: Concrete used to embed various items into the ground such as fence posts, flag poles, playground equipment, etc. Concrete for these items shall be a 4-1/2 sack mix and will not require mix design or cylinder tests.

3.17 EXPANSION, CONSTRUCTION, AND CONTRACTION JOINTS:

A. Horizontal and vertical construction joints in concrete shall be made only where approved by Architect. All construction joints shall be provided with suitable bonding grooves and keyways, and surfaces against which new concrete is to be laid shall be thoroughly cleaned with a stiff wire brush and water.

B. Expansion joints shall be filled with “Ceramar” and “Flexcell” and shall be located where shown on drawings.

C. Control joints shall be located as shown on drawings and per approved submitted CJ layout by the contractor.

3.18 SEALANT WORK: (foundation wall control Joint- details)

A. Back-up: (Backer Rod) Nonabsorbent closed cell nongassing polyolefin foam such as "Sof-Rod" by A.E.T. (Applied Extrusion Technology); polyurethane open cell foam such as Foam-Pak II by A.E.T. or Denver Foam. Backer rod shall be material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Open cell foams approved for vertical joints only. Provide 1 size larger than joint width or sized to provide 25% compression of installed rod.

B. Primer: Of same manufacturer as compound used.

C. Sealant: Polyurethane base, Single component, SikaFlex 1A, Masterseal/Sonneborne NP-1 or equal, chemical curing; Type 2 -nonsagging, conforming to FS TT-S-00227E; Class A; or nonstaining and nonbleeding.

3.19 STOOP FORM DECK:

A. Vulcraft is specified with Wheeling Corrugating Company or equal also approved.

B. “*Conform*”; Type "C", 20 (verify) gauge. Sheet steel for deck shall conform to ASTM A 653 structural quality, minimum yield strength of 33ksi. The unit design stress shall not exceed the yield strength multiplied by 0.60 with a maximum of 36ksi. Deck and accessories shall be galvanized coated conforming to ASTM A924-94, with a minimum coating class of G90 as defined in A653, unless indicated otherwise on structural drawings.

END OF SECTION

PART 1 - GENERAL:

1.01 SCOPE OF WORK:

A. This Section includes but not limited to the following:
1. Pipe Bollards.
2. Misc. Metals indicated or required..

1.02 RELATED WORK:

A Rough hardware for carpentry is by Section 06 1000.
B. Concrete, for concrete fill of Bollards: See Section 03 3000.

1.03 QUALITY ASSURANCE:

A. Misc. Metal Shop shall have been in business and produced specialty items, a minimum of 10 years.

B. Joints in Misc. metals shall be finished by Voluntary standards of National Ornamental & Misc. Metals (NOMMA)

C. Installer Qualifications: Minimum 5 years documented experience in Misc. Metals.

D. Perform Work in accordance with ASTM E985.

1.04 SAMPLES:

A. Submit in accordance with Section 01 3300.

B. Architect will review sample to determine acceptable standard of fabrication workmanship.

C. Do not proceed with fabrication prior to acceptance of sample.

1.05 SHOP DRAWINGS AND PRODUCT DATA:

A. Submit in accordance with Section 01 3300.
1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories.

B. Include erection Drawings, elevations and details where applicable.

C. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

1.06 QUALITY STANDARDS:

A. Joints in Misc. metals shall be finished by Voluntary standards of National Ornamental & Misc. Metals (NOMMA).

PART 2 - PRODUCTS:

2.01 STEEL SHAPES, BARS & PLATES:

A. Fy 36KSI, ASTM A36; ASTM A992.

2.02 BOLTS, NUTS AND WASHERS.

A. Recommended for structural steel joints; ASTM A325 or ASTM A307 and ANSI B27.2.

2.03 WELDING MATERIALS:

A. Applicable AWS D1.1, type required for materials being welded.

2.04 PIPE:

A. ASTM A53, Grade B, Schedule 40.

2.05 FABRICATION:

A. Verify dimensions on site prior to shop fabrication.

B. Fabricate items with joints neatly fitted and properly secured.

C. Fit and shop assemble in largest practical sections, for delivery to site.

D. Grind exposed welds smooth and flush with adjacent finished surfaces.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts unobtrusively located consistent with design of structure, except where specifically noted otherwise.

F. Make exposed joints flush butt type hair line joints where mechanically fastened.

2.06 FINISH:

A. Primer: Voc compliant, lead and chromate free, Universal modified–alkyd primer such as Tnemec 10-99R, Hentzen #4080, or Diamond Vogel's PN-5517, Rust-Oleum's 1573. Provide in dry mil thickness 2 mil minimum.

B. Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to prime painting.
1. Exterior Metals: SSPC SP6/NACE No. 3 - Commercial Blast Cleaning
2. Interior Metals: SSPC SP 3 - Power tool cleaning.

C. Unless otherwise noted, prime paint one coat all other steel surfaces. 2 coats primer (3.5 mil minimum) on exterior misc. metals.

D. Galvanize all steel items indicated Galvanize to a minimum of 1.25 oz. per s.f. per ASTM A386.

PART 3 - EXECUTION:

3.01 EXECUTION:

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: 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. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

F. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.02 ERECTION:

A. Obtain Architect's review prior to site cutting or making adjustments which are not part of scheduled Work.

B. Install items square and level, accurately fitted and free from distortion or defects.
1. Make provision for erection stresses by temporary bracing. Keep Work in alignment.
2. Replace items damaged in course of installation.

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

D. Supply, to appropriate Sections, items requiring to be cast into concrete, complete with necessary setting templates.

END OF SECTION

PART 1 - GENERAL:

1.01a SUMMARY

1. Telephone and electrical panel backboards.
2. Wood Studs wall framing and interior Framing.
3. Misc Wood Blocking. Example: Exterior openings, including OHD track and spring pad assemblies.

1.01 RELATED WORK:

A. Concrete formwork is by Section 03 3000.

B. Interior gypsum wallboard: Section 09 2900.

C. Gypsum Sheathing, misc. metal framing, building paper/air barrier at Fire rated Endwall at Metal Building, is by Section 13 3419, Metal Building System.

1.02 REFERENCES:

A. AFPA (American Forrest and Paper Assn.) Wood Frame Construction Manual

B. APA EWS and APA: APA - Engineered Wood Association

C. AWI: American Woodwork Institute

D. AWPA: American Wood Protection Association

E. PS 1 - Construction and Industrial Plywood

F. PS 20 - American Softwood Lumber Standard

G. PRP 108 - Performance Standards & Policies for Structural-Use Panels

H. WWPA: Western Wood Products Association

1.03 QUALITY ASSURANCE:

A. Lumber: Identify with grade stamp of an any grading Agency whose rules are approved by the Board of Review, American Lumber Standard Committee, and who provides grading service for the species specified. Provide lumber stamped with grade mark, unless indicated otherwise.

B. Wood Structural panels (plywood): Identify with grade stamp of APA.

C. Preservative Treatment: Identify with Quality Mark of AWPA.

PART 2 - PRODUCTS:

2.01 ROUGH CARPENTRY MATERIALS AND COMPONENTS:

A. Lumber: Grading PS 20, graded in accordance with WWPA Standard Rules for Western Lumber.

B. Lumber Dimensions:

1. Specified lumber dimensions are nominal. All lumber shall be surfaced unless noted otherwise.
2. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and the rules writing agencies.

C. Moisture Content: 19% maximum on lumber and MC-15, 15% maximum on plywood or OSB products.

D. Plywood **:** PS 1graded in accordance with Engineered Grades of Plywood by APA.

2.02 PRESERVATIVE TREATED WOOD/PLYWOOD:

A. Toxicity/IEQ: Products containing chromium will not be permitted. Products containing arsenic will not be permitted
1. ACQ (Alkaline Copper Quaternary), AC2 (non-arsenic preservative).
2. Pressure treat in accordance with AWPA Standard U1, T1.

B. Preservative Treatment:
1. Treat lumber in accordance with AWPA U1, UC3B category:
a. Above Ground Contact: .25 pcf treatment (ACQ) Contact/General Use.

C. Use at details where wood is on concrete (such as wall plates). At field-cut surfaces and bolt holes, brush apply preservative in accordance with AWPA Standard U1, T1.

2.03 WOOD PRODUCTS:

A. Studs: SPF, Stud grade, 10ft or less; No. 2 or better over 10 ft. height. (Hand Picked by Framing Crew)

B. Framing Lumber: No. 2 or better.

2.04 MISC. ACCESSORIES:

A. Sill Sealer: Continuous 1/4" uncompressed thickness, low density closed cell, polyethylene foam sill plate gasket.

2.05 CONNECTORS/FASTENERS used on treated wood blocking:

A. Hot dip galvanized coated fasteners conforming to ASTM A 153 and hot dip galvanized connectors should conform to ASTM Standard A653(Class G-185).

B. Anchor Bolts shall be provided in Hot Dip Galvanized finish.

2.06 FASTENERS:

A. Provide double dipped or Hot dip galvanized common or annular thread nails of sufficient length to penetrate 1-1/2" into bottom member. Use Maze finish or siding nails. Provide galvanized finish nails where nailing and blind nailing paneling and perimeter trim.

B. Interior Walls- Bottom Plate Fastening: RedHead’s LDT-3830 series large Diameter Tapcon, 3/8” x length required. Or anchor bolts listed above.

2.07 WALL BACKING/BLOCKING:

A. Wood blocking: Provide 2x6, and 2x8 blocking, unless noted otherwise.

2.08 COMMUNICATIONS & ELECTRICAL PANEL MOUNTING BOARDS:

A. FT Plywood: Use APA Rated 'Sheathing, Exp. 1, ¾" Thick, Fire Treated; Flame Spread index of 25 or less, smoke developed index of 450 or less, per ASTM E84.

PART 3 - EXECUTION:

3.01 CONDITION OF SURFACES:

A. Verify that surfaces to receive carpentry materials are prepared to exact grades and dimensions.

B. Do not proceed with Work until conditions are satisfactory.

3.02 INSTALLATION:

A. GENERAL:
1. Install items closely fitted, accurately set to required lines and levels, rigidly secured. Use longest pieces possible. Provide adequate fasteners to achieve substantial and positive anchorage.
2. All wood blocking is to be installed in straight lines and level planes and at proper elevation for installation of roof system.
3. Top surface of all horizontal blocking is to match the elevation of the surface of the new roof insulation.
4. Warped wood members are not to be used unless they can be fastened adequately to permanently hold them in their required alignment.

B. NAILING REQUIREMENTS: See Structural Drawings.

3.03 FRAMING:

A. Provide members in continuous lengths without splicing. Comply with member sizes, spacings and configurations indicated but not less that required per applicable codes and AFPA Wood Frame Construction Manual.

B. Headers: continuous, same width as studs, depths as detailed.

C. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal hangers unless noted otherwise.

D. Frame wall openings with minimum of 2 or more studs at each jamb, support headers on trimmer/jack studs. See structural for requirements.

E. Frame exterior corners so that insulation can be installed after exterior sheathing is installed. Frame exterior.

F. Provide bridging at joists in excess of 8 ft. span at mid-span, for spans of 8ft to 16 ft. for spans greater than 16 ft., provide bridging at third points of span. Fit solid blocking at ends of members to prevent rotation.

3.04 BLOCKING:

A. Wedge, align, and anchor blocking with countersunk bolts, washers, and nuts or nails.

B. Frame out for (and reinforce as necessary) passage of mechanical and electrical items.

C. Provide full bearing surfaces for framing; use square cuts.

D. Note: This Section 06 1000 shall provide blocking for Owner provided items such as toilet accessories, etc.

E. Provide at typical locations as required for the installation and hanging of surface applied items to walls or ceilings.

F. Provide blocking for installation of all case and millwork by Section 06 4000.

G. Provide blocking in walls behind all door stops (hardware is by Section 08 7100).

H. Where ceiling mounted is indicated, provide blocking and supplementary supports above ceiling,

3.06 FRAMING:

A. Walls:
   1. Openings: Double studs.
   2. Corners and Partition Intersections: Triple studs.
   3. Top Plates in Bearing Partitions: Double and lapped. Stagger joints at least 4 feet.
   4. Headers: See details.
   5. Ends of Stud Wall to Masonry/Concrete Foundation: Connect with 1/2 inch machine bolts maximum 48 inches on center and at least three in height of wall.
   6. Firestops: Spaces in wall over 10 feet high, at ceiling and floor levels, and stairs.
   7. Wood in Contact with Concrete or Masonry (Wood Plates/Sills):
      a. Use pressure treated wood as specified above.
   8. Bolt sill or wood plates to concrete and in masonry bond beams as follows unless otherwise noted on Drawings. Minimum embedment of 7 inches. Exterior walls and bearing walls - 5/8" x 8" bolt, 32 inches on center.

B. Nail as Follows:
   1. Stud to Plate: End wall, two 16d.
   2. Stud to Plate: Toe nail, three 16d or four 8d.
   3. Top Plates: Spiked together, 16d, 24 inches on center.
   4. Top Plates: Laps and intersections, two 16d.
   5. Continuous One Inch Brace to Stud: Two 8d.
   6. Two Inch Cut-In Bracing to Stud: Two 16d.
   7. Corner Studs and Angles: 16d, 30 inches on center.

A. Provide and maintain all items of protection, barricades, fences, signal lights, and other similar items as required by the building code, local ordinances, state laws and as may be required in the construction of the project.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Wall and Roof Insulation at Metal Building System is by Division 13 3419.

B. Concrete Foundations, Floors: Section 03 3000.

1.02 REFERENCE STANDARDS:

A. ASTM C578 – Rigid Cellular Polystyrene Insulation

1.04 PRODUCT DATA:

A. Submit in accordance with Section 01 3300.

B. Furnish manufacturer's descriptive literature of insulation to clearly indicate it meets specifications.

C. Furnish manufacturer's installation instructions for spray-on insulation.

1.08 PRODUCT STORAGE, DELIVERY & HANDLING:

A. Deliver materials to site in original, unopened containers and packaging, with labels clearly marked indicating manufacturer.

B. Store materials in dry area protected from moisture. Store materials susceptible to damage from freezing or overheating as recommended by the manufacturer.

C. Protect materials during the handling and installation to prevent damage and contamination.

PART 2 - PRODUCTS:

2.01 RIGID INSULATION:

A. Foundation Perimeter : Extruded cellular polystyrene, ASTM C 578, Type IV, Minimum R-value of 5.0 per inch of material at 40 degrees F. per ASTM C518; Certifoam SE by Diversifoam Products, Foamular 250 by Owens Corning Products, Styrofoam SM by Dow Chemical, or Kingspan’s GreenGuard..

2.02 ACCESSORIES

A. Adhesive:
1. Type recommended by insulation manufacturer.

B. Fasteners: Type best suited to application, hot-dip galvanized or fluoropolymer coated steel complete with nylon washers

PART 3 - EXECUTION:

3.01 INSPECTION:

A. Examine areas to receive rigid insulation to ensure Work of preceding trades is completed.

B. Check surfaces to receive rigid insulation to assure they are in uniform plane, and free of mortar chips, debris, grease, oil, or other items detrimental to installation.

C. Proceed with application of insulation only when conditions are satisfactory.

1. Tape all seams, edges etc. with 3M's Contractor's Sheathing tape, or equivalent type as manufactured by Ideal. Standard Duct tape is not allowed.

3.02 RIGID FOUNDATION INSULATION:

A. Adhere insulation with long edges horizontal, edges tightly butted and vertical joints staggered.

B. Secure insulation with adhesive applied to back of panels in accordance with recommendations by adhesive and insulation manufacturers.

END OF SECTION

SECTION 07 9000
SEALANTS AND CAULKING

PART 1 - GENERAL:

1.01 Work of this Section shall be provided by a Specialty Contractor who normally engages in sealant and caulking work only!

A. This Contractor shall provide all items, articles, materials, operations or methods listed, required, mentioned or scheduled on the Drawings and/or herein, including all labor materials, equipment and incidentals necessary and required for the completion of sealant and caulking work.

1.02 RELATED WORK:

A. Sealant at exterior paving and surfacing is by Division 32.

B. Sealants used in conjunction with installation of metal wall panels by: Division 13, Metal Bulidings' Section.

C. Caulking under thresholds is by Section 08 7000.

D. Caulking at perimeters of all door frames is by this Section.

1.03 REFERENCE STANDARDS:

A. ASTM C834 - Latex Sealants.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

C. ASTM C920 - Elastomeric Joint Sealants.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants.
ASTM C1330 - Backer Rod Standards.

E. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

F. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.04 SUBMITTALS:

A. Submit samples of colors in accordance with Section 01 3300.

B. Product Data: Furnish manufacturer's descriptive literature for each type of joint sealant provided, including installation instructions and color charts.

1.05 QUALITY ASSURANCE:

A. Use only qualified workmen thoroughly skilled and specifically trained in techniques of caulking, who can demonstrate to satisfaction of Architect their ability to fill joints solidly and

1.06 WARRANTY:

A. Provide a written Two year warranty on product and workmanship on all exterior sealants. Correct defective work within time frame listed above.

PART 2 - PRODUCTS:

2.01 BACK-UP: (Backer Rod)

A. ASTM C 1330 Type B (bicellular material with a surface skin), Nonabsorbent closed cell nongassing polyolefin foam such as "Sof-Rod" by Construction Foam Products, with Masterseal/Sonneborne's Sonolastic Soft Rod Backer, and Industrial Thermo Polymer's ITP Soft Type Backer Rod 104 also approved. Backer rod shall be material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Provide 1 size larger than joint width or sized to provide 25% compression of installed rod.
   1. NOTE: Type O (open-cell material - Denver Foam) only allowed at vertical interior control joints - where reviewed and approved at shop drawing stage.

B. Bond Break Tape: Provide polyurethane tape or plastic tape as recommended by sealant manufacturer. Provide self adhesive tape where applicable.

C. Joint Primer: Of same manufacturer as compound used. Prime all joints as required by the manufacturer.

2.02 SEALANTS/CAULKING:

A. Manufacturers: Masterseal (Sonneborn) Bostik, Dow Corning, Momentive Performance Sealants (formerly GE Silicones), Pecora Corporation, Sika Corporation, Tremco, and Vulkem are approved manufacturers.]

B. Sealant: Polyurethane base, multicomponent, chemical curing; ASTM C 920 compliance:
   1. Type and Grade: M (multi-component) and NS (nonsag).
   2. Equivalent to MasterSeal/Sonneborne's NP-2 and Tremco's Dymeric 240 series.

C. Horizontal Locations: Polyurethane base, self-leveling, multi-component, complying with ASTM C920, Type M, Grade P, Class 35. For use in horizontal joints in concrete paving, concrete floor joints; exterior or interior.

2.04 COLORS:

A. To match as close as possible adjacent material as approved by Architect.

PART 3 - EXECUTION:

3.01 INSPECTION:

A. Determine that installed Work of other Sections is satisfactory to receive joint sealers. Do not proceed with application until conditions are satisfactory.

3.02 PREPARATION:

A. Clean joints so they are free from moisture and foreign matter at time of installation. Prime according to manufacturer's instructions and ASTM C1193.

B. Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

3.03 PRIMING:

A. Where circumstances or substrates require primer, comply with the following requirements:

1. Apply primer full strength with brush or clean lint free cloth. Apply primer to a light uniform coating. Porous surfaces require more primer. Do not over apply, or allow primer onto face of substrate.
2. Allow primer to dry before applying joint sealants. Depending on temperature, and humidity, primer to be tack free, in 15 to 120 minutes.
3. Prime and seal on the same workday.

3.04 INSTALLATION:

A. Backup: Install backup to give compound depth and width recommended by manufacturers.

B. Vertical Joints: Install compound with tube gun with proper size nozzle for joint. Use sufficient pressure to properly fill the joints with sealant to the back-up material.

C. Horizontal Joints: Install compound with tube gun or special pouring equipment.

D. Surface Finish: Use beading tool to remove excess material, leaving clean smooth surface free from wrinkles, ragged edges, sags, air pockets, embedded impurities and other defects immediately clean adjacent materials which have been soiled; leave work in a neat, clean condition.

E. Mixing: Mix multicomponent, and tintable sealants completely, in length of time and equipment as recommended by the manufacturer.

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3.05 WORKMANSHIP:

A. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

B. Workmanship shall be of the highest quality in accordance with the best practice and in strict compliance with the recommendations of the manufacturer of the materials being used.

C. Remove and replace defective sealants.

D. Defective Work Includes: Leakage, hardening, cracking, crumbing, running, staining of adjacent Work by joint sealing.

3.06 SCHEDULE:

A. Includes but not limited.
1. Furnishing and Installing at Exterior of Building (sealants only):
a. Joints and cracks around louvers, door frames, wall penetrations, connections and other joints necessary to seal off building from outside air and moisture.
c Joints between different materials where indicated or required.
d. Penetrations of exterior walls.
e. Exterior joints as indicated on Drawings.

B. Furnishing and Installing at Interior of Building (sealants or caulking):
1. Both sides of all interior hollow metal door frames.
2. Interior joints as indicated on Drawings.
3. All saw cut and formed control joints in exposed concrete floors.

END OF SECTION

PART 1 - GENERAL:

1.01 SECTION INCLUDES:

A. Steel door frames and Steel (HM) Doors.

1.02 RELATED SECTIONS:

A. Section 08 7100 - Door Hardware.

B. Section 09 9000 – Paints and Coatings.

C. Opening subframes, at exterior doors in Metal Building: See Division 13.

1.03 REFERENCES:

A. ASTM A 366/A 366M - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

B. ANSI A250.6 - Hardware on Standard Steel Doors (Reinforcement-Application).

C. ANSI A250.7 - Nomenclature for Standard Steel Doors and Steel Frames.

D. ANSI/ SDI A250.8 – (SDI-100) Recommended Specifications for Standard Steel Doors & Frames.

E. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

F. ANSI/DHI A115.IG - Installation Guide for Doors and Hardware.

G. SDI-105 - Recommended Erection Instructions for Steel Frames; Steel Door Institute.

H. SDI-117 - Manufacturing Tolerances for Standard Steel Doors and Frames; Steel Door Institute.

J. SDI-124 - Maintenance of Hollow Metal Doors and Frames; Steel Door Institute.

1.04 SUBMITTALS:

A. Submit under provisions of Section 01 3300.

B. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards.

C. Shop Drawings:
1. Show layout, profiles, product components, anchorages, accessories, and finish colors.
2. Indicate door type, frame, steel, core, material thickness, mortises, reinforcements, exposed fastener locations, openings (glazed, paneled, or louvered), and hardware arrangements.
3. Include schedule identifying each unit, with door marks or numbers referencing drawings.

D. Samples: Provide if product is prefinished) Selection and verification samples for finishes, colors, and textures.

E. Certificates: Product certificates signed by the manufacturer certifying material compliance with ANSI A250.8, specified performance characteristics and criteria, and physical requirements.

F. Installation Instructions: Manufacturer's printed installation instructions, if other than as specified in SDI-105.

G. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance, if other than as specified in SDI-124.

H. Warranty documents specified herein.

1.06 DELIVERY, STORAGE AND HANDLING:

A. General: Comply with ANSI A250.8.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery:
1. *Manufacturer's original, unopened, undamaged containers, identification labels intact.*
2. Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

D. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
2. Store doors protected at corners to prevent damage or marring of finish. Store doors in upright position under cover on building site on wood sills or on floors in a manner to prevent rust and damage.
3. Store frames in upright position under cover on building site on wood sills or on floors in a manner to prevent rust and damage.
4. Do not use non-vented plastic or canvas shelters.

PART 2 - PRODUCTS:

2.01 ACCEPTABLE MANUFACTURERS:

A. Hollow Metal shall be provided by “SDI Certified” manufacturers.

B. Ceco
Curries Mesker
Steelcraft

2.02 HOLLOW METAL FRAMES:

A. Materials and Fabrication: ANSI A250.8 except as amended in this Section.

B. Interior Type: Welded ; Level 3, Extra Heavy Duty Commercial, (0.053") 16 gauge with appropriate wall anchor and strap sill anchors**.**

B. Exterior Frames: Level 3, Extra Heavy Duty Commercial rated, 16 ga. galvanealed frames, welded with appropriate wall anchor and strap sill.
1. All Exterior Door frames, hardware reinforcement, and accessories shall be manufactured from zinc coated steel complying with ASTM A 525 and A 526, minimum A60 coating. After shop fabrication installation, touch up welds, cut edges, and scratched and damaged surfaces.

2.03 HOLLOW METAL DOORS:

A. Materials and Fabrication: ANSI A250.8 except as amended in this Section.

B. Interior Doors: Level 3, Model 2, Extra Heavy Duty commercial, 16 ga. face sheets, **,** 1-3/4 inch, seamless construction, continuously welded edge.
1. Examples of acceptable doors are Ceco's Medallion (wsem) Series and Currie's 747 T series, Steelcraft's "BW" series doors.
2. The top and bottom edges shall be closed with a continuous channel, 16 gage minimum, spot welded to both face sheets maximum 4" o.c. Top of exterior doors shall be fitted with an additional flush closing channel and sealed water-tight.

C. Exterior Doors:(foam insulated doors)
1. Type: Level 3, Model 2 extra heavy duty commercial 1-3/4 inch, seamless construction (continuous weld edge), 16 ga. face sheets. Doors shall be rated level 'A' per ANSI 151.1.
2. Examples of acceptable doors are Ceco's Imperial (wsem) Series, and Currie's 707 T series with Qmax core.

3. Inner Reinforcement at foamed doors: Face Sheets shall be stiffened with high density urethane (1.8 lbs per PCF minimum) insulation. Faces and Vertical edges are to be provided seamless, the full height of door.
   a. The top and bottom edges shall be reinforced with inverted channel, 16 gage minimum, spot welded to both face sheets maximum 4" o.c.
   b. Top of exterior doors shall be fitted with an additional flush closing channel and sealed water-tight.

4. Note: All Exterior Doors, hardware reinforcement and accessories shall be manufactured from zinc coated steel complying with minimum A60. After shop fabrication installation, touch up welds and scratched and damaged surfaces. At galvanized metal, touch-up with ZRC's *Galvalite*.

2.07 FABRICATION:

A. FRAMES: Manufacturer's standard fabrication for 1-3/4-inch doors.
1. Frames:
   a. Accurately form and cut mitered corners of welded frames. Continuous arc-weld on backside of joint including stops. Grind welded joints to smooth uniform finish.
   b. Reinforce and prepare frames to receive hardware by Section 08 7100.
   c Drill frames to receive silencers (3 per single door) by Section 08 7100.
   d. Fill surface depressions of frames with metallic paste filler and grind smooth.

e. Chemically treat surfaces and apply one coat of primer. Primer shall be fully cured prior to shipment. Gray primer to be provided.

2.21 FABRICATION - DOORS:

A. Mechanically interlock longitudinal seams of vertically stiffened doors. Leave seams invisible by continuous welding and grinding smooth. Spot welded with Bondo or puttied edges are not allowed! *Steelcraft shall provide their continuous interlocking seamed edges, with continuous welding which consists of 1" welds at 6" centers, with epoxy filler installed in the space between welds.*

B. Reinforce and prepare doors and panels to receive hardware. Refer to Section 08 7100 for hardware requirements.

C. Reinforce glazed openings with 18 ga. U-shaped closure channel welded to door skins and continuous forming the periphery of the glass opening.

D. Provide astragals for double doors,where removable center mullions are not provided. Provide in accordance with UL requirements and where appropriate NFPA 80 for labeled doors.

E. Components:
1. (Material minimums) Welded 16-ga. flush Top channel and inverted bottom door channel; closer reinforcement 12-ga. one-piece channel 14" long welded to both faces.
2. Hinge reinforcement at Standard Doors:
   a. 3/16" x 1-1/2" x 9" plate type hinge reinforcement or 14-ga. minimum continuous reinforcing channel with screw preps minimum 10-ga. equivalent;
3. Hinge Reinforcement at Doors exceeding 36" in width, all exterior doors, and doors at interior of vestibules (high frequency):
   a. 12 or 14 ga. continuous reinforcement channel with screw preps minimum 10 ga. equivalent; or if a plate type hinge reinforcement is used, an optional 1 1/4"x 3/16" plate welded to the hinge reinforcement installed full length of the door similar to Ceco's *optional hinge reinforcement* shall be provided.
4. Chemically treat surfaces and apply one coat of primer. Primer shall be fully cured prior to shipment. Gray primer to be provided.

PART 3 - EXECUTION:

3.01 INSTALLATION:

A. Frames:
1. Install door frames in accordance with SDI-100 and 105, except as amended in this Section, and reviewed Shop Drawings and Product Data.
2. Install hollow metal frames plumb and square, in correct locations indicated on Drawings and with a maximum diagonal distortion of 1/16 inch. Ensure frames are securely and rigidly anchored to adjacent construction. Where existing construction style anchors are employed, fill exposed head and all surface depressions of frames with metallic paste filler and grind smooth to match adjacent surfaces. Spot prime touched up and filled surfaces.
3. Provide 12 ga. angle clips at the bottom of frames, with punched holes for securing the frames to the floor construction. Frames shall be shipped with a 16 ga. spreader channels.

3.02 DOORS - INSTALLATION:

A. Install doors in accordance with SDI-105, except as amended in this Section, and reviewed Shop Drawings and Product Data.

B. Install hollow metal doors plumb and square, and with maximum diagonal distortion of 1/16 inch. Install hardware in accordance with requirements of Section 08 7100.

3.03 ADJUSTMENT AND CLEANING:

A. Remove dirt and excess sealants or glazing compound from exposed surfaces.

B. Touch up marred or abraded surfaces to match original finish.

C. After installation, touch up field welds and scratched and damaged prime-painted surfaces. Use a primer consistent with shop coat.

D. Adjust moving parts for smooth operations.

E. Remove debris from Project site.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Fabricated steel framing (for OHD opening) is by Pre-Engineered Metal Building, Section 13 3419.

B. Electrical service to junction box located on electric door operators is by Division 26.

C. Installation of Controller/J Box, Conduit, & pulling of conductors(high and low voltage) are by Division 26. Final low voltage connections from operator to control and safety systems are by Division 8 – installer, who also sets the safety equipment at proper heights.

1.02 REFERENCES:

A. American Architectural Manufacturers Association (AAMA) 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):
1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
2. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

D. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

1.03 SHOP DRAWINGS & PRODUCT DATA:

A. Submittals for Review:
1. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
2. Product Data: Provide information on component construction, anchorage method, and hardware.
3. Samples: 3 x 3 inch paint samples showing available colors & specified color.
4. Furnish manufacturer's descriptive literature and installation, operation and maintenance instructions.

B. Closeout Submittals:
1. Copies for inclusion in Operation and Maintenance Data - per Section 01 7823

1.04 WARRANTY:

A. Provide a written 1-year warranty covering labor and material on installation & overhead doors and accessories.

B. Provide also a delamination warranty stating that for a minimum of 5 years from date of substantial completion of the Project, panel skins and insulation shall not delaminate.

1.05 QUALITY ASSURANCE:

A. Doors shall be installed by an authorized distributor/dealer of the manufacturer with installation crew foreman having a minimum of 5 years experience in overhead door installation.

1.06 OPERATION AND MAINTENANCE DATA:

A. Furnish manufacturer's recommendations for operation and maintenance in accordance with Section 01 7823.

PART 2 - PRODUCTS:

2.01 TYPE:

A. Raynor's Thermaseal "TM" 220 series, **R = 18.3,** with Midland's 2" Thermoguard Door System with 17.5 min. R Value, and Overhead Door's 596 heavy duty Series insulated overhead door system also acceptable. Doors are electric operable but manually operable in case of power failure. Door panels to be manufactured with 27 ga. skins roll formed from commercial quality hot dipped galvanized steel per ASTM A-924 and A653, with interior and exterior embossed skins having a 2-coat baked on polyester enamel finish over epoxy primer.
1. Doors to withstand 20 lbs. per square foot wind load. Deflection of door in horizontal position to be maximum 1/120 of door width. Provide supporting calculations/certification that doors meet the wind loading specified.

B. End stiles on panels: Provide the 13 gauge option , galvanized steel.

C. Rigid Insulation shall be standard to that of the manufacturer for doors listed above.
1. IECC Performance on Doors: Tested U-Factor 0.19; Tested Air Infiltration at 25 mph 0.19 cfm/ft2

D. Color: Picked from manufacturer’s standard color selection (minimum 5 colors)
Baked enamel - “XXXXXX” exterior, with “white” interior.

2.02 DOOR COMPONENTS AND MATERIALS:

A. Track Clearance: Lift clearance-high lift/ angle mount (following the pitch of roof),

B. Springs: Standard thru shaft counter balance torsion spring. Long life 50,000 cycle torsion springs with galvanized aircraft cable, with 5 to 1 minimum safety factor.

C. Lite Inserts: Double glazing; manufacturer's standard size (24" x 12" approx.) using moldings consistent with door panel construction.

D. Tracks: Galvanized steel**; 3 inches** wide; continuous vertical mounted with galvanized reverse angle mounted steel angles (2-¼” x 4” minimum angle size), minimum 12 ga. at 3” track

E. Hinge and Roller Assemblies: Heavy-duty hinges and adjustable roller holders of galvanized steel; full floating hardened steel ball bearing rollers; rollers shall contain a minimum of 10 ball bearings; located at every sill and rail meeting point.

F. Lift Mechanism: Torsion spring on cross head shaft with braided steel lift cables.

G. Head and Jamb Weatherstripping: Polypropylene brush weatherstripping in 45 degree

angled aluminum retainer; Action Industries #A0082 retainer with 1-1/2" B0769 brush is specified with equivalent products by Reese Co., Pemko Inc., and Thermal Brush/Sealeze also approved. Provide aluminum retainer in mil finish. Drill, tap and screw to metal plate at jambs and head.

1. All Door Jambs: Provide 1" vinyl, in aluminum retainer (Equal to Zero's 96A. 1" Aluminum Mill Finish, 1" Grey Vinyl, as well as the reverse angle jamb seal weatherstripping.
   a. Also provide double top seal for door top section. (head closure-provided on door section and head).

J. Bottom Weatherstripping: Fitted at bottom of doors, full length; flexible roll neoprene type.

K. Section Joint Seal: Neoprene foam rubber seal is placed full width in the section joint.

2.03 OPERATORS & CONTROLS:

A. Electric Operators: U.L. listed and approved; UL325/2010 requirements for continuous monitoring safety devices.
Raynor's
1. Provide jackshaft mounted operator equal to Control Hoist "Standard series" (Jackshaft model) or LiftMaster's Model "J", 115 volt, single phase, 60 hertz supply to Minimum size of ½ HP electric motor – maximum duty rated at 25 openings per hour; door speed of approx. 12" per second, with adjustable friction clutch; full ball bearing power train, V-belt driven; fully enclosed positive chain driven limit switch; with the OPTIONAL solenoid actuated brake; emergency operated with disconnect. NEMA 1 enclosure with motor separate from reduction mechanism for ease of maintenance.

B. Local Controls: Each door to be provided with Three-button momentary contact for OPEN-CLOSE-STOP, surface mounted with stainless steel plate. 24 volts. Locate inside building_(Note: remote Location: Verify with Drawings) NEMA 1 controls on all Doors.

D. Remote Control(visor mount): All doors provided with 2 remote controls (per door), with markings indicating which door they operate. Coordinate Door #'s with Owner.

E. MyQ and HomeLink Compatible.

2.04 SAFETY EQUIPMENT:

A Safety Edge: (At bottom of door)Shall be pneumatic type with automatic take-up reel. At large doors, and coil cord at smaller doors: Meeting UL325/2010 requirements.

B. Photo Cells/Eyes: 2 sets per door, through beam type, 1 pair mounted at 6" AFF, and 1 pair, mounted with 1 side at 12" and 1 side at 36" (shooting a diagonal beam) height above floor.

PART 3 - EXECUTION:

3.01 INSTALLATION:

A. Install overhead section doors, complete with electric operators and controls, in accordance with manufacturer's recommendations. Coordinate installation with electrical service.

B. Fit, align and adjust complete door assembly level and plumb, and to provide smooth operation.
1. Securely brace overhead door tracks suspended from structure. Secure tracks to structural members only.

C. Section 08 3600 shall furnish and install miscellaneous spring pad mounting plates and hanging angle iron required installation of track, and closer where occurs, and as required for complete installation of door system. All metal shall be prime painted.

3.02 ADJUSTMENT:

A. Adjust for proper operation after installation. Make inspection of installation 6 months and 12 months after Substantial Completion Date for purpose of adjusting assembly and general tightening of bolts, set screws, etc.

END OF SECTION

PART 1 - GENERAL

1.1 CONDITIONS

A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.

B. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings, or specified herein.

C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.

D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1.2 WORK INCLUDED

A. This section includes the following:

1. Furnish door hardware (for hollow metal and wood doors) specified herein, listed in the hardware schedule, and/or required by the drawings.
2. Section 08 7100 will be responsible for jobsite verification of the existing wood / hollow metal doors and hollow metal frames for specified hardware for proper size and function.

B. Where items of hardware are not definitely or correctly specified and is required for the intended service, 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 and quantity established by this specification for the appropriate service intended.

1.3 RELATED WORK IN OTHER SECTIONS

A. This section includes coordination with related work in the following sections:

1. Division 8 Section "Hollow Metal Doors and Frames".
2. Division 28 Sections "Electrical".

1.4 REFERENCES

A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.

1. DHI - Recommended Locations for Builders' Hardware.
2. NFPA 80 - Standards for Fire Doors and Windows.
3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
4. UL - Building Material Directory.
5. DHI - Door and Hardware Institute
6. WHI - Warnock Hersey
7. BHMA - Builders Hardware Manufacturers Association
8. ANSI – American National Standards Institute
9. IBC 2012 - International Building Code 2012 Edition (as amended by local building code)

1.5 SUBMITTALS

A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 1 - General Conditions.

B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:

1. Door number, location, size, handing, and rating.
2. Door and frame material, handing.
3. Degree of swing.
4. Manufacturer
5. Product name and catalog number
6. Function, type and style
7. Size and finish of each item
8. Mounting heights
9. Explanation of abbreviations, symbols, etc.
10. Numerical door index, indicating the hardware set/ group number for each door.

C. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).

D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the architect.

E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.

F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or in compatible items, and proposed substitutions in the hardware schedule.

G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.

H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 1 - General Conditions.

I. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.

J. Furnish with first submittal, a list of required lead times for all hardware items.

K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 1 - General Conditions.

L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.

M. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner’s representative to determine keying requirements. Upon completion of initial key

meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 1 – General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

1.6 QUALITY ASSURANCE

A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division One General Requirements.

B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.

C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review, and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to insure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.

E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.

F. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.

G. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.

H. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.

I. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.

J. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

1.7 DELIVERY, STORAGE AND HANDLING

A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.

B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.

C. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.

D. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.

E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives for above hardware items, and any other effected subcontractors or suppliers.

C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division One General Requirements.

B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

A. All exposed fasteners shall be Phillips head or as otherwise specified, and shall match the finish of the adjacent hardware. All fasteners ex-posed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.

B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Stanley	Hager	McKinney
1. Standard Weight, Plain Bearing	5PB1	F179	1279	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2016). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:

1. Standard Weight, Plain Bearing Hinges: Grade 3
2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1

C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.

1. 4 hinges for doors up to 90 inches and where listed in the Hardware Sets.
2. 1 additional hinge for every 30 inch on doors over 90 inches.

D. Unless otherwise specified, top and bottom hinges shall be located as specified in division 8 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.

E. Unless otherwise specified, furnish hinge weight and type as follows:

1. Standard weight: plain bearing hinge 5PB1 for interior openings through 36 inches wide without a door closer.
2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.

F. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.

G. Unless otherwise specified, furnish hinges in the following sizes:
   1. 4-1/2" x 4-1/2" 1-3/4" thick doors

H. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.

I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior, and out-swinging lockable interior doors.

J. Unless otherwise specified, furnish all hinges to template standards.

2.3 PIVOTS

A. Acceptable manufacturers and respective catalog numbers:

	Hager	Markar
1. Surface Reinforcing Pivot	253-254	B1923

B. Obtain pivots from a single manufacturer, although several may be indicated as offering products complying with requirements.

2.4 INTERIOR LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

	Schlage
1. Grade 1 Cylindrical	ND Series RHO lever
2. Equal by	Corbin/Russwin
3. Equal by	Sargents 10 line

A. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2017).

B. Unless otherwise specified, all locks and latches to have:
   1. 2-3/4" Backset
   2. 1/2" minimum throw latchbolt
   3. 1" throw deadbolt
   4. 6 pin cylinders
   5. ANSI A115.2 strikes

C. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.

D. Length of strike lip shall be sufficient to clear surrounding trim.

E. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.5 EXTERIOR LOCKS AND LATCHES

A. Acceptable manufacturers and respective catalog numbers:

	Manufacturer	Kaba Access	Equivalent
1.	Series:	8100 Series w/ Deadbolt	NONE

A. Mechanical Pushbutton Lock, Factory handed, Push button Access, Deadbolt model, with 1" deadbolt. Access permitted by pushbuttom combination or Key override. Vandal Resistant.

B. Unless otherwise specified, all locks and latches to have:
   1. 2-3/4" Backset
   2. ¾ minimum throw latchbolt and 1" deadbolt
   3. Key override: Provide Removable Schlage Cores LFIC
   4. ANSI appropriate strikes.

C. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.

D. Length of strike lip shall be sufficient to clear surrounding trim.

2.6 CLOSERS

A. Acceptable manufacturers and respective catalog numbers:

	LCN
1.	4040XP / 4040XP EDA
2.	Sargent's 281(351), Norton's 7500 Series

B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2019).

C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

D. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.

E. Hardware supplier shall coordinate with related trades to insure aluminum frame profiles will accommodate specified door closers.

F. Closers shall use high strength cast iron cylinders, forged main arms, and 1 piece forged steel pistons.

G. Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.

I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.

J. Provide closers with adjustable spring power. Size closers to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.

K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.

L. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.

M. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100 hour salt spray test.

N. Pressure Relief Valve, PRV, shall not be acceptable.

2.7 KICK PLATES AND MOP PLATES

A. Furnish protective plates as specified in hardware groups.

B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.

C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk.

D. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing. When protection plates over 16” are provided for labeled doors, the plate shall be labeled.

E. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.

F. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.8 OVERHEAD STOPS

A. Acceptable manufacturers and respective catalog numbers:

	Glynn-Johnson	Rixson	Sargent
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590

B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4” solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4” solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.

D. Provide special stop only (“SE” suffix) overhead stops when used in conjunction with electronic hold open closers.

E. Do not provide holder function for labeled doors.

2.9 WALL STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:

	Ives	Hager	Burns
1. Wrought Convex Wall Stop	WS406CVX	232W	570
2. Wrought Concave Wall Stop	WS406CCV	236W	575

B. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.

C. Provide Concave Wall Stop at locksets with push button options only.

D. Where wall stops are not applicable, furnish overhead stops.

2.10 WEATHERSTRIP, GASKETING

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Adhesive Edge Seal	188S	S771	5060	****
4. Sweeps	8192	18061_NB	B606	964
5. Sweep w/ drip	8198	345_N	C627	354
6. Drip Cap	142	346	16	R201

B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2017).

C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.

D. Provide weatherstripping all exterior doors and where specified.

E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.

F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.

G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.11 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:

	Zero	Pemko	NGP	Reese
1. Saddle Thresholds	8655	171	425	S205

B. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2014).

C. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.

D. Threshold Types:

1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

2.12 FINISHES AND BASE MATERIALS

A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

HARDWARE ITEM	BHMA FINISH AND BASE MATERIAL
1. Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2. Butt Hinges: Interior	652 (US26D - Satin Chromium)
3. Locks and Latches	630 (US32D - Satin Stainless
4. Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
5. Closers	689 (Powder Coat Aluminum)
6. Protective Plates	630 (US32D - Satin Stainless Steel)
7. Overhead Stops	630 (US32D - Satin Stainless Steel)
8. Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
9. Thresholds	628 (Mill Aluminum)
10. Weather-strip, Sweeps Drip	Aluminum Anodized
11. Miscellaneous	626 (US26D - Satin Chromium)

2.13 KEYING

A. Provide all cylinders in keyways as required to accommodate owners Schlage Master key system.

B. All locks under this section shall be keyed as directed by the owner to an new Master Key System.

C. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.

D. Master keys, control keys, and change keys shall be delivered by registered mail to the owner. Construction keys shall be delivered to the contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of hardware, installer shall examine door frame installation to insure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.2 INSTALLATION

A. Before hardware installation, General contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.

B. Install all hardware in accordance with the approved hardware schedule and manufacturers instructions for installation and adjustment.

C. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.

E. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.

F. Shim doors as required to maintain proper operating clearance between door and frame.

G. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.

H. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.

I. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.

K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.

L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.

M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.

N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.

O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.

P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.

Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.

R. Adjust spring power of door closers to the minimum force required to insure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to insure opening force does not to exceed 5 lbs.

S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.

T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.

U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.

V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water-resistant seal.

W. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 FIELD QUALITY CONTROL

A. After installation has been completed, the hardware supplier and manufacturers' representative for locksets, door closers, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.

B. After installation has been completed, the hardware supplier and manufacturers' representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.4 ADJUSTMENT AND CLEANING

A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.

B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

HWSET #: "A" (DRS. 101 - 3 DOORS) & DOOR 102)

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGES	AS REQUIRED	IVE
1	EA	PIVOT	253-254 series	HAG
1	EA	ENTRY LOCKSET - MORTISE- Pushbutton	KABA Model 8148 series with Key Overide, Schlage LFIC core, and Integral 1" deadbolt to the lockset.	KAB
	EA	LFIC CYLINDERS	AS REQUIRED	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH or HCUSH(verify)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIP	429	ZER
1	EA	DOOR SWEEP (BRUSH)	8192	ZER
1	EA	THRESHOLD	8655	ZER

HWSET#: "B" (DOORS 103 -5 OHDs & DOORS 104 – 4 OHDs)

QTY	DESCRIPTION	CATALOG NUMBER	MFR
	All Hardware by Section 08 3600-Overhead Doors.		

HWSET#: "C" (DOOR 105)

QTY		DESCRIPTION	CATALOG NUMBER	MFR
3	EA	HINGES	AS REQUIRED	IVE
1	EA	STORAGE RM. LOCKSET	ND80PD	SCH
1	EA	OHD STOP	900 series	GJ

FUNCTION: ND50PD (ANSI F86) STOREROOM LOCK
OUTSIDE LEVER FIXED; ENTRANCE BY KEY ONLY; INSIDE LEVER ALWAYS FREE FOR EGRESS;

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Wood Studs, and Wall Backing at Interior stud framing: See Section 06 1000.

B. Heavy gauge framing/Furring, gypsum sheathing, and Type 'X' Drywall in Exterior Fire Rated Metal Building North Endwall: See Section 13 1349, Metal Buildings

C. Section 09 9000 - Painting and Coating.

D. Doors and Frames: Section 08 1100 Hollow Metal

1.02 SECTION INCLUDES:

A. Gypsum board and wall panel products fastened to wood framing.

B. All other miscellaneous accessories and products specified herein.

1.03 SUBMITTALS /SAMPLES:

A. Submit recommended specifications and requirements of gypsum board manufacturer including control joint placement locations at walls and ceilings.

B. Submit samples of termination trim, moldings, proposed to be used on this project. Trim shall be provided in 12" lengths, indicating finish specified.
   1. Verify with Architect the quantity of samples of each item.

1.04 REFERENCE STANDARDS:

A. *Drywall Construction Handbook* by United States Gypsum Co.

B. Applicable ASTM standards referenced in the specification.

C. Gypsum Association's *Fire Design Manual and Recommended Specifications for Application and*
   1. *Finishing of Gypsum Board* (GA-216);
   2. GA-214, Recommended Specifications: Levels of Gypsum Board Finish.
   3. GA 223 - Gypsum Panel Product Types, Uses, Sizes and Standards

D. ASTM Standards: (Latest Editions)
   1. C645 - Non-Structural Steel Framing Members
   2. C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
   3. C 840, Specification for Application and Finishing of Gypsum Board.
   5. C 1280, Specification for Application of Gypsum Sheathing Board.
   6. C 1396, Specification for Gypsum Board.
   7. D 5420, Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
   8. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
   15. ASTM C840 Application and Finishing of Gypsum Board
   17. ASTM C1396 - Standard Specification for Gypsum Board.
   18. ASTM C1629 - Standard Classification for Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
   19. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

E. UL - Underwriters Laboratories Inc.

1.05 DESIGN PERFORMANCE REQUIREMENTS:

A. Select steel studs in accordance with the manufacturer's standard load tables and following design pressures and deflections:
1. At all interior partitions: L/240 at 5 psf.

PART 2 - PRODUCTS:

2.01 MANUFACTURERS:

A. Gypsum Board and related Products: Unless otherwise indicated, standard items by U.S. Gypsum are specified, with equivalent products by National Gypsum/Gold Bond, G-P Gypsum, Certainteed, Temple-Inland, Continental/LaFarge gypsum products also approved.

2.02 GYPSUM BOARD:

A. General: In lengths as long as practical to minimize number of joints.

2.03 GYPSUM BOARD –TYPES:

A. The following gypsum board to be used in specific locations:
1. Mold Resistant Drywall: Meeting ASTM C1177. Board consists of fiberglass mold resistant back facer, reduced organics in core, and heavy duty paper face. Tape with fiberglass mesh tape only. The following are acceptable:
a. M2Tech, Type X by Certainteed.
b. USG's Mold Tough, Type X.
c. National Gypsum's XP Fireshield.
d. ***All drywall*** on this project shall be mold/water resistant drywall.

2.04 FRAMING(wood): See Division 06 1000.

2.05 METAL TRIM & ACCESSORIES: ASTM C1047

A. Corner Beads: Expanded mesh flange, No. 800 mini-bead corner by USG or approved equal. Provide in zinc construction at "wet" areas.

1. Clark Dietrich's Paper Faced metal bead and trim, set in All Purpose, or Setting type Joint Compound.
2. Clark Dietrich' StraitFlex Gold (2.5") Mud on paper faced composite corner bead, set in All Purpose, or Setting type Joint Compound. Provide size based on conditions of the gyp. Bd. application.

B. Termination Trim: Expanded mesh flange, 701/801 Series by USG, Clark/Dietrich. Provide L or J termination as indicated or required. Provide in zinc construction at "WET" areas.
1. USG's Paper Faced metal Term Trim, set in All Purpose or Setting type Joint Compound.
2. Straight Flex products for L or J trim installed per Clark Dietrich's recommendations.

C. Control Joint: No. 093 by USG or Clark/Dietrich.

D. Screws: Equivalent to *Grabbe*r Type "W" .

2.06 FASTENERS FOR FRAMING:

A. Provide fasteners of type, material, size, corrosion resistance, holding power and other properties to fasten framing members securely to substrates involved; Comply with recommendations of gypsum board manufacturers for applications indicated.

2.07 SAFING INSULATION:

A. Thermafiber, FBX safing or equal.

2.08 ACOUSTIC/SOUND INSULATION:

A. ASTM C655, type 1, Sound control batt insulation. The following are approved: 'Eco Batt glass wool by Knauf, Owens Corning's EcoTouch Pink Fiberglas with PureFiber technology or Johns-Manville formaldehyde free, Certa-Pro Sustainable Insulation by Certainteed, Sound Control batts; .75 lb. density fiberglass friction fit or Kraft faced, full depth of wall cavity. Provide full width of stud spacing.

2.09 JOINT TREATMENT MATERIALS:

A. General: ASTM C 475; type recommended by manufacturer of sheet products and joint treatment materials for application indicated, unless indicated otherwise.

B. Joint Tape: Paper reinforcing tape.
   1. Interior Gypsum Board: Paper reinforcing tape.

C. Drying-Type Joint Compounds: Factory prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mix Formulation: Factory-mixed product.
   2. All-purpose compound formulated for use as both taping and topping compound
      a. "All Purpose" type shall be used for initial coats of taping, with Lightweights/Plus 3's acceptable for topping coats, unless setting type compounds are used for initial and final taping coats.

D. Use Setting type joint compounds such a Dura Bond Series (20, 45 or 90) or Quick Set Lite series by National Gypsum, where recommended, high fill areas; or where using Mold Resistant Drywall.

PART 3 - EXECUTION:

3.01 GYPSUM BOARD INSTALLATION:

A. General:
   1. Installation shall conform to GA-216, latest edition, recommended specifications as per Gypsum Association with the following exception:
   2. Use Type X(mold resistant) board except where otherwise required. Use screw attachment method. Provide control joints so no wall or ceiling length is continuous more than 30 feet. in either direction. Provide vertical control joints in walls above each door jamb extending vertical to above finished ceiling.

   3. Note: Architect and Contractor shall review *control joint* and expansion joint locations prior to framing work commencing.

4. Fasten gypsum board to studs, with recommended fasteners and fastener spacings a maximum of 12” centers (not 16”) in the field of the drywall, with edge fastening at 8” centers maximum, unless closer spacings are required per manufacturer’s recommendations.

B. On partitions/walls, apply gypsum panels horizontally, as recommended by manufacturer, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints. If applied horizontally, stagger end joints in alternate courses a minimum of 1 stud spacing.

1. Allow to dry and lightly sand between each coat and after final coat is applied to remove imperfections from wall surfaces. Leave surfaces clean and smooth ready for priming and painted finish.

3.02 TRIM:

A. For trim with flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer’s written instructions.

B. Provide rated gypsum backing of all control or expansion joints in fire rated walls per recommendations of the manufacturer and Gypsum Association.

C. Install corner bead at all outside corners. Provide termination trim wherever edge of gypsum would be exposed or semi-exposed. See also drawings for locations.

D. Install Control and expansion joints per specification or at least per ASTM C 840, and manufacturer’s recommendations, and where indicated by drawings and specifications.

3.03 FINISHING:

A. The level of finishing below relates to the *Levels of Gypsum Board Finishing* as recommended and issued by the Gypsum Association and PDCA.

B. Finish joints, edges and attachment areas at exposed surfaces, to Level 4 *plus*+ finish, This is a special finish that is greater than level 4, but is not fully skim coated like level 5. Level 4 *plus*+ is defined as joint taping of 3 coats minimum applied with tools of sufficient width to extend the taped joint a minimum of 9” beyond both sides of center of joint (std. is 6”).

.

C Where fire rated construction is specified, provide details of construction and finishing as required to meet fire rated assembly requirements, meeting GA 600 and UL requirements.

D. Apply taping compound or embedding compound in a continuous thin uniform layer to all joints and angles to be reinforced. Immediately apply reinforcing tape centered over joint and seated into compound. Compound shall be applied sufficiently to approximately 1/32 inch thick and must remain under entire surface of tape to provide proper bond. Follow immediately with a thin skim coat embedding all tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. The tape or embedding coat must be thoroughly dry prior to application of second coat. Apply second coat of joint compound over embedding coat, filling panel taper flush with surface; cover tape and feather out at least 4 inches on either side of tape. Allow second coat to dry thoroughly prior to application of finish coat.

E. Spread finish coat evenly over and extend slightly beyond second coat on all joints and feather to a smooth uniform even finish. Over tapered edges, do not allow finish joint to protrude beyond plane of the surface. Apply finish coat to cover tape and taping compound at all taped angles and to provide a true angle. Sand between all coats and following the final application of compound to provide a smooth, even surface, degree of holes, depressions, sanding marks and other imperfections, ready for decoration.

F. All screw heads, dimples and depressions shall receive minimum 3 coats of joint compound with last coat to be of finishing compound, allowing each coat to thoroughly dry before application of next coat. Each coat shall be feathered beyond previous coat to give wall a smooth and even finish.

G. Corner beads, termination trim: Staple the mesh winged portions to the wall board per manufacturer's recommendations, using galvanized staples and spaced at 9" centers. Install 1 coat compound on the he beads or termination trim. Install tape (centered on the edges of trim) as a secondary protection and finish with 3 coats of compound.

H The final coat and subsequent sanding shall leave the gypsum wallboard and treated areas uniformly smooth, level with the plane of the surface.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Temporary facilities are by Section 01 5000.

B. Misc. Metals are by Section 05 5000.

C. Hollow metal doors and Framing: See Division 8.

1.02 REFERENCE STANDARDS:

A. Architectural Painting Specification Manual and the latest edition of the Approved Product List published by the Master Painters Institute and the Painting and Decorating Contractors of America.

B. EPA AIM Rule: National VOC Emission Standards for Architectural Coatings. 1.1.
1. Greenguard Environmental institute - Indoor Air Quality emission criteria.
2. Green Seal GS-11 Environmental Standard for Paints and Coatings.
3. Green Seal GC-3 Environmental Criteria for Anti-Corrosive Paints.
4. South Coast Air Quality Management District (SCAQMD) Rule 1713, Architectural Coatings.

C. Steel Structures Painting Council (SSPC): Metal surfaces shall be thoroughly cleaned of rust, corrosion, oil, foreign materials, blisters, and loose paint per SSPC recommendations and reference standard.

1.03 QUALITY ASSURANCE:

A. Samples:
1. Submit in accordance with Section 01 3300.
2. If paint or stain manufacturer to be used is different from that specified in Section 01 1130 (Color Schedule), submit two properly labeled samples of each required finish, color and sheen.
3. Provide 3 draw downs of each product and color combination. Draw downs shall be applied using a 4 mil WFT drawdown bar on Leneta form WD plain white coated cards size: 4x6 minimum. Label each card with job name, date, product name/ number, color number/name, and name, address and phone number of supplier.
4. Provide stained wood samples on type and quality of wood specified for use on project, minimum of 24” of each type of trim and 24” square of paneling/plywood.

B. Product List: Provide 4 copies (verify) of a schedule detailing each substrate in the same order as the schedules used in Part 3 of this specification, including the following:
1. Specific products to be used for each coat.
Volume solids, Units of sheen, other performance or descriptive date as required by this specification.

C. Product Labels: Label product containers with manufacturer's markings showing: Manufacturer's name.
1. Type of material.
2. Manufacturer's product number.
3. Manufacturer's batch number.
4. Federal Specification Number.
5. Color.
6. Instructions for reducing, where applicable.
7. Documentation from the manufacturer, approving each painting system.

8. Data pages for all products listed. Data pages shall include type of resin, DFT,

D. Mock-up:
1. Before proceeding with paint application, finish one complete surface of each color scheme required, clearly indicating selected colors, finish texture, materials and workmanship.
a. Use first acceptable surface as project standard for each color scheme.
2. For spray application, paint surface not smaller than 100 square feet.

E. Reference Standard:
1. Painting Specification Manual, Painting and Decorating Contractors of America (PDCA), "New Work Surface Preparation - Part 3."
2. Master Painter's Institute, MPI gloss and Sheen Standards, Latest Edition.

1.04 QUALITY ASSURANCE:

A. All coatings provided under this Section shall comply with the following:
1. Architectural paints, coatings and primers applied to walls and ceilings: Green Seal Standard GS11, Paints, First Edition, May 20, 1993.
2. Flats: 50g/L
3. Non-Flats: 150 g/L

B. Anti-corrosive and anti-rust paints applied to interior ferrous metal surfaces: Green Seal Standard GC-03, Anti-Corrosive Paints, Second Edition, January 7, 1997.

C. Contractor performing Work under this Section shall have at least five (5) years proven satisfactory experience on projects of similar scope.

D. Conform to the standards contained in the Master Painters Institute Architectural Painting Specification Manual, latest edition, for all Work under this Section.

1.05 MAINTENANCE MATERIALS:

A. Leave in building, where directed by Architect, one gallon of each paint type and color. Label each can for positive identification.

B. Furnish description of types, colors and quantities furnished for inclusion in maintenance manual in accordance with Section 01 7839.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site in original undamaged containers with seals unbroken and containing manufacturer's original labels.

B. Storage of Materials:
1. Store only acceptable project materials on Project site.
2. Store and mix materials in suitable location within building on galvanized pans, waterproof paper or tarpaulins. Do not allow materials to freeze.
3. Comply with health and fire regulations.

C. Conform to all State and local regulations regarding disposal of products and accessory materials.

D. Furnish Material Safety Data Sheets for each paint and coating product.

1.07 ENVIRONMENTAL CONDITIONS:

A. Follow manufacturer's printed directions as to environmental conditions under which coatings and coating systems can be applied.

B. Apply products in dust-free areas.

C. Ensure minimum ambient air and surface temperature, unless otherwise approved by manufacturer, is 40 degrees F. for 24 hours before, during and 24 hours after application.

D. Do not work where inclement weather may damage surface.

E. Perform no Work under less than 15 footcandles of lighting on surfaces to be finished.

1.08 PROTECTION:

A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.

B. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and, in particular, surfaces within storage and preparation area.

C. Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting or finishing operations. Carefully store, clean and replace these items upon completion of Work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

PART 2 - PRODUCTS:

2.01 GENERAL:

A. Products for each general purpose must be of same manufacturer. Do not use products of different manufacturers over one another, except for shop prime coats specified in other Sections.

2.02 PAINT, STAIN, OILS AND VARNISHES:

A. Select from the Table of Products attached at end of this Section. All listed products will not necessarily be employed on this Project. Consult Painting Schedule for required materials.

B. Product numbers are given to establish desired quality, and are not intended to indicate color. See Section 01 1130 for required colors.

C. Provide ready-mixed products except as otherwise specified. Re-mix prior to application to ensure color and gloss uniformity.

D. Provide manufacturer's low-odor, VOC compliant products for all scheduled Work.

2.04 PAINT ACCESSORY MATERIALS:

A. Secondary products not specified by name and required to achieve specified finishes such as oils, thinners, patching compounds, and putty shall be top painter craft products of a reputable manufacturer.

PART 3 - EXECUTION:

3.01 INSPECTION:

A. Examine surfaces to receive coatings to assure that they are dry, clean, of uniform texture, free of bond inhibiting foreign substances, or other conditions that would adversely affect adhesion, protective properties, or coating appearance. Give particular attention to prime coatings provided by other contractors.
   1. Do not proceed with surface preparation or coating application until conditions are suitable.

B. Verify proper lighting, temporary heat and ventilation is provided as specified in Section 01 5000.

C. Conduct substrate-moisture tests using approved electronic moisture meter in accordance with Surface.

D. Preparation requirements of Reference Standard. Ensure substrate moisture does not exceed that specified in this Section.

E. Test cementitious surfaces for laitance/alkali in conformance with Surface Preparation requirements of Reference Standard.

F. Do not proceed with surface preparation or coating application until conditions are suitable.

3.02 PREPARATION OF NEW SURFACES:

A. General:
   1. Thoroughly clean surfaces free of loose, rough and foreign substances which will affect adhesion or appearance of applied coats.
   2. Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.

B. General:
   1. Thoroughly clean surfaces free of loose, rough and foreign substances that affect adhesion or appearance of applied coats.

D. Ferrous Metal, Primed:
   1. Remove oil, grease, rust, scale, dirt and dust. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Sand and scrape surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous.
   2. Repair damaged areas in accordance with Reference Standard.
   3. Ensure steel surfaces are satisfactory before paint finishing.
   4. Apply a treatment of phosphoric acid solution to weld areas.
   5. Clean with solvent in accordance with Reference Standard.
   6. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
   7. Clean surfaces with solvent.
   8. See Section 5.1 of SSPC Reference Standard for additional requirements.

E. Ferrous Metal, Unprimed:
1. Remove grease, rust, scale, dirt and dust. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method, ensure steel surfaces are satisfactory before paint finishing.
2. Treat weld areas with a phosphoric acid solution.
3. Clean by washing with solvent ensuring weld joints, bolts and nuts are similarly cleaned.
4. Treat surface with phosphoric acid solution in accordance with Reference Standard.
5. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
6. Prime bare steel surfaces as soon as possible after surfaces are prepared to prevent flash rusting.

F. Galvanized Metal:
1. Remove all surface contamination such as dirt, oil, grease, oxidation and other foreign matter. Wash with solvent in accordance with Reference Standard.
2. Test surface for hexavalent chromium in accordance with Reference Standard. If present, remove treatment by chemical or mechanical means. Contact galvanized metal supplier for information on pretreatment or temporary coatings applied.
3. Apply one coat of etching-type primer.
4. See Section 5.3 of Reference Standard for additional requirements.

G. Gypsum Board:
1. Remove sand, dust, dirt, oil, grease, wax, silicone, glue and all other foreign matter. Take care not to raise surface nap.
2. Conduct substrate moisture content test. Maximum moisture content 12 percent.
3. If surface defects appear before or after prime coating and/or first coat of paint, Section 09 2116 will make repairs. Re-prime repaired areas.
4. Commencement of painting indicates acceptance of substrate.
5. Notify Architect immediately If joint fillers used by Section 09 2900 will require special attention.

P. Ferrous Metal:
1. Remove grease, rust, scale, dirt and dust. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure steel surfaces are satisfactory before paint finishing.
2. Clean unprimed surfaces by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
3. Sand and scrape shop-primed surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.04 APPLICATIONS:

A. General:
1. Prime coats specified below may be omitted where factory-applied shop coats are specified in other Sections.

2 Number of coats specified below is minimum. Provide final coat that is solid and even in color and free from cloudy and mottled surfaces; free of runs, laps, sags, brush marks, air bubbles and excessive roller stipple and worked into crevices, joint and similar areas.
3. Film thickness specified below includes primer.
4. Apply each coat at proper consistency.

6. Primers shall be tinted slightly lighter that finish coats unless otherwise approved by Architect.
7. Do not apply initial coating until moisture content of surface to be finished is within limitations specified above. Test with Moisture Meter.
8. Apply coating with suitable brushes, rollers, or spraying equipment as recommended by coating manufacturer.
9. Do not exceed coating manufacturer's application rate.
   a. Comply with product manufacturer's recommended drying time between succeeding coats.
10. Apply finish coats smooth, free of brush marks, streaks, laps, pile up, and skipped or missed area.
    a. Sand and dust between each coat to remove defects visible from a distance of 5 ft.
11. Where paint abuts other materials or colors, cut paint edges clean and sharp and with no overlap.
12. Provide “Wet Paint” signs to protect newly painted finishes.
13. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.
14. Number of Coats: The number of coats specified is the minimum number of coats required.
    a. Provide additional coats to eliminate defects, imperfections, and visual deviations.

C. Metal Doors: Prime top and bottom edges, and finish paint astragals, removable mullions and lite kits. Prime and paint the doors/frames with finish system specified. Do not skip prep & primer on metal doors/ frames.

3.05 CLEANING:

A. Remove spills, splatters, and stains from all surfaces, and those in paint storage and mixing rooms.
   1. Refinish entire wall or surface where portion of finish has been damaged or is otherwise unacceptable, by Work of this Section, and at no extra cost to the Owner.

B. Remove debris from Project site upon Work completion or sooner, if directed.

C. Including Work of other trades, clean, repair and touch-up or replace when directed, products which have been soiled, discolored, or damaged by Work of this Section.

3.06 GLOSS LEVELS: Gloss at 60 degrees

A.

Gloss Level 1 (a traditional matte, flat)	Maximum 5 units
Gloss Level 2 (higher sheen flat – velvet like finish)	Maximum 10 units
Gloss Level 3 (a traditional eggshell like finish)	10-25 units
Gloss Level 4 (a satin-like finish)	20-35 units
Gloss Level 5 (a traditional Semi-gloss)	35-70 units
Gloss Level 6 (a traditional Gloss)	70-85 units
Gloss Level 7 (high gloss)	more than 85 units

B. All references to satin, eggshell, flat, etc., shall conform to gloss levels listed above. Submit supporting data that proposed paints meet these gloss/sheen levels.

3.07 SCHEDULE OF EXTERIOR WORK:

A. GENERAL: Except for obvious surfaces, paint or finish all new, unfinished and primed surfaces.

B. EXTERIOR METALS: (Items indicated but not limited to the following: hollow metal doors/frames, lintel angles, unfinished metal trim, all misc. metals such as guard posts, etc.)
   1. Alkyd Enamel Paint System:
      a. 1st Coat: Primer, Universal KemKromik Primer.
      b. 2nd Coat: *S-W Industrial Alkyd Enamel, Satin Finish,
      c. 3rd Coat: * S-W Industrial Alkyd Enamel, Satin Finish (4 mils wet, 1.3 mils dry per coat)

   * Also acceptable:
   Valspar 4000 Alkyd enamel;
   PPG Gliptex Alkyd are all approved equivalents.
   Devoe's Velour, Alkyd Enamel.

3.08 SCHEDULE OF INTERIOR WORK:

A. GENERAL: In addition to obvious surfaces which do not require painting or finishing do not paint over fire rating labels on doors or frames.

B. WALLS AND CEILINGS: Paint complete in all scheduled rooms. **[** Paint scheduled rooms as indicated on Room Finish Schedule. In unscheduled areas, use paint type to match existing; paint patched walls from 90-degree corner and patched ceilings complete.

C. FLOORS: No painting is required.

D. OTHER NEW UNFINISHED & PRIMED SURFACES: Provide specified finish on exposed surfaces. This includes prime-coated mechanical units, piping, pipe covering, conduit, ducts and interior duct surfaces visible behind grilles.

E. GYPSUM BOARD:
   1. Latex Enamel Paint System:
      a. One coat latex primer followed by two coats *eggshell latex enamel paint. Sherwin Williams ProMar 200 zero VOC.
      b. *Primer: Sherwin Williams' Pro Green 200 primer (38% minimum solids by weight) is specified .
      c. Note: Primer coat must be rolled, or spray applied and backrolled. Allow to dry a minimum of 24 hrs. at 70 degrees F, 50% humidity.
      d. Minimum dry thickness: **3.6** mils.

   *Sheen shall be verified with Architect. Semi-gloss or flat may be required. Flat at soffits and ceilings, and semigloss at janitor rooms, toilet rooms, etc.

F. FERROUS METAL: (misc. metals, hollow Metal doors, frames.
1. Alkyd Enamel Paint System:
a. One coat rust-inhibiting primer (Kem Kromik Universal Primer) followed by two coats semi-gloss alkyd enamel paint; (equal to Semi-Gloss alkyd oil)
b. Minimum dry thickness: 4.2 mils.

2. NOTE: Metal Buildings Main Rigid Frames: No Painting.

PART 1 - GENERAL: NOTE: BY OWNER

1.01 RELATED WORK:

A. Section 09 2900 - Gypsum Board Assemblies: Fire-rated wall construction

1.02 QUALITY ASSURANCE:

A. Conform to NFPA 10 for extinguishers

1.03 SHOP DRAWINGS AND PRODUCT DATA:

A. Submit in accordance with Section 01 3300.

B. Clearly indicate plan locations, operational features, color and finish, anchorage details, dimensions and rough opening sizes.

C. Furnish manufacturer's descriptive literature, installation and cleaning instructions.

1.04 OPERATION AND MAINTENANCE DATA:

A. Submit in accordance with Section 01 7823.

B. Include test refill or recharge schedules, procedures and recertification requirements.

PART 2 - PRODUCTS:

2.01 ENVIRONMENTAL REQUIREMENTS:

A. Do not install when ambient temperatures may cause freezing.

2.02 FIRE EXTINGUISHERS Manufacturers:

A. J. L. Industries is specified with Larsen's Mfg. Co., Muckle Products and Johnson Lee also acceptable.
   1. Type 3: Cosmic E Series, 10 lb. dry chemical type, fully charged, 4A/80 BC ratings.

2.03 WALL BRACKETS:

A. By fire extinguisher manufacturer.
   1. JL's MB series, which physically clamp extinguisher to bracket.
   2. Hanging hook is not acceptable.

PART 3 - EXECUTION:

3.01 INSPECTION:

A. Determine that construction of openings for cabinets has been completed. Verify rough openings for cabinets are correctly sized and located. Install at heights as acceptable to applicable regulations of governing authorities.

B. Assure that surfaces to receive units are free of debris.

C. Do not proceed with installation until conditions are satisfactory.

3.02 INSTALLATION:

A. Comply with reviewed Shop Drawings and Product Data.

B. Set units plumb, level, and true to line without warp or rack.

C. Apply protective coating to separate aluminum from incompatible materials.
   1. Anchor securely to surrounding construction.

D. Check extinguishers for proper charge, operation.

E. Remove and replace damaged, defective or undercharged units.

END OF SECTION

PART 1 - GENERAL:

1.01 Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work specified in this Section.

1.02 WORK INCLUDED:

A. Pre-engineered and fabricated structural steel building frame.

B. Sloped standing seam roof system concealed fastener with purlins, insulation system, with liner panel.

C. Wall system, insulated, with exposed fasteners, wall girts. Provide interior liner panel as detailed and required. NOTE: provide wall girts at 48" maximum spacing for liner panel support. Bid accordingly.

D. Wall and roof opening reinforcement and framing members, and finished trim. Welded roof curbs, with integral cricket.

E. Miscellaneous accessories, facia, trim and flashings.

F. Rated Gypsum Sheathing, building paper/air barrier, metal furring and Heavy gauge studs, at Fire Rated Endwall.

1.03 RELATED WORK:

A. Excavation, concrete foundation and slab including anchor bolts, wall insulation, interior finishing, drywall and mechanical/electrical Work are by others.

B. Hollow metal doors, frames and hardware are by Section 08 1100.

C. Overhead Doors are by Section 08 3600. The metal building supplier shall provide the Framed openings, and finished trim for these doors that occur in the exterior metal paneled walls.

1.04 DEFINITION:

A. Metal Building System: A building system that will employ:
   1. Either continuous or simple-span 'Z' or 'C'-shaped cold-formed purlins or open-web steel joists for support of the roof cladding. All systems (cladding, roof and wall secondary, lateral primary framing, and longitudinal bracing) work together to provide resistance to vertical and lateral loading demands.

B. Gable Symmetrical: A continuous frame building with the ridge in the center of the building, consisting of tapered or straight columns and tapered or straight rafters. The sidewall girts may be continuous (by-passing the columns). The rafters may or may not have interior columns.

1.05 REFERENCE STANDARDS:

A. American Institute of Steel Construction (AISC):
   1. AISC Specification for Structural Steel Buildings.
   2. AISC Serviceability Design Considerations for Low-Rise Buildings.

B. American Iron and Steel Institute (AISI):
   1. AISI 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 % 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% 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.
   20. ASTM E1646 - Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference
   21. ASTM A36 - Specification for Carbon Structural Steel
   22. ASTM A992 – Specification for Structural Steel Shapes

F. FM Global:
   1. FMRC Standard 4471 – Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance. Roof systems shall be installed to meet the requirements of the assembly tested.

G. Metal Building Manufacturers Association (MBMA):
1. MBMA Metal Building Systems Manual.

H. North American Insulation Manufacturers Association (NAIMA):
1. NAIMA 202 – Standard for Flexible Fiber Glass Insulation to be Laminated for Use in Metal Buildings.

J. The Society for Protective Coatings (SSPC):
1. SSPC-Paint 25 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 25 standards.
2. SSPC-SP2 – Hand Tool Cleaning.

K. 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.
3. UL-2218- Impact Resistance of Prepared Roof Covering Material

1.06 CODES AND STANDARDS:

A. In addition to local IBC - Building Code requirements, the following standards apply:

B. Structural Steel, including welded built-up shapes - American Institute of Steel Construction. Only those Sections of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" relating to design requirements and allowable stresses.

C. Cold-formed Steel - American Iron and Steel Institute - Only those Sections of the Specification for the Design of Cold-Formed Steel Structural Members relating to design requirements and allowable stresses.

D. Welding - American Welding Society - Only those Sections of the "Structural Welding Code" relating to welding procedures.

1.07 COORDINATION:

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leak proof, secure, and noncorrosive installation.

1.08 PREINSTALLATION MEETINGS:

A. Convene pre-installation meeting 2 weeks before start of installation of metal building system.

B. Attendance of parties directly affecting work of this section, including Contractor, Architect, Engineer, installer, and metal building system manufacturer’s representative.

1. Review methods and procedures related to metal building systems including,

but not limited to, the following:

a. Condition of foundations and other preparatory work performed by other trades.
b. Structural load limitations.
c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
d. Required tests, inspections, and certifications.
e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.

2. Review methods and procedures related to metal roof and wall panel assemblies including, but not limited to, the following:

a. Compliance with requirements for girt/purlin and rafter conditions, including flatness and attachment to structural members.
b. Structural limitations of purlins and rafters during and after roofing.
c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
d. Temporary protection requirements for metal roof panel assembly during and after installation.
e. Roof observation and repair after metal roof panel installation.

1.09 SUBMITTALS:

A. Comply with Section 01 3300 – 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. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Metal roof panels.
b. Wall panels.
c. Trim, facia, gutter, downspouts

E. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.

i. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted

connections, distinguishing between shop and field applications. Include transverse cross-sections.

ii. Metal Roof Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

iii. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8):

Flashing, trim, facia, gutter, downspouts, etc.

1.10 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure.
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

C. Certification: Submit “Certificate of Design and Manufacturing Conformance (Delegated Design)”.
1. Refer to Design Requirements article.
2. Certificate shall be on metal building system manufacturer’s letterhead.

D. Submit certification verifying that the metal roof system has been tested and approved by Underwriter’s Laboratory as Class 90.

E. Dealer Certification: Submit certification of dealer qualifications.
1. Certification shall state date on which authorization was granted.

F. Installer Certification: Submit certification of installer’s qualifications.

G. Sample Warranty Documentation: Submit warranty form to be issued. Warranty form shall comply with warranty provisions specified.

H. Submit Field Quality-Control Reports: Refer to Field Quality Control article.

1.11 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.

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. Letter of Certification:
1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in **North Dakota** 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. Letter of certification 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).

1.12 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.
a. Protect materials and finish during storage, handling, and installation to prevent damage.

1.13 WARRANTY:

A. Standing Seam Roof Weathertightness Warranty
1. Furnish manufacturer's weathertightness warranty for a maximum of 20 years against leaks in standing seam roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.

B. Metal building system manufacturer shall provide a written warranty for 20 years against perforation of metal roof panels due to corrosion under normal weather and atmospheric conditions.
   1. Warranty shall be signed by metal roof system manufacturer & roof system installer
   2. Maximum liability of warranty shall be no less than $0.50 per square foot of roof area.

C. 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 panels.
   1. Warranty shall be signed by metal building system manufacturers 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 30 years.
   3. For a period of 30 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.

D. Metal Building System Manufacturer’s Certification: Metal building system manufacturer shall submit a signed written Certification 1 week before bid date, 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 submitted with bid.

PART 2 - PRODUCTS:

2.01 MANUFACTURER: Subject to compliance with requirements, provide products by following:

A. Nucor Building Systems http://www.nucorbuildingsystems.com; is specified.

B. Comparable Metal Building Systems, also acceptable:
   1. Butler Manufacturing
   2. CECO
   3. VP/Varco Pruden.
   4. Behlen
   5. Star
   6. Metallic Building Systems

2.02 BUILDING DESCRIPTION:

A. Building Dimensions: Indicated on the Drawings.
   1. Horizontal Dimensions: Measure to inside face of wall sheets.
   2. Double slope Rigid frame building, with Eave Height: 20 ft . 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 Steel: Indicated on the Drawings.
   4. Minimum Haunch height: 17’-0” Above Finish floor.

B. Primary Structural Members:

1. Primary Framing System: Nucor Building Systems 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.
   a. Note: Size of the haunch of the rigid frame, shall be a maximum as indicated on the drawings. All manufacturers shall meet this requirement.
3. Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
4. Endwall Frames:
   a. Provide Beam and Post Endwall at both Endwalls (Grid Lines # 1 and #6), including Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
5. Exterior Sidewall Columns: Welded-up "H" sections sections.
6. Endwall Columns: “H” sections.
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.
9. Provide wind bracing in the bays indicated/required.
   a. Portal Column bracing provided at bays indicated. Provide standard X bracing at roof area in these bays, with portal columns at the wall areas.

C. Secondary Structural Members:
1. Secondary Framing System: Nucor’s Systems’ framing system as specified in this specification section.
2. C/Z Purlins and Girts: Precoated Galvanized finish.

D. Metal Roof System: As specified herein, in this specification section.

E. Wall System: As specified herein in this specification section.

2.03 DESIGN LOADS:

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: IBC.
   b. Year/Version: 2021
   c. Occupancy Category: Standard Occupancy, Risk Category III.

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 as follows:
   a. 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. Flat Roof Snow Load: 38.5 psf
   b. Thermal Factor (C_t): 1.0 heated.

c. Snow Importance Factor (I): 1.1.
1) Ground Snow Load (Pg): 50psf
2) The roof snow should be……50psf (GSL) x .7 (Constant) x 1.1 =38.5 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 Speed: 118 mph.
b. Wind Exposure Category: C.
c. Topographic Factor (K_{zt}): 1.0
d. Enclosure Classification: Partially Enclosed.
e. Basic Wind Pressure: 28.0 psf Ultimate pressure.
2. Wind Pressure Coefficients and the design pressures shall be applied in accordance with the governing code.

E. 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_s): See Drawings
b. Spectral response acceleration for 1-sec. period (S_1): See Drawings.
c. Site Class: D
d. Seismic Importance Factor (I): 1.25
2. Seismic loads shall be applied in accordance with the governing code.

F. Dead Load: Dead load shall consist of the weight of building system construction, such as roof, framing, and covering members.

G. Collateral Load: *(8 psf)*
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.

2.04 DEFLECTIONS:

A. Structural Members:
1. Maximum deflection of main framing members shall not exceed (See Drawings) of their respective spans.
2. Maximum deflection due to snow load in roof panels and purlins shall not exceed (See Drawings) of their respective spans.
3. Maximum deflection due to wind load in wall panels and girts shall not exceed (See Drawings) , for 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/200**

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 Steel 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 tapered or straight columns and roof beams, with gable roof.
   2. Actual Building Length: *See drawings* (124 ft)
      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: *See Drawings* (84 ft)
      a. Structural line to structural line.
      b. Nominal building width.
   4. Minimum Roof Slope: 1 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 Contractor, not 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 Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria. (North and South **Endwall @ Grid Line 1 ** & 7**)
a) Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
b) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.
c) 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.
** d. Note: If required by design of Portal Framing at endwall bays (grid line 1 &2), provide full rigid framing to accept portal frame bracing system at Grid Line # 1.

D. Secondary Structural Members: Secondary framing shall consist of purlins, girts, eave struts, flange braces and sag angles as required by design.
1. Purlins:
a. Purlins:
1) "Z"-shaped, precision-roll-formed, Precoated galvanized finish. Purlins provided in different gauges to meet specified loading conditions.
2) 8-inch, minimum "Z" sections.
b. Outer Flange of Purlins: Factory-punched holes for panel connections.
c. Attach purlins to main frames and endwalls by 1/2-inch-diameter bolts through end seat of truss purlin.
d. Brace purlins on top and bottom chords spaced at intervals indicated on erection drawings furnished by metal building system manufacturer.
e. Concentrated Loads: See Structural Drawings for requirements.

2. Eave Members:
a. Eave Struts: Factory punched 10-inch, minimum deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
3. Wall Girts:
a. "Z of C Sections" rolled-formed, Precoated galvanized steel in thickness to meet specified loading conditions.
b. 8", minimum deep "Z or C " sections.

c. See structural Drawings for requirements.

4. Bracing:
   a. Locate bracing as required by PEMB manufacturer.
   b. Diagonal Bracing:
      1) Hot-rolled rods.
      2) Attach to columns and roof beams.
   c. NOTE: Where required, provide optional fixed-base wind posts or pinned-base portal frames shall be substituted for wall rod bracing on buildings as required. Portal Framing is required on this project due to overhead doors, and lack of blank wall space.

   d. Flange Braces and Purlin Braces: Cold formed and installed as required.

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 be identified and negotiated before bidding.
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, if required, in field as specified in the painting section.
   c. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
   d. Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
2. Primary Frames:
   a. Clean steel in accordance with SSPC-SP2.
   b. Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements SSPC-Paint 25.
   c. Minimum Coating Thickness: 1.0 mil.

3. Secondary Structural Members – Roll-Formed Zee Purlins
   a. Galvanized finish, G-40; Pre galvanized or equivalent below:
      1. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
      2. Note: Standard paint Primer (red Oxide or grey is NOT acceptable.)

4. Secondary Structural Members – Wall Girts
   a. Galvanized finish: G-40; Pregalvanized or equivalent below:

      1. Hot-dipped zinc coating, ASTM A 653, G30 equivalent or better, with clear acrylic finish as previously specified.
      2. Standard Primer (red Oxide or grey is NOT Acceptable)

2.06 METAL ROOF SYSTEM:

A. Metal Roof System:

Nucor's "CFR" roof system, w/ Butler's "MR-24" roof system, or equivalent, concealed Fastener roof system. Provide machine seaming of the standing seam.

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 to support design live, snow, and wind loads.
   3. Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.

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.

D. Roof Panels:
   1. Factory roll-formed, 24 inches wide , trapezoidal rib, 2 inches high (3 inches including seam).

   2. Flat of the Panel: Minor flutes/ striations, parallel with major standing seam, entire length of panel.
   3. Custom Width Panels:
      a. For roof lengths not evenly divisible by the 24" panel width, factory-manufactured variable-width panels at the terminating endwalls to ensure modular, weathertight roof installation.
      b. Supply full length panels (Eave to ridge). Panels shall be one piece for slope lengths less than 52 ft.
      c. Joint Configuration: Off-set tongue and groove, with concealed fastener, 90 degree field seamed. Seam all panel runs at end of each day.
   4. Finish:
      a. "Exterior Metal Coating on roof panels: "Nucor's PVDF which is a 70 percent "polyvinylidene fluoride (PVDF) coating. (similar to Kynar 500" or "Hylar 5000)
      b Color: Picked by Architect from manufacturer's standard kynar colors.

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   5. Use panels of maximum possible lengths to minimize end laps.
   6. Panels provide with ridge assembly.
   7. Panel end laps shall be sealed before clamping with sealant containing hard nylon spacer beads to maintain required sealant weathertight joint profile. Joint design that does not maintain joint sealant profile and prevent sealant joint collapse is prohibited.
   8. Ridge Assembly:
      a. Design assembly to allow roof panels to move lengthwise with expansion and contraction as panel temperature changed.
      b. Factory punch parts for correct assembly.
      c. Install panel closures, and ridge reinforcement to seal panel edges at ridges.
      d. Do not expose attachment fasteners on weather side
      e. Seal standing seam using lock seam plug or equivalent.
      f. High tensile ridge cover: Span from panel closure to panel closure and flex as roof system expands and contracts.
      g. Provide roof panel metal and foam closures at panel terminations at ridge.

E. Provision for Expansion and Contraction:

1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
   a. Stainless Steel Tabs: Factory centered on roof clip when installed to ensure full movement in either direction.
   b. Maximum Force of 8 Pounds: Required to initiate tab movement.
   c. Each Clip: Accommodates a minimum of 1.25-inch 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 of roof panels.

F. Fasteners:
1. Make connections of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.
2. Fasten panel clips to structural members with 2 - 3 fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched holes in structural members.
   a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
3. Exposed fasteners penetrating metal roof membrane at the following locations do not exceed the frequency listed:
   a. Basic Panel System: 0 per square foot.
   b. High Eave Trim, No Parapet: 2 per linear foot.
   c. Exterior Eave Gutter: 2 per linear foot.
   d. Panel Splices: 2 per linear foot.
   e. Gable Trim: 0 per linear foot.
   f. High Eave with Parapet: 0 per linear foot.
   g. Ridge: 0 per linear foot.
   h. Low Eave Structural: 1.5 per linear foot.

G. Accessories:
1. Accessories, i.e., ventilators, closure trim, eave trim/facia, gable end trim/facia, perimeter trim, and all fascia trim from roof to wall transition at roof to wall panels. Provide standard with metal building system manufacturer, except for locations where custom trim is required.
1. Exterior Metal Coating on Gable Trim, and Eave Trim: “Nucor’s PVDF which is a 70 percent “polyvinylidene fluoride (PVDF) coating. (similar to Kynar 500” or “Hylar 5000)
   a. Color: Picked by Architect from manufacturer’s standard kynar colors.

3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
   a. Parts: Compatible and not cause corrosive condition.

H. Energy Conservation: See further this specification for insulation systems.
1. Insulate purlins to eliminate "thermal short circuits" between purlins and roof panels.
2. Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and roof panels by use of thermal block at each purlin location.

I. Misc. Accessories:

1. Accessories (i.e., ventilators, skylights, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: "Nucor's PDVF finish, or Butler-Cote™" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
   a. Colors: Picked by Architect.
3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
   a. Parts: Compatible and not cause corrosive condition.
5. Gutters and Downspouts: Provide prefinished gutter assembly, approximately 6" x 5" cross section, complete with oversized 4x5 prefinished downspouts.
6. Sealing Tape: 100% solids, pressure sensitive grey polyisobutylene compound tape with release paper backing. Not less than 1/2" wide and 1/8" thick, non-sag, nontoxic, nonstaining and permanently elastic.
7. Sealant: as recommended by Panel manufacturer.
   a. Butyl base sealant, (Hidden sealants) equal to Carlisle's Butyl based Water Stop sealant.
   b. Silicone Sealants: (exposed sealants) Tremco's Spectrum 1, ASTM C920,TypeS, Grade NS, Class100/50: color to match panels

2.08 ROOF JACKS:

A. Provide EPDM pipe Flashings by Buildex: EPDM rubber boot with base flange.

2.09 METAL WALL SYSTEM:

A. Wall Panel- Exterior Metal Wall System- Basis of Design: Nucor's "R" Panel "wall system (exposed fastener).

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, 1-1/4 inches high, 12 inches on center, with 2 minor corrugations between each of the major corrugations entire length of panel.
2. Single length, from base to building eave, or gable flashing .
3. Each Panel Corrugation: Fastener alignment groove to center fastener within corrugation.
4. Exposed Panel Side Laps: Hemmed to eliminate raw cut panel edge.
5. Upper End of Panels: Fabricate with square cut for all other roof panels and slopes.
6. Factory punch or field drill wall panels at panel ends and match factory-punched or field-drilled holes in structural members for proper alignment.
7. Panel Material and Finish:
   a. 26-gauge gauge painted Galvalume aluminum-zinc alloy (approximately 55 percent aluminum, 45 percent zinc), ASTM A 792.
   b. Paint with exterior colors of "PVDF Finish system. 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
      1) PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 35 years for the following.

aa. Not to peel, crack, or chip.
bb. Chalking: Not to exceed ASTM D 4214, #8 rating.
cc. Fading: Not more than 5 color-difference units, ASTM D 2244.

2) Color: Walls: Picked by Architect from manufacturer's standards.
Corner Trim, Opening trim: "Same"
Gutter, Downspouts: "Same".

D. Fasteners:
1. Wall Panel-to-Structural Connections: Prefinished -head self-drilling screws.
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. Opening Support - Subframing and opening trim:
1. Accessories (subframing and finished opening trim for walk doors, overhead doors, windows, louvers): Standard with metal building system, but custom where required, designed to resist applicable horizontal window loading, consisting of channel jambs, headers, etc., and as noted and furnished as specified. Provide prefinished metal flashing/trim to conceal panel edges at openings.
2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
3. Provide in gauge and PVDF finish to match the wall panels. See above for Color.

F. Misc. Accessories: Provide "closure foam" and accessories, at top and bottom, and terminations at openings, as standard to the Metal Building System.

2.11 INSULATION SYSTEM, includes INTERIOR LINER PANELS

A. NAIMA 202 certified Metal Building fiberglass insulation, with not less than 0.5 lb. per cubic foot density, thickness as indicated, glass fiber blanket with U.L. flame spread classification of 25 or less.

B. Vapor barrier - walls and roof: Clear vinyl film, 6 mil poly; tape all seams and edges to provide continuous vapor barrier. Minimum lap 6", install in as large of pieces as possible.

C. Roof Insulation:
1. Nominal Thickness: 13.5 inches. (4" and 9.5" fiberglass) compressed.
2. R-Value: 42.
a. Zee Purlin Member: Insulated using 3/4-inch-nominal-thick extruded polystyrene foam insulation block along each zee/purlin location to minimize "thermal short circuit" between zee and roof panels.

D. Wall Insulation:
1. Nominal Thickness: 10 inches. (4" and 6") compressed (using 8" girts) R-Value: 30.
2. Note: If providing 10 or 9.5" depth girts, shall provide 12" nominal insulation (6" and 6") Compressed, R-36.
3. Vapor barrier - walls: Clear vinyl film, 6 mil poly; tape all seams and edges to provide continuous vapor barrier. Minimum lap 6", install in as large of pieces as possible.
4. Foam Thermal Break Tape on Face of Wall Girts:
a. Quik-stop 3/16" x 3" self adhesive foam tape, by Thermal Designs.
b. Echo Tape's ¼" x 3" foam tape, FO-V2344 also acceptable.

E. Liner Panels (Walls- interior and Ceilings (underside of purlins)

1. Form panels from **29 ga.** typical minimum thickness coated steel with minimum yield strength of 80,000 psi
   a. Equal to Metal Sale's ProPanel II
2. Painted Panel Finish:
   a. Exposed Side: 0.1-mil primer and 0.4-mil minimum interior white polyester paint.
      1) Unexposed Side: 0.3-mil minimum non-color-controlled wash coat.
3. Panel Dimensions: Nominal 36 inches wide with corrugations 5/8' inches high, 9" on center.
4. Factory cut panels to lengths required. Some field shearing/cutting of panels will be required.
5. Provide termination trim at panel ends, edges, inside, and outside corner trim manufactured from minimum matching gauge sheet stock, same finish as liner panels.
6. Color: Polar White, at panels and trim.

E. Fasteners:
1. Sub-structurals and Liner Panels: Install with self-drilling screws for attachment
2. Attachment Fasteners: As specified under Roof System in this specification section.

F. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion and Contraction Movement: Accomplish in roof system.
2. As specified under Roof System in this specification section.

G. Performance Testing: As specified under Roof System in this specification section.

2.12 SEALANTS:

A. Joint Sealant: Sealant shall be heat-resisting compound having low shrinkage factor; unaffected by water; with flash-point in excess of 400°C (750 degrees F). Sealant shall not migrate oil up to 120° (250 degrees F) nor exude oil under pressure. It shall not skin, sag, nor weep in panel joints under vibration up to temperature of 65°C (150 degrees F), nor become brittle at temperature down to -1°C (30 degree F). Provide butyl tube sealant at hidden joints, and at joints in gutters and wall panels. Provide single component urethane sealants elsewhere. Use silicone sealants as approved by manufacturer.

A. Sealing Tape: Manufacturer's standard in color to match metal building panels.

2.13: FIRE RATED DRYWALL/FRAMING at FIRE RATED ENDWALL:

A. The gypsum board to be used in specific locations:
1. Mold Resistant Drywall: Fire Rated Type X: Meeting ASTM C1396. Board consists of mold resistant back facer, reduced organics in core, and heavy duty mold resistant paper face. . The following are acceptable:
   a. M2Tech, Type X by Certainteed.
   b. USG's Mold Tough, Type X.
   c. National Gypsum's XP Fireshield.
   d. Overall Thickness: 5/8"

B. Gypsum Sheathing: Fire code 5/8" USG's sheetrock brand gypsum sheathing. ASTM C79. or equivalent by National Gypsum or Certainteed.

C. Moisture/Air Barrier/Building Paper: Commercial Wrap 'D' by Tyvek is basis of design. Install per manufacturer's recommendations, using recommended washered fasteners. Equivalent Products such as GreenGard Max by Kingspan, or Barricade Wrap Plus, are also acceptable. Install onto exterior gypsum sheathing.

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D. FireTaping:
1. Interior Gypsum Board: Paper reinforcing tape.
2. Exterior Gypsum Sheathing Board: Paper reinforcing tape.
3. Use Setting type joint compounds such a DuraBond Series (20, 45 or 90) or Quick Set Lite series by National Gypsum.

E. Interior Furring Channels: 25-gage (.0179" base metal) roll-formed, hat-shaped, galvanized steel. (G-40) Depth as indicated. 24" oc spacings. Bypass interior flanges of wall girts.

F. Framing: (Structural Studs are indicated for support of exterior sheathing) 20 ga.Cee studs/framing, equal to Clark/Dietrich's CWN series(S137) where required. meeting ASTM C955,(AISI S240) Studs/framing shall be manufactured from 50KSI galvanized steel, having CP60 coating designation, or equivalent, per AISI S240.
Stud framing spacing at 24" oc. and extend from girt to girt. (*notching at girt return flanges*)
Provide also 20 ga. framing at column fireproofing, per Detail 5/A6.0.

G. Provide fasteners of type, material, size, corrosion resistance, holding power and other properties to fasten steel framing and furring members securely to substrates involved; Comply with recommendations of gypsum board manufacturers for applications indicated.

2.14 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
   a Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
   b. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
   c. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.

d. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

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 Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection. Insert leveling plates in "Base and Bearing Plates" Paragraph below if required.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.

Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Install temporary bracing and erection bridging, connections and anchors.

Provide rake or gable purlins with tight-fitting closure channels and fasciae.
Locate and space wall girts to suit openings such as doors and windows.
Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where required/indicated on erection drawings.

i. Tighten rod and cable bracing to avoid sag. Install portal columns where required.
ii. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances- Struct. Framing: Maintain erection tolerances within AISC 303.

3.03 INSTALLATION – METAL ROOF SYSTEM:

A. Metal Roof System Installation: .
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. Position panel clips and fasten to secondary structural members.(roof girts)
4. Position and properly align panels by matching factory-punched holes in panel end with factory-punched holes in eave structural member and by aligning panel with panel clip.

a. Field seam panel side laps by self-propelled and portable electrical lock-seaming machine.
   1) Field Machine field seams to final closure per roof panel design.
   2) Factory apply side lap sealant.
   3) Panel End Laps: Minimum of 6 inches, sealed with sealant (weather sealing compound), and fastened together by clamping plates.
   4) Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.
   5) Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.
      aa. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.

3.04 FLASHING TRIM AND ACCESSORY:

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.05 TOLERANCES:

A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

B. Siding and Roofing: 1/8 inch (3 mm) from true position.

3.06 CLEANUP:

A. Materials shall be rendered free and clean of dirt, debris, grease, rust, stains, scratches and markings.

B. Touch up field painting shall be performed with same type paint as show coat. Touch up shall include cleaning and painting of field connections, bolts and all damaged or defective paint and rusted areas.

3.07 INSTALLATION – METAL WALL SYSTEM:

A. Metal Wall System Installation:
   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.

B. Install insulation in two layers as previously indicated. Make sure the insulation is fluffed to proper thickness and that joints are staggered 48". Adhere the thermal block to the top of the purlins with adhesive.

3.08 INSTALLATION – INSULATION:

A. Insulation Installation: Install insulation in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings. Provide 2 layer systems at the Production Area walls and ceilings.
   1. Provide Roof insulation/Vapor barrier support, prior to liner panel installation.
   2. System used, shall be approved by Building System manufacturer.

B. Install insulation layers, with neat tight joints.

C. Insulation at Cold Storage Roof areas shall have the facer, neatly overlapped and stapled to provide neat interior appearance.

3.09 FLASHING TRIM AND ACCESSORY:

A. General: Sheetmetal shall be fabricated per requirements of "Architectural Sheet Metal Manual", SMACNA and per PEMB manufacturer's requirements.

B. Shop fabricate all items custom shaped. Sheet metal work shall be manufactured from 24 ga. prefinished material and shaped to install in strict accordance with details on drawings and approved shop drawings.

C. Use Elastomeric sealant to make watertight installation.
   1. Lap all trim and flashings a minimum of 3", and securely fasten and seal.

D. Gutters and Downspouts shall be installed to allow for expansion and contraction and installed per manufacturer's instructions.

E. Seal joints with butyl elastomeric sealant.

1
2 END OF SECTION

SECTION 210500
FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
   a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
   b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
   c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.2 NOMENCLATURE

A. NICET: National Institute for Certification in Engineering Technologies.
B. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

1.3 SCOPE OF WORK

A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the fire protection systems, in strict accordance with Division 21 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.
B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.

C. Examine site and all Contract documents prior to submittal of bid.

1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.

D. Division 21 Work: Includes the following system types:

1. Wet-Pipe Sprinkler System.

E. Delegated-Design: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data by a NICET Level III certified designer or licensed Professional Engineer responsible for their preparation.

1. Everything necessary for the complete and successful operation of this system, whether or not definitely specified on the Drawings shall be furnished and installed as if specified or indicated.

F. The Fire Protection Contractor will be a prime contractor.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design system for Class A, B, and C fires as appropriate for areas being protected, and include safety factor.
B. Fire-extinguishing system design shall be approved by authorities having jurisdiction and shall be in accordance to architectural drawings and code plans.

1.5 WORK BY OTHERS

A. Painting.
B. Wiring by Division 26.
C. Water Service into Building.
D. Exterior Fire Protection Mains.
E. Fire Hydrants.

1.6 SUBMITTALS

A. General:

1. Preferred Submittal Format: PDF, unless otherwise noted.
2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
   a. [Specification Section Number] – [Specification Name or Equipment Included]
3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 21 submittals to:

Caleb Bulow, P.E.
PRAIRIE ENGINEERING, P.C.
1905 17TH STREET SE
MINOT, ND 58701
cbulow@prairieengineeringpc.com

B. Substitution and Prior Approval to Quote.

1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.

2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
    a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Shop Drawings: Submit to Engineer via the Prime Contractor for each item indicated.

1. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
2. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. Email message text not acceptable.
3. Non-Conforming: Returned to Contractor without review.
4. Submission Timing: Prior to delivery of materials to job site.

D. Shop Drawings, Wet-pipe Sprinkler Systems:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Record Drawings

1. Format and Content: Paper copy of Drawings project site.
    a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
    b. Give particular attention to marking actual locations of underground piping.
    c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
    d. Make Record Drawings available to Engineer during project visitation.
2. Submission Timing: Close of project with Record Manuals.

G. Spare Equipment and Devices

1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

H. Operation and Maintenance Manuals

1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
3. Format and Content: Two copies, Loose-leaf hardcover binders, and in PDF format on CDs.

a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD or USB drive.
b. Include an index sheet indicating subcontractor and subcontractor's phone number and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
c. Include a copy of the Shop Drawings.
d. Include all installation, operation and maintenance data packaged with any equipment.
e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.7 AUTHORITIES AND AGENCIES

A. All work will be installed for the approval and acceptance of the following:

1. Insurance Services Office
2. State Fire Marshall
3. Local Fire Inspection Office

B. Any permits for the installation or construction of any of the work included in this section, which are required by any of the Authorities or Agencies having jurisdiction, shall be obtained and paid for by the Fire Protection Contractor.

C. All inspections, examinations and tests of any of the work included in this section, which are required by any of the Authorities or Agencies having jurisdiction, shall be obtained and paid for by the Fire Protection Contractor.

1.8 QUALITY ASSURANCE

A. Qualifications of Installers

1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 WARRANTY

A. The entire Fire Protection installation, as specified under this Section of the Specifications, shall be guaranteed for one (1) year against defective equipment, materials and workmanship. The liability of the Fire Protection Contractor under this guarantee is limited to repair or replacement of fire protection defective equipment, materials or workmanship. The guarantee period is to begin on the date the equipment is placed in operation at the Owner's request for his convenience or from the date a successful acceptance test is made, whichever occurs first.

B. The guarantee shall not be construed as requiring the Fire Protection Contractor to render service or maintenance required in the normal operation of the equipment or to make repairs that may be needed due to normal wear and tear or the Owner's negligence, abuse or breakage.

1.10 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 01 for details of temporary facilities.

PART 2 - PRODUCTS

2.1 MATERIAL

A. All material, equipment, valves and devices, installed or furnished under this Section, shall be listed or approved for use in the Fire Protection installation by the Authorities, Agencies, Codes and Standards named in this Section of the Specification.

1. Underwriter's Laboratories - Approved Fire Protection Equipment List
2. Factory Mutual Approved Equipment Manual

B. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.

C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

D. Fire Stop System material shall be by 3M “Fire Barrier”, Metacaulk, Hilti, Nelson Firestop Products, or AD Fire. See Division 07 for further details on approved materials.

2.2 ELECTRIC WIRING

A. The Division 21 Contractor shall furnish and install all water flow switches, air pressure switches and alarms, valve supervisory switches, visual/audible alarms, fire pump and controller, control panels, pre-action detection devices, air compressor and controls, special controls and electrical devices as specified herein for proper operation of the equipment furnished.

B. The Division 23 Contractor shall furnish and install all ventilation equipment and dampers, unless otherwise noted in the Drawings or Specifications.

C. Division 26 Contractor shall furnish and install, as required, wiring to supervisory switches, flow switches and alarms; and power wiring to fire pump and controller; furnished separately by Division 21 Contractor, unless otherwise noted in Equipment Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.

C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

D. In general, it is intended that piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.

E. Install piping above grid ceilings to allow easy removal of ceiling tiles. Install exposed piping as high as possible except where noted otherwise.

3.2 SURFACE CONDITIONS

A. Prior to work, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.
C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.4 COORDINATION

A. Order equipment and material in a timely fashion to assure it is on the job site when required.
B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.
C. Coordinate pipe routing with other trades to avoid conflicts with ductwork and other piping system.
D. Division 21 piping and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Pipes shall not be installed in the space near electrical panels/equipment defined as "working spaces" or "dedicated spaces".

3.5 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
2. Do not proceed with installation in area of question until conflict has been fully resolved.
3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.6 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities.
B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.7 CUTTING AND PATCHING

A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Division 21 Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.
B. Opening/holes cut to allow passage of pipes through concrete floor shall be patched by the Contractor doing the cutting unless indicated otherwise on the Drawings.
C. Fire-Barrier Penetrations

1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
2. See Specification Section 210510 for other Fire-Barrier Penetration requirements.
3. See Section 2 article “Materials” of this Specification for approved fire stop system material.

D. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.
E. Use only rotary type drilling tools to cut concrete.
F. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.8 FIELD QUALITY CONTROL

A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.
B. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.9 INSTRUCTIONS

A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Written instructions shall be graphical insofar as practical.
B. Division 21 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment.

END OF SECTION

SECTION 210510
COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers.
2. Equipment and Warning labels.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 210500.
B. Operation and Maintenance Manual: Per section 210500.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. All hangers, installed or furnished under this Section, shall be listed or approved for use in the Fire Protection installation by the Authorities, Agencies, Codes and Standards named in this Section of the Specification.
B. Carbon-Steel Pipe Hangers and Supports:

1. Description: Clevis type with locknut to threaded extension rod, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or cadmium plated steel.

C. Copper Pipe Hangers:

1. Description: Clevis type with locknut to threaded extension rod, copper-coated-steel, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

D. Trapeze Pipe Hangers:

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.2 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.4 EQUIPMENT AND WARNING LABELS

A. General Requirements

1. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

2. Minimum Letter Size: 1/2 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Fasteners: Stainless-steel rivets or self-tapping screws.
4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Metal Labels for Equipment:

1. Material and Thickness: Non-corroding metal, 20 gauge minimum thickness, and having predrilled or stamped holes for attachment hardware.

C. Plastic Labels for Equipment and Warning:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Equipment Label Color: Black letters on white background.
3. Warning Label Color: White letters on red background.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

D. Warning Label Content: Include caution and warning information, plus emergency notification instructions.

E. Equipment Label Content: Include equipment's Drawing designation or unique equipment number.

F. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing plan numbers where equipment is indicated, plus the Specification Section number and title where equipment is specified. Equipment schedule shall be provided to the Controls Contractor and included in operation and maintenance data.

2.5 FIRE-BARRIER PENETRATIONS

A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with Approved firestop materials. See Section 210500 for further details.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Arrange for grouping of parallel runs of horizontal piping, and support together on trapeze pipe hangers.

C. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Install lateral bracing with pipe hangers and supports to prevent swaying.

F. Install hangers and supports to not exceed maximum pipe deflections allowed by NFPA 13 for fire sprinkler piping.

G. Comply with NFPA 13 for pipe-hanger selections and applications.

H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

I. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

J. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20 or 25): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of fire protection equipment.
B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each branch connection, excluding short takeoffs for fixtures and terminal units.
2. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
3. At access doors, manholes, and similar access points that permit view of concealed piping.
4. Near major equipment items and other points of origination and termination.
5. Spaced at maximum intervals of 50 feet along each run.

3.4 ESCUTCHEON AND FLOOR PLATE INSTALLATION

A. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors of finished areas.
B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

C. Replace broken and damaged escutcheons using new materials.

3.5 FIRE-BARRIER PENETRATION PROTECTION

A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
B. Install Fire Stop Systems per the manufacturers guidelines.

END OF SECTION

SECTION 211000
FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Wet-pipe sprinkler system.

1.2 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 RELATED SECTIONS

A. Refer to Section 210520 “General Motor Requirements” for motor requirements.
B. Refer to Section 210500 “Common Work Results for Results For Fire Protection” for requirements of hangers, sleeves, sleeve seals, escutcheons, and labels.

1.4 SUBMITTALS

A. Shop Drawings: As per Section 210500 and prepared according to NFPA 13.

1. Materials: As covered under this section.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Approved Sprinkler Piping Drawings: Working plans that have been approved by authorities having jurisdiction.
4. Water Supply Capacity Information: Include flow test data.
5. Approved Hydraulic Calculations: Include summary sheet, detailed worksheets, and a graph sheet.

B. Operation and Maintenance Data: Per section 210500.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and engineering services.
2. Experience: Minimum of 2 years in the successful installation and operation of Fire Protection systems.

B. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."

1.6 UTILITY DATA FOR BIDDING

A. Water Utility Flow Data: Obtain prior to bidding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pressure Rating: 175 psig minimum unless otherwise noted.

2.2 FIRE-DEPARTMENT CONNECTIONS

A. Description: Flush-Type, Fire-Department Connection appropriate for PEMB wall surface.

1. Standard: UL 405.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Elkhart Brass Mfg. Company, Inc.
2. Potter Roemer.

C. Type: Flush, for wall mounting.
D. Body Material: Corrosion-resistant metal.
E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
F. Caps: Brass, lugged type, with gasket and chain.
G. Escutcheon Plate: Rectangular, brass, wall type.

2.3 BACKFLOW PREVENTION

A. Double Check Valve Backflow Preventer Assembly:

1. Description: Double check valve assembly with UL/FM approved valves on inlet and outlet of assembly.
2. Assembly Standard: ASSE 1015, AWWA C510-07
3. Check Valves:
   a. Type: Swing check.
   b. Body Material: Epoxy coated cast iron.
   c. Seats: Bronze.
4. Shut-off Valves:
   a. OS&Y gate valve, UL 262.
   b. Butterfly valves.
   c. Provide valve supervisory switches at each valve.

2.4 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.
B. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Pressure Rating: 250 psig.

C. Valve Supervisory Switches:

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Design: Signals that controlled valve is in other than fully open position.

2.5 SPRINKLERS

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.

B. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response, Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.

C. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.

2.6 AUDIBLE VISUAL ALARMS

A. Description: Weatherproof, strobe/horn unit, wall mounted, UL listed.
B. Strobe: Xenon flash, high impact lens.

1. Effective Candle Power: Minimum 15.0.
2. Peak Candle Power: 135,000.

C. Horn: 95dBA.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

A. Connect fire-protection standpipe piping to flange provided by mechanical contractor on water-service piping at service entrance into building.
B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories at connection to fire-protection water-service piping.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-protection standpipe piping.
C. Install drain valves on standpipes. Extend drain piping to outside of building.
D. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
E. Install alarm devices in piping systems.
F. Install sleeves for piping penetrations of walls, ceilings, and floors.
G. Install escutcheons for piping penetrations of walls, ceilings, and floors.
H. Bushings of any type to obtain reduction in size in fittings are not acceptable.

3.3 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main

supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

E. Install audible visual alarm above fire department connection.

3.4 SPRINKLER HEAD INSTALLATION

A. Location of Sprinkler Heads: As shown on the shop drawings.
   1. Avoid lights, and other devices.

3.5 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
B. Identify system components, wiring, cabling, and terminals.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Tests and Inspections:
   1. Fire Sprinkler Service Piping Tests: Test service piping as required by the Authority Having Jurisdiction or, in absence of published procedures, as follows:
   2. Witness: Test shall be performed in the presence of the Authority Having Jurisdiction or the representative of the Owner.
   3. Testing: Before the joints are covered in order for leaks to be detected.
   4. Pressure: Minimum of 200 psig, if maximum static pressure is 150 psig or greater the pressure test shall be 50 psig greater than maximum pressure test.
   5. Duration: Two (2) hours.
   6. Leakage Rate: Not to exceed two quarts/hr per 100 joints or gaskets irrespective of pipe diameter. Leakage for metal seated valves may increase above leakage rate by one fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section.
   7. Control Valves: Operating test shall be performed on all control valves when system is under full pressure to ensure proper operation.
   8. Certification: Upon completion, this Contractor shall complete the “Contractor’s Material & Test Certificate For Underground Piping” contained in NFPA 2 and submit copies to the Owner, Engineer, Local Fire Chief and ISO Commercial Risk Services, Inc.
   9. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   10. Flush, test, and inspect sprinkler systems according to NFPA 13, "System Acceptance" Chapter.
   11. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
   12. Energize circuits to electrical equipment and devices.
   13. Coordinate with fire-alarm tests. Operate as required.
   14. Coordinate with fire-pump tests. Operate as required.
   15. Verify that equipment hose threads are same as local fire-department equipment.

3.7 SPRINKLER SCHEDULE

A. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Upright, Pendent, and Sidewall Sprinklers: Rough bronze.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
   a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
   b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
   c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions:

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.2 SCOPE OF WORK

A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the plumbing systems, in strict accordance with Division 22 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.
B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.
C. Examine site and all Contract documents prior to submittal of bid.

1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.

D. Division 22 Work: Includes, but is not limited to, providing the following:

1. Potable Water Distribution System: Fixtures, piping, equipment.
2. Waste and Vent Systems: Piping and specialties.

1.3 SUBMITTALS

A. General:

1. Preferred Submittal Format: PDF, unless otherwise noted.
2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
   a. [Specification Section Number] – [Specification Name or Equipment Included]
3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 22 submittals to:

Caleb Bulow, P.E.
PRAIRIE ENGINEERING, P.C.
1905 17TH STREET SE
MINOT, ND 58701
cbulow@prairieengineeringpc.com

B. Substitution and Prior Approval to Quote:

1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
   a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Shop Drawings

1. Distribution: Engineer via the Prime Contractor for each item indicated.
2. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
   a. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. Email message text not acceptable.
   b. Non-Conforming: Returned to Contractor without review.
3. Submission Timing: Prior to delivery of materials to job site.

D. Record Drawings

1. Format and Content: Paper copy of Drawings project site.
   a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
   b. Give particular attention to marking actual locations of underground piping.
   c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
   d. Make Record Drawings available to Engineer during project visitation.
2. Submission Timing: Close of project with Record Manuals.

E. Spare Equipment and Devices

1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

F. Operation and Maintenance Manuals

1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
3. Format and Content: Two copies, Loose-leaf hardcover binders, and in PDF format on CDs or USB drive.
    a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD.
    b. Include an index sheet indicating subcontractor and subcontractor’s phone number; and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
    c. Include a copy of the Shop Drawings.
    d. Include all installation, operation and maintenance data packaged with any equipment.
    e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers

1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

1.5 AUTHORITIES AND AGENCIES

A. Materials, workmanship and installation: Comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
B. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.
C. Codes and standards shall include, but not necessarily be limited to, the following:

1. International Energy Conservation Code (IECC);
2. Uniform Plumbing Code;
3. North Dakota State Building Code;
4. International Building Code (IBC);
5. International Mechanical Code (IMC);
6. International Fuel Gas Code (IFC);
7. National Fire Protection Association (NFPA) – Sections as adopted by authority having jurisdiction.

D. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.

1. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
2. Meeting the minimum standards of the above Codes does not permit a lower grade of construction where Plans or Specifications call for workmanship or materials in excess of Code Requirements.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 GUARANTEE AND WARRANTY

A. Except where otherwise noted, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year after Owner's beneficial use of the building or mechanical system. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner during that one year period.
B. Guarantee shall include trips to the project site by Contractor to adjust mechanical equipment as required, ensuring it is operating as intended.
C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

1.7 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.8 NOMENCLATURE

A. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.
B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

2.2 ELECTRIC WIRING

A. The Division 22 Contractor shall furnish all motors, special controls and electrical devices as specified herein for proper operation of the equipment furnished.
B. Division 26 Contractor shall furnish and install, as required, disconnects, starters, switches, etc., and do all necessary power and control wiring including the installation of electrical devices such as thermostats, humidistats, remote control panels, etc., furnished separately by Division 22 Contractor, unless otherwise noted in Equipment Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques,

sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.
C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

3.2 SURFACE CONDITIONS

A. Prior to work of each Section of Division 22, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.
C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.4 COORDINATION

A. Order material in a timely fashion to assure it is on the job site when required.
B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.
C. Division 22 piping, duct and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Mechanical ducts and pipes shall not be installed in the space near electrical panels/equipment defined as "working spaces" or "dedicated spaces".

3.5 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
2. Do not proceed with installation in area of question until conflict has been fully resolved.
3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Drawings indicate extent and general layout of plumbing systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and

operating system in general conformance with Specifications and Drawings.

2. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
3. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
4. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.6 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities to pre-construction condition.
B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Section 230530 of the Specifications by this Contractor.

3.7 OFFSETS

A. Where required to allow clearance of ducts, electrical conduit and outlet boxes, beams, etc., to avoid interference with work of other trades, to increase head room under pipes or to improve the appearance of pipe work, this Contractor shall offset his pipes as directed by the Architect/Engineer.

3.8 CUTTING AND PATCHING

A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Plumbing Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.
B. Fire-Barrier Penetrations

1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
2. See Specification Section 220510 for other Fire-Barrier Penetration requirements.
3. See Section 2 article “Materials” of this Specification for approved fire stop system material.

C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.
D. Use only rotary type drilling tools to cut concrete.
E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.9 FIELD QUALITY CONTROL

A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.
B. Piping Inspections:

1. Perform tests specified below in presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
b. Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

C. Domestic Water Service Piping Tests: Test water service piping as required by the Authority Having Jurisdiction or the Plumbing Code, or, in absence of published procedures, as follows:

1. Testing: Before the joints are covered in order for leaks to be detected.
2. Pressure: Minimum of 125 psig.
3. Duration: Two (2) hours.
4. Valves: Operating test shall be performed on all valves when system is under full pressure to ensure proper operation. Perform multiple times during test to ensure proper operation.
5. Certification: Backfilling shall not be resumed until test results and work have been approved by Architect/Engineer.

D. Domestic Water, Sanitary, and Vent Piping Tests: Test domestic water, sanitary, and vent piping as required by the Authority Having Jurisdiction or the Plumbing Code, or, in absence of published procedures, as follows:

1. Domestic Water Piping:
   a. Pressure: Minimum of 125 psig.
   b. Duration: Two (2) hours.
2. Sewer, Soil, Waste, Drain and Vent Piping:
   a. Procedure: Close all openings and pressurize with air.
   b. Pressure: Minimum of 5 psig.
   c. Duration: 15 minutes.
   d. System may be tested in its entirety or in sections.
3. Building sewer from the building to the sewer main:
   a. Insert a test plug at the point of connection with the Public sewer.
   b. Pressure: 10 feet water head.
   c. Duration: 15 minutes, constant water level.

E. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.10 ADJUSTING

A. Perform the following domestic water adjustments before operation:

1. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
2. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 INSTRUCTIONS

A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's plumbing systems and equipment.
B. Division 22 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus.
C. Formal instructions shall be video recorded when required by other Sections of this Specification by this Contractor. Format shall be DVD. Formal instruction to be included with each Record Manual, being referenced to and a part of the Manual.

3.12 CLEAN UP

A. Each Contractor shall be responsible for cleaning up after his work, including the removal of all scrap material left on the job by his men or Subcontractors. This will include the removal of all pipe cuttings, pieces of pipe and insulation and other debris.
B. After all tests have been made and the plumbing systems are operating properly, this Contractor shall go over the entire system and remove labels from all plumbing fixtures and other plumbing equipment.
C. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Hangers.
5. Escutcheons.

B. Nomenclature:

1. SWP: Steam working pressure.
2. CWP: Cold working pressure.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 220500.

1. Product Data: Each type of valve, gauge, strainer, sleeve, and sleeve-seal system.
2. Fire-Barrier Penetrations: UL Classified System, System Number.

B. Operation and Maintenance Manual: Per section 220500.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.
B. Standard and Rating: Comply with NSF-61-G.

2.2 BALL VALVES

A. Two-Piece, Full-Port, Metal, Ball Valves:

1. Standard and Rating: 250 psi CWP at maximum 250°F.
2. Body Design: Two piece
3. Body Material: Forged brass or Bronze.
4. Seats: PTFE or TFE.
5. Stem: Brass or Bronze, blowout-proof, packing nut.
6. Ball: Chrome-plated brass.
7. Port: Full or Regular.
8. Operator: Lever; separate lever nut.

2.3 BUTTERFLY VALVES

A. Iron, Single Flange Butterfly Valves:

1. Basis of Design: Nibco LD 2000
2. Standard and Rating: MSS SP-67, 200 psig, 5°F to 250°F.
3. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange; extended neck.
4. Body Material: Epoxy coated; ASTM A 126, cast iron or ASTM A 536, ductile iron; EPDM seat.
5. Stem: One- or two-piece stainless steel.
6. Disc: Aluminum bronze.
7. Operator: Lockable handle for 5” and smaller, gear for 6” and larger.

2.4 CHECK VALVES

A. Check Valve – Bronze Swing:

1. Standard and Rating: 200 psig CWP at 100°F.
2. Body Design: Y-pattern.
3. Body Material: Bronze.
4. Disc: Bronze or PTFE.

2.5 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Clevis type with locknut to threaded extension rod, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or cadmium plated steel.

B. Copper Pipe Hangers:

1. Description: Clevis type with locknut to threaded extension rod, copper-coated-steel, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

C. Trapeze Pipe Hangers:

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

D. Plastic Pipe Support Channel

1. Description: 18 Ga. steel v-channel; standard finish.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

2.7 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.8 FIRE-BARRIER PENETRATIONS

A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with Approved firestop materials. See Section 220500 for further details.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
B. Install calibrated-orifice, balancing valves where shown on drawings.
C. Install valves in horizontal piping with stem at or above center of pipe in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or butterfly valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.3 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
B. Metal Trapeze Pipe-Hanger Installation: Arrange for grouping of parallel runs of horizontal piping, and support together on trapeze pipe hangers.
C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
G. Install lateral bracing with pipe hangers and supports to prevent swaying.
H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
I. Insulated Piping:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4” and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4” and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. 4” and smaller: 12 inches long and 0.06 inch thick.
   b. 5” and larger: 18 inches long and 0.06 inch thick.
5. Pipes 8” and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

J. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
K. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

L. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
M. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
N. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
O. Use thermal-hanger shield inserts for insulated piping and tubing.
P. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.

Q. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20 or 25): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod.

R. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

S. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

T. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.4 ESCUTCHEON AND FLOOR PLATE INSTALLATION

A. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors of finished areas.
B. Install escutcheons for piping penetrations of walls within concealed cabinet spaces.
C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
D. Replace broken and damaged escutcheons using new materials.

3.5 FIRE-BARRIER PENETRATION PROTECTION

A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
B. Provide intumescent collars, wraps, fire bands, sealants, and other firestopping materials as required to maintain the fire ratings for the piping and insulation materials used.
C. Install Fire Stop Systems per the manufacturers guidelines.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe 2” and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full or regular port, brass or bronze.
3. Check Valve – Bronze Swing.

B. Pipe 2-1/2” and Larger:

1. Butterfly Valves.
2. Check Valves: Bronze Swing.

END OF SECTION

SECTION 220600
WATER SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Water service pipe.
2. Water meter.
3. Gate valves.
4. Transition couplings.
5. Service and tapping saddles.

B. Nomenclature:

1. SWP: Steam working pressure.
2. CWP: Cold working pressure.

1.2 SCOPE OF WORK

A. The work covered under this Section shall include the furnishing of the labor, equipment and materials necessary for a complete water service to building as shown on Drawings.

1.3 RELATED SECTIONS

A. See Section 230530 of the for Excavation and Backfill.

1.4 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 220500.
B. Product Data: Provide data on materials in accordance with Section 220500 for all piping, fittings, valves, fire hydrants, corporation stops, curb stops, tapping sleeves, service and tapping saddles, transition couplings, pipe adapters, and specialties.
C. Manufacturer's Instructions: For valves, hydrants, and specialties, furnish in accordance with Section 220500.
D. Provide all special tools required for valves, hydrants, and specialties.
E. Provide records of measured depths of water mains, service leads, valves, connections, transition couplings, adapters, thrust blocking; measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements; measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work; and field changes of dimension and detail.

1.5 QUALITY ASSURANCE

A. Potable-water piping and components shall comply with NSF 60 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

1.6 AUTHORITIES AND AGENCIES

A. Materials, workmanship and installation: Comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
B. Obtain and pay all permits, inspections, licenses for any tapping, connection or initial meter fees and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

PART 2 - PRODUCTS

2.1 WATER SERVICE PIPE

A. Polyvinyl Chloride (PVC) Pipe:

1. AWWA C900 DR-18, 235 psi for sizes 4 inches to 12 inches in diameter.
2. All pipe to have standard ductile iron pipe outside dimension.
3. Ductile Iron Fittings:
4. C900 PVC pipe (4 inches to 12 inches): Grip-Tite, SSB, ductile iron Class 350 fittings conforming to ANSI/AWWA C153/A21.53 compact push-on fittings.
5. PVC fittings maybe used in-lieu of ductile iron fittings for PVC pipe installations 12 inches and smaller. PVC fittings shall meet all applicable requirements of the latest edition of AWWA C900 and AWWA C907.
6. Provide restrained joints and fittings where so indicated on the drawings.
7. Push-on or mechanical rubber gasket joints conforming to the compression gasket ring requirements of ANSI/AWWA C111/A21.11 and ASTM D3139, and as shown on Drawings.
8. Cement line pipe fittings in accordance with ANSI/AWWA C104/A21.4.
9. Buried and submerged ductile iron pipe fittings shall have a bituminous exterior coating (asphalt coating).
10. Encase buried ductile iron pipe fittings with polyethylene conforming to ANSI/AWWA C105/A21.5.
11. Provide stainless steel nuts, bolts, and glands.
12. Nuts, bolts, glands, and gaskets incidental.

B. Ductile Iron Pipe:

1. All ductile iron pipe for water service shall be mechanical joint Class 52 350 PSI pipe conforming to AWWA C-151 and AWWA C-153 for joint. Piping shall include all joint accessories, gasket follower gland and bolts. Fittings shall be furnished with mechanical joint bell on all openings. Use retainer glands on elbow at riser.
2. Retainer glands, and restraint rings shall be Ebaa ‘Megalug’ type with wedge style design.
3. Mechanical joint tee head bolts, square head bolts and hex nuts shall be all stainless steel type. Install with anti-seize compound to ease installation of fittings.
4. Ductile iron flanges shall be secured to floor/wall with threaded rod that has been securely fastened to concrete floor or wall.
5. Ductile iron shall be used for fire sprinkler riser.
6. A magnesium sacrificial anode will be cad welded to the ductile iron fire riser per detail noted on the drawings. Anode shall be equivalent to Farwest Corrosion Control Company ProMag H-1 Standard Potential, Model 17D3, 17 lb magnesium anode. Anode shall be fabricated per ASTM B843 Industry Standard for AZ63B(H-1A) standard potential anodes. Anode shall be nominal 25” long and have 10 foot of #12 THHN insulated solid core copper lead wire. Anode shall be pre-packaged in cloth bag containing 75% hydrated gypsum, 20% bentonite and 5% silicon Sulfate backfill material to maintain moisture around the anode to reduce earth resistance.

2.2 WATER METER

A. Furnish and install a 2” meter of the type approved by the Water Department.

1. Meter shall have a self-generating remote readout.

2.3 GATE VALVES

A. Description: Ductile iron resilient wedge gate valve.

1. Meet or exceed the ANSI/AWWA C509 standards.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. American Flow Control.
2. Mueller Company.
3. Waterous Valve Company.
4. A.P. Smith Valve Company.
5. M & H Valve Company.
6. Clow Valve Company.

C. Valve Features:

1. Minimum working pressure of 200 psi for 4-inch to 12-inch valves.
2. Equipped with non-rising stem with 2-inch square operating nut, open left (counter clockwise) rotation.
3. Push-on joints for gate valves 12 inches and smaller.
4. Tapping valve should provide flanged end to connect to tapping sleeve.

D. Materials:

1. Valve Body: Ductile iron or cast iron, epoxy-coated interior and exterior.
2. Wedge: Ductile iron or cast iron encapsulated with EPDM rubber.
3. Stem and Stem Nut: Bronze or ductile iron.
4. Seat: Resilient gate, bubbletight closure design.
5. Nuts and Bolts: Stainless steel.

E. Accessories:

1. Provide two-piece adjustable valve box, riser, cover marked “Water”, T-wrench of sufficient length (one wrench for each five valves installed), and polyethylene encasement conforming to ANSI/AWWA C105/A21.5 for buried valves.

2.4 TRANSITION COUPLINGS

A. Description: Insulating boot to stop electrolytic action between piping of dissimilar metals.

1. Rating: Minimum 250 psi.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Power Seal
2. Ford Meter Box Company
3. Romac Industries, Inc.

C. Materials:

1. End and Center Rings: Ductile iron, epoxy or nylon coated inside and out.
2. Fasteners: Stainless steel.
3. Boot: EPDM.
4. Gaskets: SBR.

D. Where pipes of dissimilar metal are joined, ensure dielectric insulation to prevent galvanic corrosion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that municipal utility water main size, location, and invert elevations are as indicated.

3.2 PREPARATION AND STORAGE

A. Store pipe on-site on flat surface so barrel is evenly supported. Do not stack higher than six (6) feet. Cover pipe with opaque material for extended storage. Keep ends of stored pipe covered until installation.
B. Remove scale and dirt on inside and outside of pipe, fittings, valves, and appurtenances before assembly. Inspect pipe and other materials for damage before installation.

3.3 BEDDING

A. Hand trim excavation for accurate placement of pipe to elevations indicated.
B. Form and place concrete for pipe thrust restraints at any change of pipe direction, tee, plug, or hydrant. Place 3,000 psi concrete to permit full access to pipe and pipe accessories. Comply with details on Drawings for bends, tees, fire hydrants, and service tap connections.

3.4 INSTALLATION - PIPE, VALVES, AND APPURTENANCES

A. Install all pipe and appurtenances in strict accordance with manufacturer's recommendations and in accordance with AWWA 600 and AWWA C605, as applicable.
B. Install water main, service leads, and appurtenances so as to avoid existing utilities.
C. All foreign material or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench and it shall be kept clean by approved means during and after laying.
D. Cut pipe in a neat and workmanlike manner without damaging the pipe.
E. Contractor may, in suitable locations, install pipe by trenchless methods for convenience. If trenchless method requires substitution of pipe material, new pipe material shall meet equivalent pressure class and inside diameter of new pipe material shall be equal to or greater than specified PVC material. Damage to existing utilities resulting from trenchless installation methods shall be Contractor’s responsibility to repair damaged utility.
F. All trenches, excavations, and boring pits shall be sheathed and braced, as necessary, so as to provide a safe place for workmen. Comply with all applicable OSHA safety requirements relating to trenching, boring operations, confined spaces, and other aspects of this type of construction.
G. Keep trenches free from surface and ground water until pipe jointing is complete.
H. Locate curb stop valves, and gate valves a uniform distance from property line, utility easement line, back of curb, or other applicable line, when so required by municipal code or policy or so directed by Engineer.
I. All hydrants, valves, and fittings shall be set on cast in place or precast concrete blocks in order to prevent the weight from being transmitted to the pipe.
J. Form and place concrete for thrust blocking at each bend, tee, change of direction, plug, or hydrant. Thrust blocks shall bear on undisturbed trench wall.
K. When pipe laying is not in progress, the open end(s) of the pipe and fittings shall be plugged. The temporary plug shall be the same size and type used to make a permanent closure to insure a watertight plug and absolute cleanliness inside the pipe.
L. Install valve boxes plumb and directly over valve.
M. Pipe and Service Lead Installation:

1. Contractor shall acquire a water tapping permit for tapping any existing water main. Contractor shall pay permit fee. Contractor may choose to hire the City Water Department to make the tap.
2. Install water main and water service leads at a minimum depth of cover of 8 feet.
3. Install pipe to allow for expansion and contraction without stressing pipe.
4. Install pipe such that maximum deflections from straight line or grade do not exceed

manufacturer's specifications. Install bend fittings where maximum deflections are exceeded.

5. Locate water service leads and curb stops with the property owner when such locations are not shown on the Drawings.
6. Install access fittings to permit disinfection of water system .

N. Encase all metallic pipe, fittings, valves, fire hydrants, service saddles, couplings, connectors, and other appurtenances in polyethylene sheeting or tubing in accordance with AWWA C105.
O. Inspection: Do not cover pipe, fittings, valves, couplings, or hydrant barrels until all bedding, joints, and polyethylene wrap have been inspected.
P. Contractor shall be responsible for cleaning and restoring to full operation of property owner's internal operation (i.e. flow meter, backflow preventer, fire protection, sprinkler line, etc.) if as a result of connecting to existing service lead internal operation is adversely affected.
Q. Flange on fire sprinkler line shall be installed level with bolt pattern on flange set so valve stems connected to line can be installed parallel or perpendicular to wall.
R. Fire sprinkler line flanges shall be secured to floor/wall with threaded rod that has been securely fastened to concrete floor or wall.

3.5 SEWER CROSSING REQUIREMENTS

A. Install water mains no closer than a horizontal distance of 10 feet from sewer lines, except: when crown of sewer is at least 18 inches below invert of the water main and the sewer is laid in a separate trench or water main is laid to one side of common trench on a bench of undisturbed soil, separation shall be 6 feet horizontally.
B. Install water main no closer than a vertical distance of 18 inches between the invert of top pipe and crown of bottom pipe at crossings.
C. Where new water main crosses an existing sewer:

1. Center a full standard pipe length of water main over (or under) sewer if crossing is within 3 feet above sewer or below sewer.
2. No additional protection required if water main is at least 3 feet above sewer.

D. Provide thoroughly compacted backfill between pipes where a new pipe crosses a new or existing pipe for adequate support.

3.6 WATER METER INSTALLATION

A. Install a ball valve on each side of the meter. Construct a steel angle frame or pour a concrete pad under meter to support weight. Paint support frame black.
B. Where required by local authority: Install a bypass line with valve parallel to the meter.

3.7 PRESSURE TEST

A. Domestic Water Service:

1. Trench may be partially backfilled, leaving the joints exposed for examination.
2. All newly laid piping or any valved section of water line or piping: hydrostatically tested at 125 PSI for minimum of 2 hours.
3. Exposed pipe, joints and fittings shall be carefully examined during the partially open trench test.
4. Each valve shall be opened and closed several times during the test.
5. Joints showing visible leakage shall be replaced or remade as necessary.
6. Cracked or defective pipe, joints, fittings or valves shall be removed and replaced with sound material.
7. Test shall be repeated until the test results are satisfactory.

8. All replacement and repair shall be without additional expenses to the Owner.
9. Backfilling shall not be resumed until test results and work have been approved by Architect/Engineer.

B. Underground Fire Sprinkler Service Piping.

1. All new fire service mains: Hydrostatically tested at 200 PSI for a minimum of 2 hours. If maximum static pressure is 150 PSI or greater, pressure test shall be at 50 PSI greater than maximum static pressure. Tests shall be performed before the joints are covered in order for leaks to be detected.
2. Leakage from new pipe and fittings shall not exceed two quarts/hr per 100 joints or gaskets irrespective of pipe diameter. Leakage for metal seated valves may increase above leakage rate by one fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section.
3. An operating test shall be performed on all control valves when system is under full pressure to ensure proper operation.
4. Test shall be performed by the Contractor in the presence of the authority having jurisdiction or the representative of the owner. On completion of the test, the Contractor shall complete the "Contractor's" Material & Test Certificate For Underground Piping" contained in NFPA 2 and submit copies to the Owner, Engineer, Local Fire Chief and ISO Commercial Risk Services, Inc.

C. Flushing of Pipe.

1. Underground mains and fire sprinkler service lines to system risers shall be flushed prior to connection to sprinkler piping. Piping shall be flushed for a significant time period to ensure piping has been thoroughly flushed. Minimum flow rate shall not be less than:
   a. Hydraulically calculated water demand rate of system including hose requirements OR
   b. Flow necessary to provide a velocity of 10 ft. per sec. or greater OR
   c. Maximum flow rate available to the system under fire conditions.

3.8 DISINFECTION OF POTABLE WATER SYSTEM

A. New potable water systems shall be disinfected prior to use whenever required by the Authority having jurisdiction. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by the Health Authority, the following:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed follow procedures described below:
3. Flush piping system with clean, potable water until dirty water does not appear at outlets.
4. Fill and isolate system according to either of the following:
5. Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
6. Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
7. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
8. The procedure shall be repeated if it is shown by a bacteriological examination, made by the Authority, that contamination still persists in the system.

END OF SECTION

SECTION 220700
PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic water piping.

B. The work covered by this Specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the plumbing systems, in strict accordance with Section 220700 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

1.2 REFERENCE

A. Related work in Section 230700 “HVAC Insulation.”

1.3 SUBMITTALS

A. Shop Drawings: For materials covered under this section as per Section 220500.
B. Operation and Maintenance Manual: Per section 220500.

1. Product Data: Each type of insulation.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. All insulation shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:

1. Owens-Corning Fiberglass.
2. Johns Manville.
3. Knauf Insulation.

B. All manufacturers are subject to compliance with requirements.
C. Provide products by one of the manufacturers specified or by prior approval.

2.2 COMMON INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable

according to ASTM C 795.

2.3 INSULATION

A. Fiberglass Wrap: Glass fibers bonded with a thermosetting resin; FSK or ASJ Max jacket. Comply with ASTM C 553, Type II and ASTM C 1290, Type I and Type III.
B. Fiberglass Board: Glass fibers bonded with a thermosetting resin, semi-rigid; FSK or ASJ Max jacket. Comply with ASTM C 612, Type IA or Type IB.
C. Fiberglass, Preformed Pipe Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.

2.4 INSULATION JACKETS

A. ASJ Max Jacket: Poly-encapsulated paper jacket; Factory applied shall comply with ASTM C1136, Type I, II, III, IV.
B. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; Factory applied shall comply with ASTM C 1136, Type II.

2.5 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.6 SEALANTS

A. Joint Sealants: Permanently flexible, elastomeric sealant, compatible with insulation materials, jackets, and substrates.

2.7 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

2.8 TAPES

A. Tapes: Match jacket with compatible adhesive as recommended by jacket manufacturer.
B. ASJ Max Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.
C. FSK Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.

2.9 SECUREMENTS

A. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    1. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    2. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    3. Adhesive-backed base with a peel-off protective cover.
B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
C. Wire: 12 gauge nickel-copper alloy or 14 gauge soft-annealed, stainless steel or 14 gauge soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of pipes and fittings.
C. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
D. Install insulation with jackets as follows:

1. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip.
2. Overlap jacket longitudinal seams at least 1-1/2 inches. Staple laps with outward clinching staples along edge.
3. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

E. Insulation Installation on Fittings, Valves, and Unions:

1. Install with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate fittings and specialties using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive.
3. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic and reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
4. Stencil or label the outside insulation jacket of each union with the word "union."

F. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
B. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire-rated wall and partition penetrations.

1. See Specification Section 220510 for further Fire-Barrier Penetration requirements.

C. Floor Penetrations: Install insulation continuously through floor penetrations. Seal penetrations through fire-rated assemblies.

1. See Specification Section 220510 for further Fire-Barrier Penetration requirements.

3.4 FIBERGLASS PREFORMED PIPE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with

outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.5 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.6 PIPING INSULATION SCHEDULE

A. Indoor, Aboveground:

1. Domestic Cold Water:
   a. 1-1/4” diameter pipe and smaller: Fiberglass, 1” thick, R-4 minimum.
   b. 1-1/2” diameter pipe and larger: Fiberglass, 1-1/2” thick, R-6 minimum.

2. Domestic Hot Water: 140°F and Below.
   a. 1-1/4” diameter pipe and smaller: Fiberglass, 1” thick, R-4 minimum.
   b. 1-1/2” diameter pipe and larger: Fiberglass, 1-1/2” thick, R-6 minimum.

END OF SECTION

SECTION 221100
PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Pipe and fitting materials, and joining methods for the following:
   a. Domestic water distribution piping.
   b. Sanitary waste and vent.
2. Sacrificial anode for fire riser.

1.2 REFERENCE

A. Refer to Section 220510 "Common Work Results for Plumbing" for requirements of hangers, sleeves, sleeve seals, and escutcheons.

1.3 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 220500.

1. Product Data: Provide a separate shop drawing for each of the following piping systems showing the material and fastening method chosen by the contractor:
   a. Aboveground domestic water.
   b. Underground domestic water.
   c. Aboveground sanitary waste and vent.
   d. Underground sanitary waste and vent.

B. Operation and Maintenance Data: Equipment listed under Product Data article above as per Section 220500.

1.4 QUALITY ASSURANCE

A. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
B. Non-potable water piping materials shall bear stamp or other markings of testing agency.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper
B. Soft Copper Tube: ASTM B 88, Type K, annealed temper.
C. Grooved-End Copper Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
   a. Anvil International, Inc.
   b. Victaulic Company.
2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 °F for use with housing, and steel bolts and nuts.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
E. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

F. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
   a. Apollo Valves.
   b. NIBCO, Inc.
   c. Viega, LLC.
2. Fittings for 2” and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for 2-1/2” to 4”: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.2 MECHANICAL-JOINT, DUCTILE-IRON PIPE

A. AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
B. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
C. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and stainless steel bolts.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.
B. CISPI, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40.
B. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
C. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

1. Flame Spread: Less than 25 per ASTM E84/UL723.
2. Smoke Developed Index: Less than 50 per ASTM E84/UL723.

2.5 PVC, AWWA PIPE

A. AWWA C900, Class 150, with bell end with gasket, and with spigot end.
B. Comply with UL 1285 for fire-service mains if indicated.
C. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
D. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.6 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

2.7 HIGH DENSITY POLYETHYLENE (HDPE) POTABLE PIPING

A. All pipe and heat-fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM D2513, sections 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D3035 or D2447.
B. The material shall have a Hydrostatic Design Basis of 1600 psi at 73°F per ASTM D2837. The material shall be a high-density polyethylene compound having a minimum cell classification of PE345464C per ASTM D3350.
C. Dimensions

1. Smaller than 3” shall be manufactured in accordance with ASTM D3035 with a minimum dimension ratio of 11.
2. 3” and larger shall be manufactured in accordance with ASTM F714 with a minimum dimension ratio of 17.

D. Heat fused fittings in accordance with pipe manufacturer’s procedures.
E. Fusion transition fittings with reinforced threads shall be used to adapt to metal or reinforced hose connection fittings. Barbed fittings are not an acceptable transition to polyethylene pipe.

2.8 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.
B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
C. Manifold: Multiple-outlet, corrosion-resistant-metal assembly complying with ASTM F 877; with corrosion-resistant-metal valve for each outlet.

2.9 PE-RT PIPING AND FITTINGS

A. PE-RT Distribution System: ASTM F2769 for potable water.
B. Fittings for PE-RT Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PE-RT tube dimensions.
C. Manifold: Multiple-outlet, corrosion-resistant-metal assembly complying with ASTM F2769; with corrosion-resistant-metal valve for each outlet.

2.10 PP POTABLE PIPING AND FITTINGS

A. PP Potable Pipe and Fittings: ASTM F 2389, pipe extruded and drainage-pattern fittings molded, from virgin PP-RCT resin; with heat fusion-joint ends.

1. Domestic hot water piping shall contain a fiber layer to restrict thermal expansion.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or prior approved:

1. Aquatherm Green Pipe; Aquatherm, NA.
2. Niron; Nupi Americas.

C. Transition Fittings: Threaded transition fittings shall be used where a threaded connection is required.

2.11 PIPING JOINING MATERIALS

A. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
B. Joining system for FRP as recommended by manufacturer.

2.12 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings shall be CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions, and one end with threaded brass or stainless steel insert and one solvent-cement-socket end.
B. Plastic-to-Metal Transition Unions shall be CPVC four-part union with brass threaded end, solvent-cement-joint plastic end, rubber O-ring gasket, and union nut.

2.13 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 °F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

2.14 SACRIFICIAL ANODE

A. Description: Magnesium sacrificial anode for fire riser.

1. Standard: Fabricated per ASTM B843 for AZ63B(H-1A) standard potential anodes.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or prior approved:

1. Farwest Corrosion Control Company.

C. Basis of Design: ProMag H-1 Standard Potential, Model 17D3.
D. Length: 25” long.
E. Accessories:

1. 10 foot of #12 THHN insulated solid core copper lead wire.
2. Anode shall be pre-packaged in cloth bag containing 75% hydrated gypsum, 20% bentonite and 5% silicon Sulfate backfill material to maintain moisture around the anode to reduce earth resistance.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping.

B. In general, it is intended that piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.
C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Exposed piping shall be run as high as possible except where noted otherwise.
D. Piping shall be fabricated from Contractor's Shop Drawings or field measurements and not from Contract Drawings.
E. Extend plumbing piping to 5 feet from outside face of building wall for connection to building services, including water, fire, waste, and storm piping.
F. This Contractor shall verify all inverts of existing mains and elevations with reference to existing and finish grades. Minimum depth of bury for water lines is 8'0".
G. On water-supply and fire-service lines 4" and larger, install poured concrete thrust blocks at tees, elbows and at base elbow on domestic and fire water service risers in building. Blocks shall be poured against undisturbed earth of trench wall.
H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
I. Install waste piping 3” and smaller at 1/4” slope, and 4” and larger at 1/8” slope. Vent and storm piping shall be 1/8” slope, unless otherwise noted.
J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
K. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221300 "Sanitary Waste Piping Specialties."
L. Install piping to permit valve servicing.
M. Install piping free of sags and bends.
N. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
P. Install sleeves for piping penetrations of walls, ceilings, and floors.
Q. Install sleeve seals for piping penetrations of below grade concrete walls and slabs.
R. Install escutcheons (chrome plates) for exposed piping penetrations of finished walls, ceilings, and floors.

3.2 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.
B. Transition Fittings in Aboveground Domestic Water Piping 2” and Smaller: Plastic-to-metal transition fittings.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for 2” and Smaller: Use dielectric unions.

3.4 FIRE SERVICE INSTALLATION

A. Flange on fire sprinkler line shall be installed level with bolt pattern on flange set so valve stems connected to line can be installed parallel or perpendicular to wall.
B. Fire sprinkler line flanges shall be secured to floor/wall with threaded rod that has been securely fastened to concrete floor or wall.
C. Cad weld magnesium sacrificial anode to the ductile iron fire riser per detail noted on the drawings.
D. Install anti-seize compound to ease installation of fittings.
E. Install retainer glans on elbow at riser.

1. Retainer glans and restraint rings shall be Ebaa ‘Megalug’ type with wedge style design.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 50 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 50 feet or longer.
3. Install trapeze hanger for multiple parallel piping 50 feet or longer.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

B. Install hangers for steel piping as follows:

1. 1” and smaller: 8 feet with 3/8-inch rod.
2. 1-1/4” to 3”: 10 feet with 3/8-inch rod.
3. 4” to 6”: 12 feet with 1/2-inch rod.
4. 8” and larger: 12 feet with 5/8-inch rod.

C. Install hangers for drawn-temper copper piping as follows:

1. 1-1/2” and smaller: 6 feet with 3/8-inch rod.
2. 2” to 4”: 10 feet with 3/8-inch rod.
3. 6” and larger: 10 feet with 1/2-inch rod.

D. Install hangers for CPVC, PVC, and PP as follows:

1. 1” and smaller: 3 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8” rod.
2. 1-1/4” to 3”: 4 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8” rod.
3. 4” to 6”: 4 feet with 1/2-inch rod; 10 feet with pipe support channel and 1/2” rod.
4. 8” and larger: 4 feet with 5/8-inch rod; 10 feet with pipe support channel and 5/8” rod.

E. PEX and PE-RT:

1. 1” and Smaller: 3 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8” rod.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
G. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

3.6 FIELD QUALITY CONTROL, ADJUSTING, CLEANING

A. Comply with requirements in Section 220500 “Plumbing General Provisions”.

3.7 PIPING SCHEDULE

A. Do not use flanges or unions for underground piping.
B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
C. Piping materials are identified below. If more than one material is listed for an application, selection from materials listed is Contractor's option.
D. Underground water-service piping 4” and 6”:

1. Soft copper tube, Type K, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
3. PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.

E. Aboveground water-service piping 4” and 6”:

1. Hard copper tube, Type K, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

F. Under-building-slab, domestic water, building-service piping:

1. 3” and smaller:
   a. HDPE; heat fused fittings in accordance with pipe manufacturer’s procedures.
   b. Soft copper tube, Type K, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. 3” and larger: Bell and spigot, ductile-iron pipe.

G. Under-building-slab, domestic water piping:

1. 1” and smaller: PEX and PE-RT tube, no joints; Soft copper tube, Type K, Type L, no joints; PP Potable Piping, heat-fused fittings; PE-RT tube, no joints or heat-fused fittings.
2. 3” and smaller: HDPE, heat fused fittings; PP Potable Piping, heat-fused fittings.

H. Aboveground domestic water piping:

1. All sizes: Hard copper tube, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. 2-1/2” and larger: Hard copper tube, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
3. 4” and smaller: Hard copper tube, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

I. Underground Fire-Service-Main Piping 4” to 8”:

1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
2. Beyond 5 feet from outside face of building wall: PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.

J. Aboveground Fire-Service-Main Piping 4” to 8”: Ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
K. Change of direction fittings for vent, soil, and waste pipe:

1. Soil and waste piping: Long-sweep bends.

2. Vertical stacks change of direction from horizontal to vertical: Sanitary tees and short-sweep 1/4 bends acceptable.
3. Back to back or side by side fixtures with common drain pipe: Long turn, double Y-branch and 1/8-bend fittings.

L. Aboveground, vent, soil, and waste piping:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   a. Exception: PVC shall not be used for 20 feet from waste receptacle where waste stream is 140°F or greater, such as from commercial dishwashers.
3. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
4. Additional option for piping 4” and smaller: Copper DWV tube, copper drainage fittings, and soldered joints.

M. Underground, vent, soil, and waste piping:

1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   a. Exception: PVC shall not be used for 20 feet from waste receptacle where waste stream may exceed 140 °F, such as from commercial dishwashers.
3. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

END OF SECTION

SECTION 221200
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Hose bibbs.
4. Drain valves.
5. Water-hammer arresters.
6. Trap-seal primer valves.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 220500.
B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 220500.

1.3 QUALITY ASSURANCE

A. Comply with NSF 61, "Drinking Water System Components - Health Effects," for potable-water storage tanks. Include appropriate NSF marking.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig minimum unless otherwise indicated.
B. For products where a list of pre-approved manufacturers is not provided, the submitted product must be equivalent to the indicated basis of design.

2.2 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

1. Basis of Design: Watts Regulator Co. NF8
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded.
5. Finish: Rough bronze.

2.3 BACKFLOW PREVENTERS

A. Description: Potable water protection valve assemblies.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Apollo Valves.
2. Watts.
3. Zurn.

C. Double-Check, Backflow-Prevention Assemblies:

1. Basis of Design: Watts Regulator Co. 007.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.

4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Body: Bronze for 2” and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for 2-1/2” and larger.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
   a. Valves 2” and Smaller: Ball type.
   b. Valves 2-1/2” and Larger: Outside-screw and yoke-gate type.

2.4 HOSE BIBBS

A. Hose Bibbs:

1. Basis of Design: Watts Regulator Co. SC8.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Outlet Connection: Garden-hose thread.
5. Vacuum Breaker: Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
6. Equipment Rooms: Rough bronze finish, wheel or tee handle operation.
7. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.5 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Equivalent to Watts Regulator Co. Series BD-QT.
2. Pressure Rating: 150-psig minimum CWP.
3. Size: 3/4”.
4. Body: Forged Brass.
5. Ball: Chrome-plated brass.
6. Stem Packing: Teflon.
7. Handle: Aluminum or Vinyl-covered steel.
8. Outlet: Threaded, short nipple with garden-hose thread and cap with brass chain.

2.6 WATER-HAMMER ARRESTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. AMTROL, Inc.
2. Josam Company.
3. Sioux Chief Manufacturing Company, Inc.
4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products.
7. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

B. Water-Hammer Arresters: Comply with ASSE 1010 or PDI-WH 201.

1. Type: Copper tube with piston.
2. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 TRAP-SEAL PRIMER DEVICE - PNEUMATIC

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Precision Plumbing Products, Inc.
2. Sioux Chief Manufacturing Company, Inc.
3. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

4. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

B. Basis of Design: Precision Plumbing Products model PR-500.
C. Supply-Type, Trap-Seal Primer Device: Comply with ASSE 1018, bronze body with rough bronze finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water hammer arresters in piping branches with fast-closing valves, such as flush valves. Locate upstream of last fixture in pipe branch.
C. 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.
D. Connect water piping to water heaters and storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
E. Drain Valves: 3/4” ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.
F. If any device, fixture, or panel is required to be wall mounted by this contractor, provide AC Plywood, 3/4” or 5/8” thickness, painted both sides with fireproof paint, color to be determined and coordinated with owner. Paint is required even if installed on a non-fire rated wall.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
B. Test each pressure vacuum breaker, backflow preventer according to authorities having jurisdiction and the device's reference standard.

3.3 CLEANING

A. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in section 220500 “Plumbing General Provisions.”

END OF SECTION

SECTION 221300
SANITARY WASTE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Floor sinks.
4. Sand/oil interceptors.
5. Trench drains.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 220500.
B. Operation and Maintenance Data: For equipment covered in this section as per Section 220500.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Except in other Part 2 articles where noted, the following manufacturers are acceptable

1. Josam Company; Josam Div.
2. MIFAB, Inc.
3. Sioux Chief Manufacturing Company, Inc.
4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products Inc.
7. Zurn Plumbing Products Group; Specification Drainage Operation.

B. All manufacturers are subject to compliance with requirements
C. Provide products by one of the manufacturers specified or by prior approval.

2.2 CLEANOUTS

A. Standard: ASME A112.36.2M.
B. Cleanouts – Exposed:

1. Body Material: As required to match connected piping.
2. Size: Same as connected drain line as indicated on drawings.
3. Closure: Countersunk or raised-head threaded plug.
4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

C. Cleanout –Floor:

1. Basis of Design: Wade 6000 Series.
2. Cover – Finished Floor: Nickel bronze; scoriated; “C.O.” cast into cover.
3. Cover – Unfinished Floor: Cast iron; “C.O.” cast into cover.
4. Cover Shape: Round, except where noted otherwise on drawings.
5. Type: Adjustable housing.
6. Size: Same as connected drain line as indicated on drawings.
7. Closure: Brass plug.
8. Body or Ferrule: Cast iron in areas subjected to wheel traffic; Plastic permitted light duty areas.
9. Top Loading Classification: Heavy duty in areas subjected to wheel traffic; Light duty otherwise.

10. Riser: Long radius bends.

D. Cleanouts – Wall:

1. Body: Soil pipe test tee, material as required to match connected piping.
2. Size: Same as connected drain line as indicated on drawings.
3. Closure: Raised-head, threaded plug.
4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.3 FLOOR DRAINS

A. Floor Drains:

1. Basis of Design: Watts FD-100
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain. Provide funnels where shown on drawings.
4. Body: Cast iron; provide seepage flange and clamping device.
5. Size: Same as connected drain line as indicated on drawings.
6. Strainer: Nickel bronze; adjustable; round, except as otherwise indicated on drawings.
7. Raised Flange: Provide for drains in mechanical rooms.
8. Loading Classification: Heavy duty in areas subjected to wheel traffic; Light duty otherwise.
9. Trap Features: Cleanout and trap-seal primer valve drain connection where shown on drawings.

2.4 FLOOR SINK

A. Cast-iron Floor Sink:

1. Basis of Design: Watts FS-740.
2. Body Material: Cast iron with white acid resisting porcelain enamel interior lining.
3. Receptor Size: 12” square, 8” deep.
4. Top or Strainer Material: Nickel bronze.
5. Top or Strainer: Square, anti-tilting, loose set; Slotted pattern, full grate except as otherwise noted on drawings; Light duty loading.
6. Bottom Strainer: Aluminum; dome shaped.
7. Pipe Size: As indicated on drawings.

2.5 SAND/OIL INTERCEPTORS - POLYMER

A. Description: Polyethylene or fiberglass reinforced plastic oil and solids separator furnished for above or below grade installation with field adjustable riser system. Cover shall provide water/gas-tight seal and have a maximum load capacity appropriate for the install location.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Striem: OS Series.
2. Zurn: Proceptor.

C. Standard Features:

1. Risers: field adjusted for piping inverts.
2. Inlet and outlet diffusers: removable.
3. Cover Capacity: H20 pickable cast iron cover.

2.6 TRENCH DRAINS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the

following or other prior approved:

1. Manufacturers listed in paragraph 2.1.
2. Dura Trench; Eric'sons.
3. Sioux Chief Manufacturing Company, Inc.

B. Trench Drains – Vehicle Storage:

1. Body Material: Cast iron or HDPE.
2. Flange: Anchor with weep holes.
3. Grate Material: Ductile iron or gray iron, epoxy or powder coated.
4. Top-Loading Classification: Heavy duty.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to 4". Use 4" CO for drainage piping up to 6" in size. Use 6" CO in larger drainage piping unless larger cleanout is indicated.
2. Locate at each aggregate change in direction of piping greater than 135 degrees.
3. Locate at minimum intervals of 75.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
D. Set grates of floor drains flush with finished floor, unless otherwise indicated.

1. Size same as drainage piping.
2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

3.2 GENERAL INTERCEPTOR INSTALLATION

A. Sand/Oil Interceptor shall be furnished by this Contractor and turned over to the General Contractor for installation. This Contractor shall provide all piping and accessories.
B. It is this Contractor's responsibility to field verify all piping inverts into and out of the interceptors to provide the correct extension/riser lengths to maintain the scheduled minimum solid and liquid capacities. Extension/riser lengths shall not result in reduced interceptor capacity.
C. Unless otherwise noted, install cleanouts at the inlets and outlets of all interceptors.
D. Install all interceptors with clear space for servicing.

3.3 TRENCH DRAIN INSTALLATION

A. Trench drains shall be furnished by this Contractor and turned over to the General Contractor for installation. This Contractor shall provide all piping.

3.4 PROTECTION

A. Protect drains during the remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mop service basins.
2. Wall faucets.
3. Freeze-proof hydrants.

B. See Drawings for basis of design manufacturers and models.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 220500.
B. Operation and Maintenance Data: For equipment covered in this section as per Section 220500.

1.3 QUALITY ASSURANCE

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
B. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.1 MOP SERVICE BASIN

A. Description: One piece, floor mounted, mop basin with faucet and accessories.

1. Standard: IAPMO/ANSI Z124.6.
2. Material: Cast polymer composite.
3. Color: White.
4. Drain: Dome stainless steel grid with 3” outlet.

B. Mounting: On floor and flush to wall.
C. Faucet: Wall mounted, hot and cold faucet with wall brace and pail-hook.

1. Standard: ASME A112.18.1/CSA B125.1.
2. General: Include hot- and cold-water indicators.
   a. Material: Commercial, solid brass.
   b. Finish: Polished chrome plate.
   c. Check Stops: Provide on hot and cold water.
3. Mounting Type: Back/wall, exposed.
4. Valve Handle(s):
   a. Non-ADA: 2-inch lever.
   b. ADA Compliant: 6-inch elbow blades.
5. Spout: Rigid.
   a. Vacuum Breaker: Required for hose outlet.
   b. Spout Outlet: 3/4” hose thread.

D. Accessories:

1. 3-foot length of 5/8” hose with bracket equivalent to Fiat model 832AA .
2. Mop Hanger equivalent to Fiat model 889CC.
3. 12” stainless steel splash guard.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Fixture:
   a. Ferguson Enterprises, Inc.; ProFlo Brand.
   b. Fiat Products.
   c. Florestone Products Co., Inc.
   d. Mustee, E. L., & Sons, Inc.
   e. Swan Corporation.
   f. Zurn.
2. Faucet:
   a. American Standard.
   b. Cambridge Brass, Inc.
   c. Chicago Faucets.
   d. Component Hardware Group, Inc.
   e. Delta Faucet Company.
   f. Elkay.
   g. Grohe America, Inc.
   h. Just Manufacturing.
   i. Kohler.
   j. Moen Incorporated.
   k. Sloan.
   l. T & S Brass and Bronze Works, Inc.
   m. Zurn.

2.2 FREEZE-PROOF HYDRANTS

A. Description: Concealed, self-draining, non-freeze wall hydrants.

1. Operation: Loose key, include one with each hydrant.
2. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
3. Outlet: Concealed, garden-hose thread.
4. Nozzle and Wall-Plate Finish: Flush mounted, with chrome finish.
5. Mounting Height: 2 feet above finished grade unless otherwise noted.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Josam Company.
2. Wade Specification Drainage Products.
3. Watts Water Technologies.
4. Woodford Manufacturing Company.
5. Zurn Industries, LLC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation:

1. Install fixture supports firmly attached to building structure.
2. Install fixtures level, plumb, and in accordance with manufacturer's rough-in and installation instructions and height requirements of authorities having jurisdiction.

B. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

C. Joint Sealing:

1. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to fixture color.

3.2 CLEANING AND PROTECTION

A. Clean fixtures and fittings with manufacturers' recommended cleaning methods and materials.
B. Do not allow use of fixtures after final cleaning for temporary facilities unless approved by Owner.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
   a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
   b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
   c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions:

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.2 SCOPE OF WORK

A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the HVAC systems, in strict accordance with Division 23 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.
B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.
C. Examine site and all Contract documents prior to submittal of bid.

1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.

D. Division 23 Work: Includes, but is not limited to, providing the following:

1. Hydronic Heating System: Piping, plant equipment, fuel supply, heating equipment.
2. Insulation System: Piping.

1.3 SUBMITTALS

A. General:

1. Preferred Submittal Format: PDF, unless otherwise noted.
2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
   a. [Specification Section Number] – [Specification Name or Equipment Included]
3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 23 submittals to:

Caleb Bulow, P.E.
PRAIRIE ENGINEERING, P.C.
1905 17TH STREET SE
MINOT, ND 58701
cbulow@prairieengineeringpc.com

B. Substitution and Prior Approval to Quote:

1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
   a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Shop Drawings

1. Distribution: Engineer via the Prime Contractor for each item indicated.
2. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
   a. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. Email message text not acceptable.
   b. Submit a separate shop drawing file for each Specification Section including only the items within that Section.
   c. Non-Conforming: Returned to Contractor without review.
3. Submission Timing: Prior to delivery of materials to job site.

D. Record Drawings

1. Format and Content: Paper copy of Drawings project site.
   a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
   b. Give particular attention to marking actual locations of underground piping.
   c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
   d. Make Record Drawings available to Engineer during project visitation.

2. Submission Timing: Close of project with Record Manuals.

E. Spare Equipment and Devices

1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

F. Operation and Maintenance Manuals

1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
3. Format and Content: Two copies, Loose-leaf hardcover binders, and in PDF format on CDs or USB drive.
   a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD.
   b. Include an index sheet indicating subcontractor and subcontractor’s phone number and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
   c. Include a copy of the Shop Drawings.
   d. Include all installation, operation and maintenance data packaged with any equipment.
   e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers

1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

1.5 AUTHORITIES AND AGENCIES

A. Materials, workmanship and installation: comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
B. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.
C. Codes and standards shall include, but not necessarily be limited to, the following:

1. International Energy Conservation Code (IECC);
2. Uniform Plumbing Code;
3. North Dakota State Building Code;
4. International Building Code (IBC);
5. International Mechanical Code (IMC);
6. International Fuel Gas Code (IFC);
7. National Fire Protection Association (NFPA) – Sections as adopted by authority having jurisdiction.

D. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method.

Refer all such discrepancies to the Engineer immediately.

1. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
2. Meeting the minimum standards of the above Codes does not permit a lower grade of construction where Plans or Specifications call for workmanship or materials in excess of Code Requirements.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 GUARANTEE AND WARRANTY

A. Except where otherwise noted, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year after Owner's beneficial use of the building or mechanical system. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner during that one year period.
B. Guarantee shall include trips to the project site by Contractor to adjust mechanical equipment as required, ensuring it is operating as intended.
C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

1.7 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.8 NOMENCLATURE

A. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.
B. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

2.2 ELECTRIC WIRING

A. The Division 23 Contractor shall furnish all motors, special controls and electrical devices as specified herein for proper operation of the equipment furnished.
B. Division 26 Contractor shall furnish and install, as required, disconnects, starters, switches, etc., and do all necessary power and control wiring including the installation of electrical devices such as thermostats, humidistats, remote control panels, etc., furnished separately by Division 23 Contractor, unless otherwise noted in Equipment Specifications or noted in Section 230900.

PART 3 - EXECUTION

3.1 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques,

sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.
C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.
D. In general, it is intended that ductwork and piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.

3.2 SURFACE CONDITIONS

A. Prior to work of each Section of Division 23, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.
C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.4 COORDINATION

A. Order equipment and material in a timely fashion to assure it is on the job site when required.
B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.
C. Division 23 piping, duct and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Mechanical ducts and pipes shall not be installed in the space near electrical panels/equipment defined as "working spaces" or "dedicated spaces".

3.5 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
2. Do not proceed with installation in area of question until conflict has been fully resolved.
3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Drawings indicate extent and general layout of mechanical systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
2. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
3. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
4. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.6 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities to pre-construction condition.
B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Section 230530 of the Specifications by this Contractor.

3.7 OFFSETS

A. Where required to allow clearance of electrical conduit and outlet boxes, beams, etc., to avoid interference with work of other trades, to increase head room under mechanical systems or to improve the appearance of mechanical systems work, this Contractor shall offset his mechanical system as directed by the Architect/Engineer.

3.8 CUTTING AND PATCHING

A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Division 23 Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.
B. Opening/holes cut to allow passage of ducts and pipes through concrete floor shall be patched by the Contractor doing the cutting unless indicated otherwise on the Drawings.
C. Openings between ductwork and fire rated walls and floors shall be sealed with fire rated caulking or steel collars on both sides of wall or floor.
D. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.
E. Use only rotary type drilling tools to cut concrete.
F. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.9 FIELD QUALITY CONTROL

A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.
B. Low Pressure Hydronic Piping Tests: Maintain constant pressure.
    1. Pressure: Minimum of 100 psig.

2. Duration: One hour.

C. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.10 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
D. Hydronic Systems shall be adjusted as follows:

1. The Plumbing and Heating Contractor shall submit a report of the hydronic system balancing certifying the following:
   a. Each flow fitting location by name, the specified GPM and the actual measured GPM.

3.11 CLEANING

A. Clean interior of duct and piping systems. Remove dirt and debris as work progresses.
B. The hydronic water systems shall be cleaned as follows:

1. Division 23 Contractor shall utilize Garrett-Callahan Formula 247 to degrease, descale and generally clean the piping according to the recommendations of the company specialist. After completion of this work, the Contractor shall add the proper quantity of Garrett-Callahan Formula 12L corrosion inhibitor or provide a Nitrite residual of 500-1000 ppm. Equivalent products by Chemsearch, Dearborn, Brentag, or Agassiz Chemical are acceptable.

3.12 INSTRUCTIONS

A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's mechanical systems and equipment.
B. Copies of written operating and maintenance instructions shall be included with each Record Manual.
C. Division 23 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus.
D. Formal instructions shall be video recorded when required by other Sections of this Specification by this Contractor. Format shall be DVD. Formal instruction to be included with each Record Manual, being referenced to and a part of the Manual.

3.13 CLEAN UP

A. Each Contractor shall be responsible for cleaning up after his work, including the removal of all scrap material left on the job by his men or Subcontractors. This will include the removal of all pipe and sheet metal cuttings, pieces of sheet metal, pipe, and insulation and other debris.
B. Clean all heating units, clean and straighten fins on all coils, clean scale, dirt or debris off piping, motors, etc., oil or grease all motors, fan bearings, pump gear boxes, etc., and leave in a clean best possible working condition

C. After all tests have been made and the mechanical systems are operating properly, this Contractor shall go over the entire system and remove labels from all mechanical equipment.
D. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.
E. Perform all cleaning as required by other Sections of Division 23.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Ball valves.
2. Check valves.
3. Hangers.
4. Escutcheons.
5. Thermostats.

B. Nomenclature:

1. SWP: Steam working pressure.
2. CWP: Cold working pressure.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 230500.

1. Product Data: Each type of valve, gauge, strainer, sleeve, and sleeve-seal system.

B. Operation and Maintenance Data: To include in operation and maintenance manuals as per Section 230500.

PART 2 - PRODUCTS

2.1 VALVE MANUFACTURERS

A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:

1. Anvil International.
2. Conbraco Industries, Inc.; Apollo Valves.
3. Milwaukee Valve Company.
4. Nexus Valve.
5. NIBCO INC.
6. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
7. Victaulic Company.
8. Viega, LLC.

B. All manufacturers are subject to compliance with requirements
C. Provide products by one of the manufacturers specified or by prior approval.

2.2 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.
B. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

2.3 BALL VALVES

A. Two-Piece, Metal, Ball Valves:

1. Basis of Design: Apollo Valves 70-100 Series.
2. Standard and Rating: MSS SP-110; 150 psi SWP, 600 psi CWP at 500°F.
3. Body Design: Two piece, forged brass or bronze; PTFE or TFE seats.

4. Stem: Brass or Bronze, blowout-proof, packing nut.
5. Ball: Chrome-plated brass, full or regular port.
6. Operator: Lever; separate lever nut.

2.4 CHECK VALVES

A. Check Valve – Bronze Swing:

1. Basis of Design: Nibco T-413-B, threaded end; Nibco S-413-B, solder end.
2. Standard and Rating: MSS SP-80; 200 psig CWP; 350°F.
3. Body Material and Design: ASTM B 62, bronze; Y-pattern body; bronze disc.

2.5 PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Clevis type with locknut to threaded extension rod, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or cadmium plated steel.

B. Copper Pipe Hangers:

1. Description: Clevis type with locknut to threaded extension rod, copper-coated-steel, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

C. Trapeze Pipe Hangers:

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.6 DUCT HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
B. Strap and Rod Sizes: 1”, 16 gauge straps; 3/8” rod.
C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
E. 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.
F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

2.9 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.10 THERMOSTATS

A. Single-Stage, Heating-Only Thermostat with floor slab sensor:

1. Heat-Off switch.
2. Fan on-Auto switch.
3. Exposed set point.
4. Exposed indication.
5. Deg F indication.
6. Floor slab sensor.

B. Control Wiring: Unshielded twisted-pair cabling.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. All valves shall be installed in accessible locations. If any valve is found to be installed in a location deemed inappropriate by the Owner and/or Engineer, the contractor shall relocate the valve at no additional cost to the owner.
B. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
C. Install valves in horizontal piping with stem at or above center of pipe in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or butterfly valves.
2. Throttling Service: Ball or butterfly valves.
3. Pump-Discharge Check Valves:
   a. 2” and Smaller: Bronze swing check valves with bronze disc.
   b. 2-1/2” and Larger: Iron silent check valves with rubber seats.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing and Steel Piping, 2” and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing and Steel Piping, 2-1/2” and Larger: Flanged ends.

D. In general, ball valves are preferred over butterfly, gate, and globe valves on piping 2" and smaller.

3.3 PIPE HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
B. Metal Trapeze Pipe-Hanger Installation: Arrange for grouping of parallel runs of horizontal piping, and support together on trapeze pipe hangers.
C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
D. Load Distribution: Install hangers and supports so that piping live and dead loads and

stresses from movement will not be transmitted to connected equipment.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
G. Install lateral bracing with pipe hangers and supports to prevent swaying.
H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
I. Insulated Piping:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4” and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4” and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. 4” and smaller: 12 inches long and 0.06 inch thick.
   b. 5” and larger: 18 inches long and 0.06 inch thick.
5. Pipes 8” and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

J. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
K. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
L. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
M. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
N. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
O. Use thermal-hanger shield inserts for insulated piping and tubing.
P. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.

Q. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20 or 25): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod.

R. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

S. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

T. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.4 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.5 VALVE SCHEDULE

A. Pipe 2” and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves.
3. Check Valves: Bronze swing.

3.6 ESCUTCHEON AND FLOOR PLATE INSTALLATION

A. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors of finished areas.
B. Install escutcheons for piping penetrations of walls within concealed cabinet spaces.
C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
D. Replace broken and damaged escutcheons using new materials.

3.7 THERMOSTAT SCHEDULE

A. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
B. Install thermostats at mounting height of 48 inches above floor to center of device.
    1. Line voltage thermostats installed by Electrical Contractor.
    2. Mount on interior walls wherever possible. Provide insulation backing when mounting on exterior walls.
    3. Install floor slab sensor in conduit under slab.

END OF SECTION

SECTION 230530
EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. The Contractor shall do all excavating and trench work necessary for the complete installation, as shown on the Drawings, for piping underground or under the floors.

1.2 QUALITY ASSURANCE

A. Backfill under any Federal, State or Local Municipality highway or street shall be backfilled in compliance with all Federal, State and Local Municipalities Codes and Regulations. All material used for backfill under such highways and streets shall be inspected and approved by the governing Authority. Before any bituminous or concrete is placed over such fills, they shall be inspected and approved by the governing Authority.
B. This Contractor shall repair, to the original condition, all sidewalks, curb, gutter, fence, streets or highways damaged or taken up to install outside services.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIALS

A. Backfill in trenches inside and under building shall be sand or gravel materials approved by the Architect/Engineer.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILLING

A. Bell holes shall be excavated to insure sewer pipe resting for its entire length upon the bottom of the trench. Banks of trenches shall be kept as nearly vertical as possible and, if required, shall be properly sheeted and braced. The pipe trenches outside the building, after the piping has been tested and approved, shall be backfilled with excavated materials free from large clods or stones, carefully deposited in layers of 6"-8" in thickness on both sides of the pipe and thoroughly and carefully rammed until enough fill has been placed to provide a cover of not less than one foot above the pipe. The balance of the fill shall be deposited in layers not to exceed 9" in thickness and compacted to the density Specified under Compaction.
B. All materials excavated shall be deposited on the side of the trenches beyond reach of slides. Excavated material shall not be piled where it will interfere with traffic or other trade's work. All earth taken from trenches shall be deposited as directed or removed from site, as directed by the Architect/Engineer.
C. No pipes or PVC conduit shall be bedded directly on rock, but shall be cushioned by a 6" layer of sand or as approved by the Architect/ Engineer.
D. Maintain excavation in good order and provide bracing where necessary to prevent caving, settlement, or damage. Provide necessary pumps, power, suction and discharge lines to keep all excavation free from standing water.
E. All excavations are to be completed in a workmanlike manner, level and smooth.
F. Backfill under concrete or bituminous slabs, curbs, streets, parking lots, driveways, sidewalks or any other concrete items shall be of coarse gravel or material approved by the Architect/Engineer. Water shall be used as necessary to insure proper compaction of fill.

3.2 CLEANING

A. All areas to be backfilled shall be thoroughly cleaned of all construction and other debris.

3.3 COMPACTION

A. Compaction shall be done in lifts as the backfill is deposited in layers as specified above.

B. Compaction shall be to % of Standard Proctor density as listed below:

1. Grassed areas: 85% of Standard Proctor.
2. Under pavements and walks: 90% of Standard Proctor.
3. Under building floor slabs: 95% of Standard Proctor.

C. Moisture content shall be within 2% to 3% optimum moisture as determined by ASTM D-698. Compaction density shall be as determined by ASTM D-698.

END OF SECTION

SECTION 230700
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Piping Insulation.

B. The work covered by this Specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the HVAC systems, in strict accordance with Section 230700 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

1.2 REFERENCE

A. Related work in Section 220700 “Plumbing Insulation.”

1.3 SUBMITTALS

A. Shop Drawings: For materials covered under this section as per Section 230500.

1. Product Data: Each type of insulation.

B. Operation and Maintenance Data: Per section 230500.

1. Product Data: Each type of thermal insulation system.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. All insulation shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:

1. Owens-Corning Fiberglass.
2. Johns Manville.
3. Knauf Insulation.

B. All manufacturers are subject to compliance with requirements.
C. Provide products by one of the manufacturers specified or by prior approval.

2.2 COMMON INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

2.3 INSULATION

A. Fiberglass Wrap: Glass fibers bonded with a thermosetting resin; FSK or ASJ Max jacket. Comply with ASTM C 553, Type II and ASTM C 1290, Type I and Type III.
B. Fiberglass Board: Glass fibers bonded with a thermosetting resin, semi-rigid; FSK or ASJ Max jacket. Comply with ASTM C 612, Type IA or Type IB.
C. Fiberglass, Preformed Pipe Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.

2.4 INSULATION JACKETS

A. ASJ Max Jacket: Poly-encapsulated paper jacket; Factory applied shall comply with ASTM C1136, Type I, II, III, IV.
B. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; Factory applied shall comply with ASTM C1136, Type II.
C. Self-Adhesive Outdoor Jacket: 5-ply high strength composite, self-adhesive, 7-mil-thick, laminated vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white or stucco-embossed aluminum-foil facing.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
        a. Polyguard Products; Alumaguard series.
        b. Venture Tape; VentureClad series.
D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14; stucco embossed, 0.016” thick.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
        a. Childers Brand, Specialty Construction Brands, Inc.
        b. Metal Jacketing Systems.
E. PVC Jacket: Comply with ASTM D1784, Class 16354-C. High impact resistant, UV resistant, minimum 0.030” thick.

2.5 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.6 SEALANTS

A. Joint Sealants: Permanently flexible, elastomeric sealant, compatible with insulation materials, jackets, and substrates.

2.7 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

2.8 TAPES

A. Tapes: Match jacket with compatible adhesive as recommended by jacket manufacturer.
B. ASJ Max Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.

C. FSK Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.
D. Aluminum-Foil Tape: Vapor-retarder tape, 2 inches wide.
E. PVC Tape: White vapor-retarder PVC tape, 2 inches wide.

2.9 SECUREMENTS

A. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

1. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
2. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
3. Adhesive-backed base with a peel-off protective cover.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
C. Wire: 12 gauge nickel-copper alloy or 14 gauge soft-annealed, stainless steel or 14 gauge soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install multiple layers of insulation with longitudinal and end seams staggered.
C. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
D. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic. Install insulation continuously through hangers and around anchor attachments.
E. Install insulation with jackets as follows:

1. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip.
2. Overlap jacket longitudinal seams at least 1-1/2 inches. Staple laps with outward clinching staples along edge.
3. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
4. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

F. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Roof/Wall Penetrations: Install insulation continuously through roof/wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof/wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside flashing at least 2 inches.
4. Seal jacket to roof flashing with flashing sealant.

B. Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate fittings and specialties using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic and reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
4. Stencil or label the outside insulation jacket of each union with the word "union."

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 FIBERGLASS INSTALLATION

A. General Procedures:

1. Apply adhesives according to manufacturer's recommended coverage rates of duct and plenum surfaces.

3.6 FIBERGLASS PREFORMED PIPE INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections

of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3.7 PIPING INSULATION SCHEDULE

A. Indoor, Aboveground:

1. Heating-Hot-Water, 200°F and Below: Fiberglass.
   a. 1-1/4 inch diameter pipe and smaller: 1-1/2 inches thick, R-6 minimum.
   b. 1-1/2 inch pipe diameter and larger, 2 inches thick, R-8 minimum.

END OF SECTION

SECTION 232000
HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Pipe and fitting materials, and joining methods for the following:
   a. Hot-water heating piping.
   b. Radiant slab heating piping.

1.2 REFERENCE

A. Refer to Section 230510 "Common Work Results For HVAC" for requirements of hangers, sleeves, sleeve seals, and escutcheons.
B. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings
C. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
D. ASTM B75 – Standard Specification for Seamless Copper Tube
E. ASTM B88 – Standard Specification for Seamless Copper Water Tube
F. ASTM F3226 – Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems
G. IAPMO PS 117 – Press and Nail Connections
H. CSA 6.32 / ANSI LC-4 – Metallic Press-Connect Fittings for Fuel Gas Distribution Systems

1.3 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 230500.

1. Product Data: Provide a separate shop drawing for each of the following piping systems showing the material and fastening method chosen by the contractor:
   a. Aboveground hot-water heating.
   b. Underground hot-water heating.

B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.4 QUALITY ASSURANCE

A. All piping shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.
B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
C. Installers of press-connect bronze, copper, carbon steel or stainless steel fittings:

1. Installers shall attend a manufacturer's installation training class as having been trained and qualified to join piping with press-connect fittings. On-site training and credentialing by manufacturer's representative is acceptable.
2. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of press-connect bronze, copper, carbon steel or stainless steel fittings.
3. Press-connect bronze, copper, carbon steel or stainless steel fittings shall be installed using proper tool, actuator, jaws, and rings as instructed by the manufacturer.

1.5 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.

1. Standard Warranty Period: Not less than one year from the date of Substantial Completion.
2. Cold Press Warranty:
   a. Copper Pressure Seal: Not less than 50 years from the date of installation.
   b. Steel Pressure Seal: Not less than 15 years from the date of installation.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
B. Soft Copper Tube: ASTM B 88, Type K, annealed temper.
C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
D. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
E. Copper Pressure-Seal Fittings: ASME B16.51, press-connect pressure fittings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
   a. Apollo.
   b. Mueller Streamline Co.
   c. NIBCO, Inc.
   d. Viega, LLC.
2. Fittings for 2” and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end with leakage path feature to provide identification of un-pressed connections.
3. Fittings for 2-1/2” to 4”: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal and stainless-steel grip ring in each end.
4. Fittings to include color coded markings on exterior to indicate usage.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
B. Cast-Iron Threaded Fittings: ASME B16.4; Classes as indicated in Part 3 "Piping Applications" Article.
C. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, as indicated in Part 3 "Piping Applications" Article.
D. Cold Press Mechanical-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
   a. Viega, LLC.
2. Fittings: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer.
   a. Gas Fittings: Conform to material requirements of ASME B31.9 and performance criteria of ANSI/CSA LC4a/CSA 6.32a.

2.3 PEX PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide piping by one of the following or other prior approved:

1. HeatLink Group Inc.
2. Infloor Radiant Heating Inc.
3. MrPEX Systems, Inc.
4. REHAU.
5. Stadler-Viega.
6. Uponor.
7. Watts Radiant, Inc.; a division of Watts Water Technologies, Inc.
8. Zurn Plumbing Products Group.

B. Pipe Material: PEX plastic according to ASTM F 876.
C. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.10 mg per cu. m/day at 104 °F according to DIN 4726.
D. Fittings: ASTM F 1807, metal insert and copper crimp rings.
E. Pressure/Temperature Rating: Minimum 100 psig and 180 °F.

2.4 PE-RT PIPING AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide piping by one of the following or other prior approved:

1. HeatLink Group Inc.
2. Infloor Radiant Heating Inc.
3. MrPEX Systems, Inc.
4. Roth.
5. Uponor.
6. Watts Radiant, Inc.; a division of Watts Water Technologies, Inc.
7. Zurn Plumbing Products Group.

B. Pipe Material: PE-RT plastic according to ASTM F2623 for hydronic systems.
C. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.10 mg per cu. m/day at 104 °F according to DIN 4726.
D. Fittings: ASTM F 1807, metal insert and copper crimp rings.
E. Pressure/Temperature Rating: Minimum 100 psig and 180 °F.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings shall be CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions, and one end with threaded brass or stainless steel insert and one solvent-cement-socket end.
B. Plastic-to-Metal Transition Unions shall be CPVC four-part union with brass threaded end, solvent-cement-joint plastic end, rubber O-ring gasket, and union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
B. Dielectric Nipple:

1. Comply with ASTM F1545.
2. Pressure Rating: 425 psi at 225°F.
3. Materials: Carbon steel body with crosslinked polyethylene (PEX) plastic insert.

C. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 °F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
C. Install radiant heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.
D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Exposed piping shall be run as high as possible except where noted otherwise.
E. Install piping to permit valve servicing and free of sags and bends.
F. Install press fittings with a minimum spacing of 1” between fittings.
G. Select system components with pressure rating equal to or greater than system operating pressure.
H. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
I. Install drains, consisting of a tee fitting, 3/4” ball valve, and short 3/4” threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
J. Install unions or flanges in piping, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
K. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
L. Install 3/4” nipple and ball valve in blowdown connection of strainers 2” and larger. Match size of strainer blowoff connection for strainers smaller than 2”.
M. Install escutcheons (chrome plates) for exposed piping penetrations of finished walls, ceilings, and floors.

3.2 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 50 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 50 feet or longer.
3. Install trapeze hanger for multiple parallel piping 50 feet or longer.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
7. Install hanger 12” from elbow joint.

B. Install hangers for steel piping as follows:

1. 1” and smaller: 8 feet with 3/8-inch rod.
2. 1-1/4” to 3”: 10 feet with 3/8-inch rod.
3. 4” to 6”: 12 feet with 1/2-inch rod.
4. 8” and larger: 12 feet with 5/8-inch rod.

C. Install hangers for drawn-temper copper piping as follows:

1. 1-1/2” and smaller: 6 feet with 3/8-inch rod.
2. 2” to 4”: 10 feet with 3/8-inch rod.
3. 6” and larger: 10 feet with 1/2-inch rod.

D. PEX:

1. 1” and Smaller: 3 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8” rod.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
F. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

3.3 PIPING APPLICATIONS

A. Piping materials are identified below. If more than one material is listed for an application, selection from materials listed is Contractor's option.
B. Hot-water heating piping, aboveground, 2” and smaller:

1. Type L, drawn-temper copper tubing; wrought-copper solder-joint fittings, or pressure-seal-joint fittings.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
3. Schedule 40 steel pipe; Class 125, cold press mechanical-joint fittings.

C. Hot-water heating piping, underground, 2” and smaller:

1. PEX, plastic piping; fittings to be ASTM F 1807, metal insert and copper crimp rings.
   a. No joints shall be allowed underground
2. PE-RT, plastic piping; fittings to be ASTM F 1807, metal insert and copper crimp rings.
   a. No joints shall be allowed underground

END OF SECTION

SECTION 232100
HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Flow Meters.
2. Air control devices.
3. Strainers.
4. Gauges (temperature, pressure).
5. Thermowells.
6. Gage attachments.

1.2 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 230500.

1. Product Data: For each type of the following:
   a. Flow Meters
   b. Air Control Devices.
   c. Strainers.
   d. Gauges.

B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1. Product Data: Flow control valves, gauges, and strainers.

1.3 QUALITY ASSURANCE

A. All equipment shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.
B. Motors: Comply with requirements in Section 230520 "General Motor Requirements."

1.4 GENERAL REQUIREMENTS AND SYSTEM DESCRIPTIONS

A. The Hot Water Heating System shall be piped in a full flow orientation and shall contain electric boilers, air purger, an expansion tank, and a system strainer. The system will supply 120°F heating water to radiant floor heating located throughout the building. The system fluid shall be 100 % water.

PART 2 - PRODUCTS

2.1 FLOWMETERS

A. Description: Inline spring and piston type flowmeter.

1. Basis of Design: Omega Easy-view Flowmeter, model FL-9000.
2. Material: Clear polysulfone, T300 series stainless steel spring, Buna flow indicator ring, Buna O-rings (on units with brass end fittings).
3. Ratings: 250°F, 325 psig.

2.2 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. American Wheatley.
2. Amtrol, Inc.
3. Armstrong Pumps, Inc.

4. Bell & Gossett Domestic Pump; a division of ITT Industries.
5. Caleffi Inc.
6. Niles Steel Tank.
7. Spirotherm, Inc.
8. Taco.
9. Wessels Company.
10. Viega, LLC.

B. Manual Air Vents: Rated for 150 psi at 240°F; with extended tube.

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Include PT port on coil installations.
4. Operator: Screwdriver or thumbscrew.

C. Automatic Air Vents: Rated for 150 psi at 225°F.

1. Basis of Design: Bell and Gossett #97.
2. Body: Brass.
3. Operator: Float.

D. Expansion Tanks:

1. Standard: ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
2. Body: Welded steel, rated for 125 psi at 240°F.
3. Taps: Air charge and drain.
4. Air Separator: Heavy-duty butyl rubber diaphragm or removable bladder as scheduled.

E. Air Purger: Rated for 150 psi at 225°F; with bottom tapping for installation of expansion tank and top tapping for vent.

1. Basis of Design: Bell and Gossett IAS.
2. Body: Cast iron.

2.3 STRAINERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Armstrong International.
2. Bell & Gossett.
3. Metraflex Company (The).
4. O.C Keckley Company.
5. Titan Flow Control.
6. Victaulic.
7. Viega, LLC.

B. Combination Ball Valve / Strainers

1. Description: Combination wye strainer, full port shut-off valve and union.
2. Basis of Design: Bell & Gossett model UBY
3. Body: Brass.
4. Ball: Full Port Chrome Plated.
5. Ball Seal: PTFE.
6. Rating: 400 psig.
7. Stem: Stainless steel.
8. O-rings: EPDM.
9. Strainer: 20 mesh stainless steel.
10. Include PT port when installed on a coil.
11. End Connections: Threaded ends for 2” and smaller; flanged ends for 2-1/2” and larger, or as required by the contractors chosen installation methods.

2.4 GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Miljoco Corporation.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.
4. WIKA Instrument Corporation - USA.
5. Winters Instruments - U.S.

B. Thermometers – 6” Industrial-Style, Liquid-in-Glass:

1. Basis of Design: Weiss Instruments model HW5A2.
2. Case: Plastic or cast aluminum; 6-inch nominal size.
3. Case Form: Adjustable angle.
4. Tube: Glass with magnifying lens and blue or red non-toxic liquid.
5. Tube Background: Permanent scale markings graduated in deg F.
6. Stem: Brass or Aluminum and of length to suit installation.

C. Thermometers – Digital:

1. Basis of Design: Trerice SX9 Solar Therm series.
2. Case: Hi-impact plastic or cast aluminum.
3. Case form: Adjustable angle.
4. Display: 1/2” LCD digits, wide ambient formula
5. Power Source: Integral solar cell.
6. Min/Max Feature: Button to recall minimum and maximum temperatures over a given period; resettable.

D. Pressure Gages – Dial Type:

1. Basis of Design: Weiss Instruments 4UG series.
2. Standard: Conform to ASME B40.100.
3. Case: Cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: White aluminum with scale markings graduated in psi.
7. Scale: Select so expected pressure reading is in center of range.

E. Pressure Gages – Digital:

1. Basis of Design: Weiss Instruments DUGY3 Series.
2. Standard: Conform to ASME B40.100.
3. Case: Glass reinforced plastic; 4-1/2-inch nominal diameter.
4. Sensor: Gold-plated ceramic.
5. Wetted Materials: Stainless Steel.
6. Power: Solar cell.
7. Display: 5/8” high.
8. Accuracy: 0.5% full scale.
9. Ranges: Select so upper limit is two times expected average reading.
10. Ambient Operating: 10°F to 140°F.

F. Gauge Accessories:

1. Thermowells:
   a. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
   b. Lagging Extension: Include on thermowells for insulated piping and tubing.
   c. Heat-Transfer Medium: Mixture of graphite and glycerin.
2. Snubbers: Brass; piston or porous-metal-type surge-dampening device. Include

extension for use on insulated piping.
3. Siphons (Pigtail): Loop-shaped section of brass or steel pipe.
4. Valves: Brass ball, threaded.

PART 3 - EXECUTION

3.1 AIR CONTROL DEVICE INSTALLATION

A. Install manual air vents on air chamber at the high point of all piping and in the return piping at all heating units. In coil installations, provide a PT port.
B. Install float type automatic air vent with ball valve on top of air purgers if integral vent is not provided. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
C. Air/dirt separator and expansion tank to be installed on the suction side of the system pumps.
D. Provide valved drain and hose connection on strainer blow down connection.
E. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks. Pipe relief valve outlet to nearest floor drain.

3.2 GAUGE INSTALLATION

A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
    1. Install thermowells with extension on insulated piping.
    2. Fill thermowells with heat-transfer medium.
B. Adjust faces of meters and gages to proper angle for best visibility.
C. Install valve and snubber in piping for each pressure gage for fluids (except steam).
D. Install valve and siphon fitting in piping for each pressure gage for steam.

3.3 FLOW CONTROL SCHEDULE

A. Install flow meter and ball valve at return connection to each radiant floor heating circuit and where shown on drawings.

3.4 HEATING AND COOLING FLUID SCHEDULE

A. Heating Fluid:
    1. Boiler System: 100% water.

3.5 THERMOMETER SCHEDULE

A. Install thermometers in the following locations:
    1. Inlet and outlet of each radiant manifold.
    2. System return to boilers.
    3. Other as shown on the drawings.
B. Heating, Hot-Water Piping: 0 to 250°F.

3.6 PRESSURE GAUGE SCHEDULE

A. Install pressure gages in the following locations:
    1. Suction and discharge of each pump.
B. Scale Range for Pump Gauges: 0 to 100 psi. on discharge, 0 to 30 psi on suction.

END OF SECTION

SECTION 232200
HYDRONIC PUMPS AND SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hydronic pumps.

1.2 REFERENCE

A. See Section 223000 “Plumbing Equipment” for domestic water pumps.

1.3 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 230500.

1. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.4 QUALITY ASSURANCE

A. Motors: Comply with requirements in Section 230520 "General Motor Requirements."

1.5 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.

1. Warranty Period: Not less than one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Except where otherwise noted, the following pump manufacturers are acceptable:

1. Armstrong Pumps Inc
2. Bell & Gossett; Div. of ITT Industries
3. Grundfos Pumps Corp.
4. Taco, Inc.
5. Thrush Company Inc.
6. Wilo USA LLC

B. All manufacturers are subject to compliance with requirements.
C. Provide products by one of the manufacturers specified or by prior approval.

2.2 CAPACITIES AND CHARACTERISTICS

A. See schedules on the Drawings for pumps listed below.
B. Pump Ratings: 125-psig pressure and 220 °F temperature, unless otherwise indicated.
C. Pump Motors: Single speed and rigidly mounted to pump casing with permanently lubricated ball bearings, unless otherwise indicated.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and

application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 0520 “Common Motor Requirements.”
3. Enclosure: Open, dripproof.

2.3 WET ROTOR PUMPS

A. Description: Factory-assembled and -tested, wet rotor, seal less, self-lubricating, cartridge pump designed for installation with pump mounted horizontally or vertically.
B. Pump Construction:

1. Casing: Cast iron, with universal flange to flange dimensions.
2. Impeller: Non-metallic.
3. Pump Shaft: Ceramic.
4. Pump Bearings: Carbon.

C. Motor: Single or multi-speed stainless steel replaceable cartridge design.

2.4 IN-LINE PUMPS – CLOSE-COUPLED

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump; designed for installation with pump and motor shafts mounted horizontally or vertically.
B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Permanently lubricated ball bearings.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

END OF SECTION

SECTION 260500
COMMON WORK RESULTS
FOR ELECTRICAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
   a. "Part 1.0 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
   b. "Part 2.0 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
   c. "Part 3.0 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions

1. "Furnish" - Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. "Install" - Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. "Or Approved Equal" - Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. "Or Equivalent" - Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. "Provide" - Furnish and install in place, total and operational.
6. “Manufacturer’s Representative” – person properly trained/certified for the specific equipment and a regular employee of the Manufacturer, the Manufacturer’s Representative Agency, a third party specializing company, or the selling distributor.
7. "Substantial Completion" - The date when the project has been completed, inspected, and accepted by the Engineer and Owner.

C. Work Included

1. Provide labor, equipment and materials in connection with Work specified and shown on Drawings.
2. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.
3. Examine site and all Contract documents prior to submittal of bid.

D. Work Installed But Furnished Under Other Directives

1. Provide service for electrically operated equipment not specified in Division 26, 27 & 28. Verify size and locations of such connections by securing all rough-in requirements from the equipment supplier.
2. Equipment requiring electrical service shall be furnished with motors, special controls and remote electrical devices as specified in other Divisions.
3. Verify extent of controls and devices furnished by referring to Divisions where Work is specified.
4. Provide disconnects, starters, control devices, thermal units, fuses, switches and all necessary power and control wiring. Include the installation of remote electrical devices furnished separately with the equipment. Provide identification for remote devices as directed by the Engineer.
5. Contractors of other Divisions providing electrically operated equipment shall verify with the Electrical Contractor the proper voltage and phase before releasing equipment for shipment.
6. Unless otherwise specified, Contractor responsible for furnishing such equipment is also responsible for setting in place.

1.2 NOT USED

1.3 NOT USED

1.4 SUBMITTALS

A. Substitution and Prior Approval to Quote.

1. The reference to manufacturer's name and catalog or model numbers shall be interpreted as establishing a standard of quality, not as limiting competition.
2. Suppliers wishing to price material or equipment not referenced in Specifications or on Drawings shall apply in writing to Engineer for approval to quote. Electronic submittals shall be in PDF format. Include complete descriptive technical data on the proposed item consisting of: model numbers, type, size and performance characteristics. Procedure also applies to requests by Contractor. Self-addressed, stamped envelope required for return reply.
3. The request for prior approval to quote shall be received in Engineer's office no later than 192 hours (eight days) prior to bid opening. All substitute items approved for quotation will be listed in Addenda sent to all planholders in advance of bid opening.
4. Contractors choosing to use material or equipment other than those shown on Drawings or specified in detail, but approved for quotation, shall be responsible for physical dimensions and coordination. Architect, Engineer, or Owner will not be responsible for costs of necessary changes and additional work required by Contractor or any other trades.
5. Substitutions will not be permitted after bid opening.

B. Correspondence

1. Direct all correspondence concerning Division 26, 27, & 28 submittals to:

JASON HUNZE
PRAIRIE ENGINEERING, P.C.
1905 17TH ST SE
MINOT, ND 58701
jhunze@prairieengineeringpc.com

C. Shop Drawings

1. Before any of the materials are delivered to the job, submit to Engineer via the Prime Contractor complete Shop Drawings for each item indicated.
2. Include catalog numbers, performance data, dimensions and other descriptive information.
   a. The actual part numbers and options for equipment to be utilized shall be highlighted to indicate exact equipment to be furnished.
   b. Only include information relevant to the equipment being provided. Any extraneous materials shall be removed prior to submittal.
3. Shop Drawings shall be in electronic PDF format and shall include catalog sheets showing all necessary information. Shop drawings shall be separated by specification section, and equipment from separate specification sections shall not be combined.
4. Shop Drawings shall be submitted under the appropriate specification section of the electronic submittal service being used. The shop drawing file for each section shall include the specification section number, section name, and revision number. Example: “262726 Wiring Devices REV 01”.
   a. If an electronic submittal service is not being used, shop drawings may be emailed to the Engineer at the email address indicated above. Emailed shop drawings shall not exceed 10 MB. If shop drawings exceed 10 MB, contact the Engineer to arrange for a file transmittal method.
5. Each Shop Drawing folder shall be **stamped, initialed, and dated**, on a cover sheet included in the PDF submittal by Division 26 Contractor to indicate they have thoroughly reviewed them in accordance with General Conditions. **Email message text not acceptable.**
   a. If the Division 26 contractor is under a Prime Contractor, the Prime Contractor may also include a review stamp. However this does not relieve the Division 26 contractor from applying their review stamp.
6. Shop Drawings not in conformance with Specification will be returned to Prime Contractor without review.
7. A maximum of two reviews will be completed for each section. Additional submittals required due to lack of proper corrections being made may be subjected to review fees from the Engineer billed to the Division 26 contractor.

D. As-Built Drawings

1. Designate one set of clean blueprints at project site as As-Built Drawings. Make As-Built Drawings available to Engineer during project visitation.
2. As work progresses, Contractor's field supervisor shall mark As-Built Drawings in red pencil to indicate actual conditions of installation.
3. Show same general details as Drawings.
4. Give particular attention to marking actual locations of feeders and underground runs.
5. Affix all addendum and change order descriptions to appropriate as-built drawing sheet, utilizing spray adhesive.
6. Submit As-Built Drawings to Engineer along with Record Manuals at close of project in PDF format.
   a. As-Built Drawings shall be submitted as one PDF file.
   b. Record Manuals shall be submitted as one PDF file.
7. Provide minimum one hard copy of As-Built Drawings to the Owner.
8. Review Division 1 for additional requirements for hard copies of As-Built Drawings.

E. Record Manuals

1. Upon completion of Work of this Division and as condition of its acceptance, Contractor shall compile Record Manuals.
   a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual.
   b. Provide one electric PDF copy to Engineer for review.
      1) After electronic PDF copy is reviewed and approved, provide one hard copy of Record Manual to Owner. Include an index sheet indicating each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
      2) Review Division 1 for additional requirements for hard copies of Record Manuals.
   c. Record Manual information shall be included for all equipment/material where Shop Drawings are required. **Also include all installation, operation and maintenance data packaged with any equipment**.
2. Turn over to Owner all spare equipment and devices specified and shown. List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Include one copy of formal instructional recordings, properly identified as to specification section.
4. Include copy of State Electrical Board Wiring Certificate in each Record Manual.
5. Include service equipment fault current calculation and step-down transformer fault current calculations in record manuals. Utility transformer fault current shall be calculated per Section 260553-3.3. Step-down transformer fault current shall be calculated per Section 262200-1.2. Provide in tabular form, as per the following example:

Transformer	kVA	Sec. Voltage	Phase	Impedance	Fault Current	Date Calculated
Utility	300	480	3	1.06%	34,043 amps	11/15/2016
T-1	150	208	3	3.8%	10,958 amps	11/15/2016

6. Calculate the available fault current (AFC) for the mechanical and electrical equipment listed and provide the information in tabular form, utilizing naming convention on the drawings.
   a. HVAC Equipment 1HP and larger
   b. Refrigeration Equipment
   c. Elevator Equipment
   d. Industrial Control Panels
   e. Electrical Distribution Equipment
   f. Branch Panelboards
   g. MCC's.

7. Fault Current Table Format Example:

Equipment	Voltage	Phase	AFC at Equip.	Date Calculated
AH-1	480	3	5,289 amps	11/15/2016
CU-1	208	3	2,321 amps	11/15/2016

8. Transformer fault current table and equipment fault current calculation table shall be grouped together in the same tabbed section of the record manuals.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers

1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.
3. To the maximum extent possible, retain the same supervisory personnel throughout the duration of the Work.

B. Licenses, Permits, Codes and Standards

1. Materials, workmanship and installation: comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
2. Codes and standards shall include, but not necessarily be limited to, the following:
   a. Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL)
   b. National Electrical Code (NEC)
   c. National Fire Protection Association (NFPA)
   d. Occupational Safety and Health Act (OSHA)
   e. State and local wiring standards
   f. Building and fire codes
3. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
4. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
5. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

1.6 GUARANTEE AND WARRANTY

A. Unless otherwise modified by other sections of this specification, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year. Warranty period shall begin at date of substantial completion, or date of specific equipment commissioning, whichever is later. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner.

B. Guarantee shall include trips to the project site by Contractor to adjust electrical equipment as required, ensuring it is operating as intended.

C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

D. Contractor shall include written warranty statement, indicating start and end dates of warranty period. Warranty statement shall be included with each copy of the Record Manuals.

1.7 CHANGES TO CONTRACT

A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.

B. Proposed changes shall be accompanied with complete substantiating documentation.

1. Provide an itemized list of quantities for materials, equipment, and supplies.
   a. Include unit costs for each item and extended price.
   b. Include unit labor for each item and extended time.
2. Provide subcontractor proposals that include the same substantiating documentation.
3. Provide quotations from suppliers for any specially ordered equipment.

C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing “suggested pricing” from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.

D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.

E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.

F. Allowable markups for contractor and subcontractors
1. Overhead on work performed by own forces: 12% maximum.
2. Profit on work performed by own forces: 10% maximum.
3. Commission on work performed by Subcontractors: 5% maximum.
4. Sales tax.
5. Bond and permit increases where applicable.

G. No additional markups shall be allowed for:
1. Field and/or office supervision/administration time.
2. Tool burden.
3. Shop burden.
4. Overhead/Profit applied to work performed by others.

H. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.

I. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.

J. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.8 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.9 APPLICATIONS FOR PAYMENT

A. Refer to Division 1 “Applications for Payment”.

B. Provide one additional copy, sent directly to the Engineer.

C. Format and content:

1. When included with the Bid, the following categories shall be indicated on the application for payment:
   a. *Project mobilization.*
   b. *Demolition*.
   c. *Service & Distribution* (all switchgear, panels, transformers, motor control centers, and loose control/disconnects, installed in place).
   d. *Lighting* (all fixtures and lamps, installed in place, including pre-fabricated wiring system).
   e. *Wiring Devices* (all switches, receptacles, and plates, except voice-data, installed in place).
   f. *Equipment Connections* (HVAC, elevator, food service, etc, connected in place).
   g. *Basic Materials* (all conduit, wire, boxes, supports, fittings, grounding materials, except special systems and voice-data cabling systems, installed in place).
   h. *Fire Alarm & Detection* (all system equipment, installed in place).
   i. *Special Systems* (all system equipment and cabling, installed in place, broken out by Specification Section. Examples include Clock and Program, Intercom, Nurse Call, Public Address, Sound Reinforcement, Rescue Assistance, TV Signal Cabling, Architectural and Theatrical Lighting Controls, and the like).
   j. *Generator* (all system equipment, installed in place).
   k. *Voice-Data Cabling Systems* (all system equipment, installed in place).

PART 2 – PRODUCTS

2.1 MATERIAL

A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.

B. All material and equipment shall be new when delivered to the job and be listed by a Nationally Recognized Testing Laboratory (NRTL).

C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

2.2 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 3 – EXECUTION

3.1 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.

C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

3.2 SURFACE CONDITIONS

A. Prior to work of each Section of Division 26, 27, & 28, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 COORDINATION

A. Order material in a timely fashion to assure it is on the job site when required.

B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.

3.4 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
2. Do not proceed with installation in area of question until conflict has been fully resolved.
3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Drawings indicate extent and general layout of electrical systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
2. Data indicated on Drawings and in these Specifications is as exact as could be secured, but absolute accuracy is not guaranteed.
3. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
4. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
5. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.5 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities.

B. Trench and backfill for installation of underground conduits to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by electrical installations shall be accomplished in accordance with Earthwork Specifications by this Contractor.

3.6 CUTTING AND PATCHING

A. Carefully lay out all work in advance to minimize cutting, channeling or drilling.

B. Where necessary, all such cutting and patching shall be done in a manner approved by Architect.

C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.

D. Use only rotary type drilling tools to cut concrete.

E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.7 TESTS

A. Perform all tests as required by Engineer during construction and as described in other Sections of these Specifications.

B. Testing of entire installation shall be completed before final inspection.

3.8 INSTRUCTIONS

A. After all required approvals of the Work have been obtained; demonstrate the operation and maintenance of all electrical equipment to the Owner's personnel.

B. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's electrical systems and equipment.

C. Copies of written operating and maintenance instructions shall be included with each Record Manual.

D. Electrical Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus. Formal instruction to occur with each Record Manual, being referenced to and a part of the Manual.

E. Formal instructions shall be recorded when required by other Sections of this Specification by this Contractor. Format shall be digital media capable of being played on Windows or Mac operating systems, or shall be submitted on a USB storage device.

1. Electronic PDF files for the as-built drawings and record manuals shall also be included on the USB storage device with the formal instructions.

3.9 CLEAN UP

A. Remove all scrap material left on job during and after installation of Work.

B. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

C. Perform all cleaning as required by other Sections of Division 26, 27, & 28.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Temporary electricity.

1.2 PRODUCT HANDLING

A. Protection

1. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout the progress of Work.

B. Replacements

1. In the event of loss or damage, immediately make all repairs and replacements necessary at no additional cost to Owner.

PART 2 – PRODUCTS

2.1 UTILITIES

A. Temporary Facilities

1. General: all costs, including utility company charges, required for the performance of temporary electrical system, shall be paid by Electrical Contractor.
2. Energy charges: Refer to Division 1 for requirements.
3. Temporary Electricity: Electrical Contractor shall:
   a. Furnish and install all necessary temporary wiring.
   b. Provide area distribution boxes located so the individual trades may use their own construction type extension cords.
   c. Provide GFCI protection on all temporary power per NEC.

END OF SECTION

SECTION 260510
REMODELING WORK

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide work in remodeled area as shown on Drawings and Specifications.

B. Existing Conditions

1. Visit existing buildings before submitting bid and become familiar with all pertinent existing conditions. Make allowance in bid for all pertinent existing conditions. No Change Orders will be issued:
   a. For Contractor's failure to visit site and acquaint himself with existing conditions.
   b. For any portion of remodeled work necessary for complete installation of systems shown.
   c. Due to Contractor's lack of understanding of amount of work or difficulty of work involved.

PART 2 – PRODUCTS

2.1 See following sections of this Specification.

PART 3 – EXECUTION

3.1 GENERAL

A. Wiring in existing building shall remain except as noted on Drawings or specified.

B. Verify existing conditions relative to work involved and make allowances thereto.

C. Balance additional loads to existing circuitry between phases.

D. Furnish a revised, typed panel directory on existing panelboards where circuitry is changed.

3.2 CUTTING AND PATCHING

A. Carefully lay out all work in advance to minimize cutting, channeling or drilling.

B. Where necessary, all such cutting and patching shall be done in a manner approved by Architect.

C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all costs.

D. Use only rotary type drilling tools to cut concrete.

E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.3 REMOVAL AND/OR REUSE OF EXISTING MATERIALS AND EQUIPMENT

A. Remove or relocate existing conduits, wires, equipment, devices or fixtures indicated on Drawings or as required.

B. Remove any existing non-active voice/data cables including trunk cables, and any other special systems cables in the entirety. Verify with Owner prior to removal.

C. Remove any existing exposed abandoned raceways, including those above accessible ceiling finishes in their entirety. Verify with Owner prior to removal. Where complete conduit removal is not feasible, cut conduit flush with walls and floors, and patch surfaces.

D. Provide additional code-mandated supports on any remaining (existing prior to project and located within the remodel area) unsupported raceway systems or communications cabling including fiber optic, voice/data and special systems.

E. Where existing multi-wire lighting and power branch circuits are modified in any way, it is this Contractor's responsibility to provide additional grounded (neutral) conductors as required between the electrical panelboard and existing circuit devices. Circuit breaker tie-handles are not acceptable. In the event that existing raceways are not properly sized to accommodate the required additional conductors, new raceway shall be installed.

F. Where the reuse of existing conduits, wires, and devices, or fixtures is permissible, verify that wiring is continuous. Existing outlet or junction boxes shall not be rendered inaccessible by structural changes made to the building.

G. Verify that no devices are cut off from power source unless specifically noted.

H. Existing equipment which is indicated as being removed and not indicated for reuse shall remain the property of the Owner, stored as directed. Remove and dispose any material the Owner does not wish to retain, except fluorescent lamps and ballasts.

I. Do not break, dump or otherwise destroy removed fluorescent and HID lamps, due to possible mercury contamination. Removed lamps are to be recycled and converted by an EPA-Licensed company regularly engaged in this business, and offering this service in accordance with all EPA, State, and Local Regulations:

Green Lights Recycling, Inc.
10040 Davenport Street NE
Blaine, MN 55449
(763) 785-0456

Recycle Technologies
4000 Winnetka Ave. N
Minneapolis, MN 55427
(800) 969-5166

Waste Management Lamp Tracker, Inc.
10050 Naples St NE
Blain, MN 55449
(800) 664-1434

or equivalent as selected by the Contractor.

All associated recycling costs shall be included in this Contract. Recycler shall provide Owner with a Certificate of Conversion, indicating Owner's manifested lamps have been properly recycled and converted. Comply with recycler's packing and shipping instructions.

J. Do not dump or otherwise destroy removed ballasts, due to possible PCB contamination. Removed ballasts are to be destroyed by an EPA Licensed company regularly engaged in this business, and offering this service in accordance with all EPA, State, and Local Regulations:

Green Lights Recycling, Inc.
10040 Davenport Street NE
Blaine, MN 55449
(763) 785-0456

Recycle Technologies
4000 Winnetka Ave. N
Minneapolis, MN 55427
(800) 969-5166

Waste Management Lamp Tracker, Inc.
10050 Naples St NE
Blain, MN 55449
(800) 664-1434

or equivalent as selected by the Contractor.

All associated destruction costs shall be included in this Contract. Recycler shall provide Owner with a Certificate of Destruction, indicating Owner's manifested ballasts have been properly destroyed. Comply with packing and shipping instructions.

K. Assume existing equipment and fixtures shown to be reused are in good working condition and can be installed without any repairs or, if in unusable condition, notify the Architect for decision. Contractor shall be responsible for any damage by his personnel to equipment in removal or handling.

L. Provide blank plates as required at existing rough-ins not being re-used.

M. Clean fixtures and other equipment removed and indicated for reuse. Provide new lamps for reused fixtures.

3.4 CONTINUITY OF SERVICE

A. Existing building will be in use during construction. Schedule and carry out work for a minimum of inconvenience to the Owner.

B. All service interruptions shall require a prior approval by Owner. Confine interruptions to the smallest area possible.

C. Verify that automatically controlled, electrically operated equipment is returned to the same operating condition which existed prior to interruption.

3.5 ASBESTOS

A. Contractor is assumed to be knowledgeable about Federal, State, and Local requirements with respect to asbestos issues.

B. Avoid disturbance of any asbestos-containing material (ACM) within the construction area or elsewhere on the site.

C. Verify with Owner’s “Asbestos Survey and Management Plan” the extent (if any) of existing asbestos.

END OF SECTION

SECTION 260519
CONDUCTORS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide a complete system of conductors enclosed in a raceway.

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 CONDUCTOR

A. Copper

1. Soft drawn, annealed.
2. Conductivity of not less than 98% pure copper.
3. Insulated for 600 volt service.
4. #10 AWG and smaller: Solid, THWN/THHN.
5. #8 AWG and larger: Stranded, THWN/THHN.
6. Provide USE where required by Code.

B. MC Cable

1. MC cable is not acceptable for use as a wiring method.

2.2 SPLICES

A. #10 AWG and smaller: Scotchlock Y, R or G as manufactured by 3M Company, or equivalent.

B. #8 AWG and larger: Compression type, as manufactured by Anderson, Burndy, Thomas and Betts Company, or equivalent.

2.3 LUBRICANT

A. General

1. NRTL-listed.
2. Flame resistant
3. Compatible with conductor insulation.

B. Acceptable Manufacturer

1. As selected by Contractor.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with Code, product listing, and manufacturer's recommendations.
2. Install wire and cable in Code-conforming raceways after moisture and debris is swabbed from conduit.
3. Refer to system specified for conductor's peculiar to that system.
4. Conductor sizes: Standard AWG, #12 minimum unless otherwise indicated.
5. Fixture taps: minimum #16 AWG.
6. Conductor temperature ratings: Compatible with the equipment to which it is to be connected. Refer to product listing.
7. Make conductor length for parallel feeders identical.
8. Derate ampacities as required for high ambient temperatures or conductor fill.

B. Color

1. Multi-wire (shared neutral) circuits.
   a. 120/208 volt
      1) Phase conductors: Black, red or blue.
      2) Grounded conductor (neutral): White.
      3) Grounding conductor: Green or bare.
   b. 277/480 volt
      1) Phase conductors: Brown, orange or yellow
      2) Grounded conductor (neutral): Gray
      3) Grounding conductor: Green or bare.
2. Separate neutral circuits:
   a. 120/208 volt
      1) Phase conductors: Black, red or blue.
      2) Grounded conductor (neutral): White with stripe colored to match phase.
      3) Grounding conductor: Green or bare
   b. 277/480 volt
      1) Phase conductors: Brown, orange or yellow.
      2) Grounded conductor (neutral): Gray with stripe colored to match phase.
      3) Grounding conductor: Green or bare
3. Switch legs: Same as phase conductors.
4. 120 volt isolated ground circuits:
   a. Phase conductor: Orange.
   b. Grounded conductor (neutral): White with orange stripe.
   c. Grounding conductor: Green with yellow stripe.

C. Splices

1. Eliminate wherever possible.
2. Made only at outlet or junction boxes.
3. Obtain special permission from Engineer for any splices in feeder conductors.

D. Voltage Drop

1. Increase size of circuit wiring in accordance with NEC 210.19(A)(1), fine print note, No. 4.
2. Use #10 AWG minimum for all home run conductors longer than 75 feet on 120/208/240 systems and 150 feet on 277/480 systems.

3.2 TESTS

A. After equipment and wiring is installed, and before it is energized, test all power circuits with a megohmeter for insulation resistance, phase-to-phase and phase-to-ground faults.

B. Before testing, disconnect all equipment that might be damaged by the test voltages.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING
FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Bond and ground all electrical equipment in accordance with National Electrical Code, State/Local Codes, these Specifications and as shown on Drawings.

B. Description of System

1. The service equipment, conduit systems, supports, cabinets and neutral conductor shall be solidly grounded and bonded in accordance with National Electrical Code to form a permanent effective and continuous grounded system.

PART 2 – PRODUCTS

2.1 GROUND RODS

A. Steel with a metallically bonded outer layer of electrolytically applied copper.

B. Minimum 1/2" diameter 10 foot length, unless otherwise indicated.

C. Sectional rods not permitted.

D. Manufacturer: ERITECH or equivalent.

2.2 GROUND ROD CLAMPS

A. Ground rod clamps shall be high strength silicone bronze.

B. Manufacturer: ERITECH or equivalent.

C. At Contractor's option, exothermic welding (CADWELD) or impact compression (ERITECH Hammerlock) may be used in place of ground rod clamps.

2.3 WATER PIPE GROUND CLAMPS

A. Steel U-bolt with bronze saddle.

B. Thomas and Betts Company 3900 series or equivalent.

2.4 REBAR GROUND CLAMPS

A. Bronze alloy construction.

B. Sized as required by rebar stub out.

C. Eritech RC or EK series as required by local authority. Equivalent products by Thomas and Betts acceptable.

PART 3 – EXECUTION

3.1 GENERAL

A. **Grounding conductors not shown or included on floor plans.**

B. **When required, increase trade size of raceway accordingly.**

C. Aluminum not acceptable for use as a grounding conductor.

3.2 SYSTEM GROUNDING

A. Provide grounding electrode system in accordance with NEC 250.50. If available, each of the items listed in 250.52(A)(1) through (A)(8) shall be bonded together to form grounding electrode system.

B. Connect grounding electrode conductor to grounded service conductor.

C. Provide raceway enclosing grounding electrode conductor. If metallic, bond as per NEC 250.64(E). Provide grounding bushing as required complete with jumpers same size as grounding electrode conductor.

D. To comply with NEC 250.53, provide two ground rods spaced minimum 6'-0" apart.

3.3 EQUIPMENT GROUNDING CONDUCTOR

A. Non-metallic conduit: Sized in accordance with NEC, except as further modified by this Specification.

B. Flexible Metal Conduit, Liquidtight Flexible Conduit.

1. Other than for connection of 120 volt recessed luminaires, not acceptable for use as means of grounding.
2. Provide bonding jumper sized in accordance with NEC around all flexible conduits. Use fittings having lugs for termination of jumper.
3. Spiral wrap not acceptable. Lay along surface, secured with cable ties.
4. Bonding jumper maximum length: 6'.
5. Bonding jumper not required where separate equipment grounding conductor is used.

C. Branch Circuits

1. **Separate equipment grounding conductor required for each raceway.**
2. Size: per NEC 250.122.
3. Bond to grounding bars, junction boxes and luminaire grounding screws.
4. Field install grounding screw in luminaire if not provided by factory.

D. Feeders

1. **Separate grounding conductor required.**
2. Bond to grounding bars in switchboards, panelboards and motor control centers.
3. Provide grounding bushing at both ends of all feeders utilizing metallic raceway.
   a. Bond to grounding bars at both ends.
   b. Size bonding jumpers to match equipment grounding conductor.

4. Feeder Equipment Grounding Conductor Size:
   a. Size per NEC 250.122.
   b. Copper equivalent ampacity when aluminum phase conductors utilized.
5. Do not splice grounding conductor.

E. Water Pipe System

1. Bond interior metal water piping per NEC Section 250.104(A) if water pipe system is not used as part of grounding electrode system.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all conduit systems as shown on Drawings or required by Codes and Specifications.

B. Description of System.

1. Provide code-conforming raceway system for all conductors unless specifically noted otherwise by phrase "not in conduit".

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings for all raceway runs in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Metallic conduit and tubing: Allied Tube and Conduit, Republic Conduit, or equivalent.

B. Non-metallic conduit: Carlon Schedule 40 or Schedule 80 where required, Allied Tube and Conduit, Cantex Inc., or equivalent.

C. Flexible metal conduit: Aluminum.

D. Liquidtight, flexible metal conduit: Anaconda Sealtite or equivalent.

E. Fittings

1. Rigid metal conduit: Appleton, Crouse-Hinds, or equivalent**. Pot metal condulet fittings not acceptable.**
2. EMT:
   a. **Steel.**
   b. Setscrew or watertight as required.
   c. Thomas and Betts Company, or equivalent.
   d. **Pot metal, "Sock-on" and indentor fittings not acceptable.**
3. Flexible metal conduit: STEEL, Thomas and Betts Company XC-400 series, or equivalent.
4. Liquidtight flexible metal conduit:
   a. **Steel.**
   b. Straight or angled as required.
   c. Appleton, Thomas and Betts Company or equivalent.

F. Hangers and Supports

1. As required by Codes and Specifications.
2. Raco, Unistrut, or equivalent.

3. Erico conduit clips, Type 8-M, 12-M and K-8 acceptable for individual branch circuit runs.

G. Metal Surface Raceway

1. Wiremold 500/700 metallic series or equivalent, unless otherwise indicated on Drawings.
2. Provide associated fittings as required.
3. Standard color as selected by the Architect.

H. Wireway

1. NRTL 870 listing throughout, including connectors and fittings.
2. Hinged cover construction.
3. Sealing capability where required.
4. Suitable for "lay-in" installation of conductors.
5. Rust inhibiting phosphatizing undercoat and baked enamel finish.
6. Plated hardware.
7. Square D "Square Duct" or equivalent.

I. Expansion Fittings

1. Metallic: OZ, Thomas and Betts Company, or equivalent.
2. Non-Metallic: Carlon, or equivalent.

J. Firestop Assemblies

1. Firestop systems shall consist of fittings and/or intumescent materials assembled as per UL (or other NRTL) System Details.
2. Product manufacturers: 3M, Chase Technology Corporation, Dow Corning Fire Stop, Hilti, International Protective Coatings Corp. (Flame Safe), Nelson Fire Stop Systems.

K. Thru Wall and Floor Seals

1. OZ-Gedney Type "FSK" or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Electrically continuous throughout.
2. Plumb and level.
3. Cut square and reamed smooth.
4. Use commercial bender for offsets and bends.
5. Cap to prevent debris from entering during construction.
6. Swab conduit prior to installation of conductor.
7. Provide pull cord in empty conduits.
8. Alter conduit routing to avoid structural obstructions, minimizing crossovers.
9. It is the intent of this Specification to provide reasonable provisions for future expansion of electrical use (See NEC 90.8 and 90.1(B), FPN). Therefore, **install all branch circuit home runs as shown on Drawings. Do not combine home runs or increase quantity of conductors therein.**
10. Install raceway, conduit and fittings in accordance with Code, NRTL listing and manufacturer's recommendations.

B. Concealed Interior Raceway

1. Conceal all raceway within building construction.
2. May be run in a direct line for Contractor's convenience.
3. For Contractor's convenience, **concealed** stubs from concrete-encased PVC conduit runs may extend to first **concealed** junction box.
4. Where applicable, center within insulation any electrical conduit routed in attic space. Provide sealing as per NEC 300.7(A) for all conduits exposed to different temperatures.

C. Exposed Interior Raceway

1. Run parallel or perpendicular to building lines.
2. **Provide RGSC or EMT stubs for concrete-encased PVC conduit runs.** Extend stub from RGSC coupling set flush in floor.
3. Provide flexible conduit as required for motor and equipment connections.

D. Concrete Encased Raceway

1. Shall not interfere with structural integrity of slab, column, or beam.
2. Installation subject to acceptance of Structural Engineer.
3. Maximum diameter 1/3 thickness of concrete member.
4. Install in center of section.
5. Provide expansion fitting when crossing building expansion joint. Grounding integrity of raceway to be maintained.

E. Exterior Raceway

1. Minimum 24" below grade.
2. PVC unless otherwise indicated.
3. **Exterior surface stubs for PVC conduit runs: RGSC, including final underground sweep.** Exterior surface stubs acceptable only where specifically shown.
4. Penetrating Watertight Walls or Floors: Provide block-out with 1/2" clearance around conduit for underground penetrations. Pack with Oakum and caulk with non-shrinking grout, or provide conduit entrance seal.
5. Penetrating Roof or Waterproofing Membranes: Provide flashing and pitch pocket.
6. Contractor responsible for providing a watertight penetration.
7. Coat RGSC penetrations with heavy asphaltic-base compound.
8. Unless otherwise indicated, route exterior conduits to interior distribution equipment concealed under slab.

F. Supports

1. Refer to NEC 300.11
2. **Tie wire supports not acceptable.**
3. Support Spacing: NEC.

G. Specific Locations

1. Allow 6" minimum clearance at flues, steam pipes and heat sources.
2. Conduit visible behind grills and registers: paint black.
3. Seal conduit where leaving heated area and entering unheated area.
4. Penetrating non-watertight walls or floors: Pack space between conduit and block-out on both sides with Oakum.
5. Penetrating fire rated walls or floors: Seal to prevent passage of fire or products of combustion.

6. From each flush mounted panel location, stub three additional 3/4" conduits into nearest accessible ceiling space.
7. Do not mount raceway on ductwork, cover access doors, panels, controls, or otherwise hinder normal maintenance and repair of the equipment.
8. Motors:
   a. Connect to motor feeder or branch circuit by means of flexible metal conduit or liquidtight flexible metal conduit in moist areas.
   b. Minimum flexible length: 18".
   c. Where practical, feed floor mounted motors from raceway installed in or under slab.
   d. When floor mounted motors are fed overhead, provide required support for raceway. Extend raceway to floor and provide a floor flange. Insert "T" condulet fitting at proper height and extend flexible conduit to motor.

3.2 SIZE

A. National Electrical Code, subject to stated minimums.

B. Minimum Size

1. Exterior raceway: 3/4".
2. In or under poured concrete (including precast concrete panels): 3/4".
3. Branch circuit home run: 3/4". Consider home run to include raceway length from panelboard, switchboard, or motor control center to nearest power consuming or switching device on that circuit.
4. Feeders: 3/4".
5. All others not listed: 1/2".

3.3 TYPE

A. Intermediate Metal Conduit (IMC)

1. May be used in place of rigid galvanized steel conduit for Contractor's convenience.
2. Comply with manufacturer's recommendations for bending, threading and cutting operations.
3. Install as specified for rigid galvanized steel conduit.

B. Rigid Galvanized Steel Conduit (RGSC)

1. Use:
   a. Overhead electric and telephone service entrance. IMC or Aluminum not acceptable for this application.
   b. All raceway exposed to weather. Aluminum not acceptable for this application.
   c. Where required by national, state and local codes.
2. Fittings: Threaded except at KO type boxes where double locknut/bushing method acceptable.
3. Waterproof entire length with heavy asphaltic base compound when:
   a. Embedded directly in earth.
   b. Embedded in concrete directly in contact with earth, with or without vapor barrier.
   c. Penetrations run directly from concrete with earth, to soil burial.
4. Factory applied PVC coating acceptable in place of asphaltic base compound.

C. Rigid Non-Metallic Conduit (PVC)

1. Use only in slabs and exterior underground locations. See 3.1 B3, C4 and E3 for limitations.
2. Provide insulating bushing at all terminal adapters.
3. Provide equipment grounding conductor within raceway.
4. Increase trade size accordingly for equipment grounding conductor.
5. Utilize commercial heating element type bending equipment. **Do not use torches to bend PVC conduit.**

D. Electrical Metallic Tubing (EMT)

1. Use in all areas not prohibited by NEC and this Specification.
2. Do not use in concrete slabs on or under grade, or walls under grade.
3. Do not use in exterior underground applications.

E. Flexible Metal Conduit

1. Use for connections to transformers, motors, fixed appliances, recessed luminaires and other equipment as required.
2. Use liquidtight conduit with liquidtight fittings in areas of high moisture content.

F. Metal Surface Raceway

1. Install complete with matching boxes, fittings, and end caps, parallel or perpendicular to building construction.
2. Wire adjacent devices to alternate circuits where metal surface raceway contains devices integral to the channel.
3. Feed from flush connector in wall directly into raceway. Field cut base as required with 1/2" knockout for this purpose. Do not utilize Wiremold catalog #2051H for 2000/2100 series.

G. Fire Resistive Walls and Decks

1. Preserve integrity of fire rating through the use of UL (or other NRTL) Listed firestop assemblies of appropriate penetration type and rating time.
2. Install in accordance with manufacturer's recommendations.
3. All floor to floor penetrations and all wall penetrations into Mechanical, Electrical, and Communications Rooms shall be sealed with 1 hour firestop assemblies unless more stringent rating is required by building codes.
4. Include UL (or other NRTL) firestop assembly sheets and manufacturer product data sheets specifically used with the Project Closeout Documentation.

END OF SECTION

SECTION 260534
OUTLET, PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all outlet, pull and junction boxes complete with associated covers and rings.

B. Work Installed But Furnished Under Other Directives.

1. Obtain manufacturer's backboxes or recommendations for special equipment.

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 CEILING BOXES

A. Flush and Surface

1. 2-1/8" minimum depth.
2. Square or octagon as required.
3. Galvanized steel.
4. Manufacturer: Appleton, Raco, Steel City or equivalent.

2.2 WALL BOXES

A. Flush

1. One and two gang wall boxes: 4" square box, 2-1/8" minimum depth with appropriate plaster or tile ring.
2. More than three gang: Gangable 3-1/2" deep unless wall cavity limits depth to 2-1/2".
3. Use 4-11/16" square boxes where required by Code.
4. Single gang masonry boxes acceptable only for single conduit entrance. Feed-through circuiting not acceptable. Use 4" square box/tile ring for feed-through applications.

B. Surface Mounted Devices

1. 4" square box, 2-1/8" minimum depth with appropriate 1/2" raised cover.
2. Manufacturer: Appleton, B-Line, Raco, Steel City, Wiegmann, or equivalent.

C. **Sectional, through wall and handy boxes not acceptable.**

2.3 PULL AND JUNCTION BOXES

A. Galvanized steel with cover.

B. Size: National Electrical Code.

C. Manufacturer: Appleton, Raco, Hoffman, Shallbetter, Steel City, Wadsworth or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with code, product listing and manufacturer's recommendations.
2. Install boxes plumb, level and flush with finish surface.
3. Support securely and rigidly.
4. Verify wall depths to ensure adequate clearance for special backboxes.
5. Provide barriers in ganged switch outlets where voltage between adjacent switches exceeds 300 volts.

B. Location

1. Governed by structural conditions and obstructions.
2. Mount switch outlet on strike side of door, maximum 4" from door opening to first switch. Verify door swing with Architectural Plan.
3. Coordinate equipment outlets prior to installation for proper concealment.
4. Center outlets with respect to acoustical tile, paneling and furring trim.
5. Adjust outlets in masonry or tile construction to horizontal and vertical mortar joints.
6. Clear all piping, ductwork and other obstructions.
7. For outlet boxes on opposite sides of walls or partitions with separation distances of 24" or less, pack all interconnecting conduits with Duxseal after conductor installation, to prevent sound transmission.
8. Outlet boxes improperly located shall be corrected at Contractor's expense.

C. Mounting Heights

1. All device mounting heights shall conform to ADA Recommendations. Refer to Standard Electrical Symbol Legend for nominal mounting heights.
2. Verify height of all outlets to ensure installation above top of radiation covers, mirrors, counters and any other obstructions that may alter nominal mounting height.
3. **Measure from finish floor to centerline of outlet.**
4. Mount exterior outlets horizontally. Measure height from nearest interior finish floor below outlet.
5. Mount outlet designated AC (above counter) no less than 4" higher than top of countertop backsplash.

D. Fire Resistive Walls and Ceilings

1. Penetrations for steel electrical outlet boxes permitted, provided:
   a. Boxes do not exceed 16 square inches in area.
   b. Area of such openings shall not exceed 100 square inches for any 100 square feet of area.
   c. Outlet boxes on opposite sides of walls or partitions separated by horizontal distance of 24 inches.

E. Pull and Junction Boxes

1. Pull and junction boxes are generally not indicated on Drawings.
2. Install in accordance with National Electrical Code and as required to facilitate wire pulling.
3. Do not install in finished spaces without approval of Engineer.

F. Identification

1. Identify pull and junction boxes containing system voltages in excess of 250 volts to ground with voltage markers.
2. Voltage markers: Not visible in finished areas.

END OF SECTION

SECTION 260553
IDENTIFICATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Label electrical equipment as required by Codes and Specifications and as specifically directed by Engineer.

PART 2 – PRODUCTS

2.1 PANEL DIRECTORIES

A. Include directory cards with panelboards.

2.2 NAMEPLATES

A. Machine engraved black laminate with white core, except as otherwise indicated.

B. Minimum letter size: 1/8".

C. Minimum plate size: 1" X 3".

2.3 VOLTAGE MARKERS

A. Vinyl impregnated cloth markers with legend as required.

B. Manufacturer: Ideal #44-360, or equivalent.

2.4 PRESSURE SENSITIVE TAPE

A. Use only when specifically referred to in other Sections.

B. Manufacturer: Dymo, or equivalent.

2.5 UNGROUNDED CONDUCTOR IDENTIFICATION

A. As per NEC 210.5(C) and 215.12(C).

B. Typewritten cards behind plastic shield, affixed with double-stick carpet tape. Heat surface prior to affixing directory.

PART 3 – EXECUTION

3.1 GENERAL

A. Directory Cards

1. **Typewritten only.** Hand lettering unacceptable, except at "spares" and "spaces", where neat hand lettering with erasable pencil is required.
2. Indicate type of load and rooms where load occurs.
3. **Do not use room numbers as shown on Drawings, but refer to name and numbers on door.**
4. Do not identify until final load balancing is accomplished.

B. Nameplates

1. Apply plumb and level with two counter-sunk screws.
2. Glue, double-stick tape, or similar adhesive not acceptable.

C. Device Plates

1. Machine engrave directly on plate in lieu of separate nameplate.
2. Fill inscriptions with contrasting color.

D. Voltage Markers

1. Not visible in finished areas.

E. Junction Boxes

1. Mark all covers with indelible marker to indicate panelboard designation and circuit numbers for circuits contained within box.

3.2 EMERGENCY SYSTEM COMPONENTS

A. All boxes and enclosures (including transfer switches, generators and power panels) for emergency circuits shall be permanently marked so they will be identified as a component of an emergency circuit for system.

3.3 SERVICE EQUIPMENT FAULT CURRENT NAMEPLATE

A. Provide warning nameplate on each service disconnecting means enclosure indicating the fault current of the system.

B. Fault current shall be calculated at the utility transformer, using an assumed infinite primary bus, and using the actual transformer impedance and kVa values.

C. Red laminate with white core.

D. Letter height: minimum ¼”

E. Legend

SERVICE AVAILABLE FAULT CURRENT: _____
TRANSFORMER KVA: _____
TRANSFORMER IMPEDANCE: _____
DATE: _____

3.4 "WILD LEG" WARNING NAMEPLATE (240V 3∅ 4W SYSTEMS)

A. Provide a warning nameplate on all fusible switches, panelboards and switchboards where a grounded (identified) conductor is present.

B. Red laminate with white core.

C. Letter height: minimum 1/4".

D. Legend:

CAUTION “B” PHASE HAS 208 VOLTS TO GROUND
240V 3∅ 4W DELTA SYSTEM

END OF SECTION

SECTION 260583
CONNECTION TO EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. The Contractor shall provide operational electrical connections to all electrically driven or controlled equipment.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General

1. The Contractor shall provide all necessary materials and labor required to make final operational connections to all equipment, generally as shown on the Drawings, and specifically as required by equipment specifications and installation literature.
2. Control devices and panels furnished by others will be delivered to the contractor at the jobsite, and shall be installed in accordance with manufacturer's printed instructions. Review equipment specifications to determine extent of work involved.

PART 3 – EXECUTION

3.1 GENERAL

A. Provide operational connections for all equipment shown on the Drawings. Connections shall be in accordance with manufacturer's recommendations, and shall be left operating in a manner acceptable to the Engineer and Owner.

B. Provide available fault current calculations for equipment listed in Section 260500-1.4E based on actual installation criteria (conductor lengths, raceway types, etc.). Calculations shall incorporate the current limiting effects of fuses supplied with local disconnecting means. Include calculation information in Record Manuals.

C. For all exterior mechanical equipment, provide weatherproof GFCI receptacle outlet within 25' of equipment, circuited to nearest unswitched power. Refer to NEC 210.63 and 406.8.

D. For all mechanical equipment located in attic and crawl spaces, provide porcelain lamp holder with integral receptacle and lamp guard, circuited to nearest unswitched power via pilot handle toggle switch near access hatch. Engrave plate. Refer to NEC 210.70(C).

3.2 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. It is the intent of this Specification to provide all necessary equipment as detailed, for a complete lighting control system.
2. The work included under this Specification shall cover:
   a. All labor, materials and equipment to furnish the lighting control system herein specified.
3. The work shall include the services of a commissioning agent. The commission agent shall be a factory-trained representative who shall commission the system for proper operation and instruct the Owner as to proper operation, programming, and maintenance.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Submit floor plan drawing indicating all device locations and circuitry requirements between devices.
3. Provide connection/riser diagram for specific project involved. Upon Engineer's review, provide **additional three** copies for Contractor use at the project site and for Record Drawing/Manual submittal at project closeout.

B. Manuals

1. Provide information in accordance with Section 260500. Manuals shall include descriptions of equipment and methods of maintenance and operations.

PART 2 – PRODUCTS

2.1 CONTROL SYSTEM COMPONENTS

A. Component communication shall be by low voltage hard wired protocol and/or by a wireless mesh network.

B. Switches, modules, and sensors shall be as indicated on the drawings.

1. Unless otherwise indicated on the Drawings, wall switches for wireless control systems shall be powered by line voltage. Battery powered devices not acceptable.
2. Battery powered wireless daylight sensors shall be acceptable.
3. Switching relays that are utilized for emergency egress lighting shall be in conformance with UL 924.

2.2 SEQUENCE OF OPERATIONS

A. The following descriptions are intended to provide a baseline operational platform for the system. All specific operating points shall be verified with the end user. If not acceptable to the end user, alternative points shall be offered and approved by the Engineer.

1. Shop Space:
   a. Individual zone on/off as indicated on drawings.

b. Occupancy Sensors shall operate in Vacancy Mode (switch on, auto off) after 20 minutes.

PART 3 – EXECUTION

3.1 STORAGE

A. Store Lighting Control Components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. Provide control station identification as per Drawings.

3.3 TESTS

A. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative. The commissioning agent shall configure the system as per the sequence of operation, make any adjustments/additions to the configuration as required or instructed, and verify the complete operation of the entire system.

1. Electrical contractor shall notify owner and engineer twenty one (21) working days in advance to scheduling system commissioning.

B. Furnish a letter of verification to Engineer indicating that the system has been tested and configured by manufacturer's representative and is found to be complete and functional. List date of test and name of manufacturer's representative. Testing to include a functional test of all devices and verification of proper configuration for all devices. Notify Owner and Engineer one week in advance of scheduled tests.

C. As part of the required project close out Record Manuals, provide documentation on the commissioning of the system including room by room description indicating:

1. Sensor parameters, time delays, sensitivities and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc).
3. Load parameters (e.g. blink warning, etc).

3.4 INSTRUCTIONS

A. After system commissioning is complete, the commissioning agent shall provide the Owner with complete instructions as to proper operation and maintenance of the lighting control system.

B. Record instructions and include with manual in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide panelboards where indicated and scheduled.

1.2 SUBMITTALS

A. Shop Drawings:

1. Submit information in accordance with Section 260500. Show all details of:
   a. Lugs.
   b. Locations for grounding bar, neutral bar and directory.
   c. Main bus amperage and arrangement.
   d. Weight and physical dimensions of enclosures.
   e. Cover and lock type.
   f. Quantity of spaces.
   g. Quantity, arrangement, amperage and short circuit withstand ratings in RMS amperes for all circuit breakers.
   h. Any other pertinent data.
   i. Applicable series rating for this particular riser/fault current combination.

B. Record Manuals

1. Submit information in accordance with Section 260500.
   a. Include fault current available at buss. Fault current calculations shall be based on actual installation criteria (conductor lengths, raceway types, etc.)
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Product of same manufacturer.

B. Sizing and design based upon Eaton equipment; Eaton catalog numbers utilized for reference.

C. Other Acceptable Manufacturers.

1. Approved equal units by Siemens or Square D.

D. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for bid.

2.2 GENERAL

A. Provide sub-feed lugs, contactors, main breakers or other equipment as scheduled.

B. Provide copper bus, copper isolated neutral bar and copper grounding bar in all panelboards.

C. Use load centers only where specifically indicated. Provide copper bus with plated aluminum neutral and grounding bar.

D. NRTL-listed, and "suitable for use as service equipment" when required.

E. Feeder risers are schematic only and not intended to infer lug arrangements. Contractor to indicate desired lug arrangements and sizes on shop drawings.

F. Connection from load side of main breaker to panel bus shall be bus bar. Insulated wire and backfed types not acceptable.

G. NRTL-recognized series ratings acceptable, with minimum ratings as specified herein.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Circuit Breakers

1. Bolt-on.
2. Breaker Types:
   a. Quick-make, quick-break, thermal magnetic unless otherwise indicated.
3. Trip indicating.
4. Common trip on multi-pole breakers; handle ties not acceptable.
5. Minimum SCCR rating:
   a. NRTL tested and certified series combinations acceptable.
      1) 10,000 for systems up to 240 volts.
      2) 35,000 for 277/480 volt systems.
6. Single pole 15 and 20 ampere ratings to be NRTL-listed as “Switching Breakers” and carry SWD marking.
7. FIRE ALARM EQUIPMENT
   a. Circuit breakers feeding fire alarm control panels and/or other fire alarm equipment shall be equipped with a pad-locking device capable of locking the circuit breaker in the closed position.

B. Bus Assembly and Temperature Rise

1. Rating: As scheduled.
2. 98 percent conductivity.
3. "Distributed phase" or "Phase sequence" type bus bar connections.
4. Adjacent single pole breakers connected to opposite polarities.
5. Multi-pole breakers installable in any location.
6. Provisions for additional breakers such that field addition of connectors or mounting hardware will not be required.

C. Wiring Terminals

1. NRTL-listed as suitable for type of conductor specified.

D. Circuit Numbering

1. Starting at top, odd numbers in sequence down lefthand side and even numbers in sequence down righthand side.

E. Cabinet

1. Enclose bus assembly in steel cabinet.
2. Wiring gutter sizes and steel gauge in accordance with NEMA and NRTL standards.
3. Fabricate box from galvanized steel or equivalent rust resistant steel.
4. Furnish **without** pre-punched knockouts.

F. Fronts

1. Code gauge, full finished steel with rust inhibiting primer and baked enamel finish.
2. Not removable with door in locked position.
3. Adjustable trim clamps.
4. Concealed steel hinges.
5. Door with tumbler-type cylinder lock, catch and spring-loaded door pull.
6. Flush lock not to protrude beyond door front.
7. Key all locks alike.
8. Circuit directory frame and card with clear plastic covering on inside of door.

G. Manufacturer

1. Eaton Pow-R-Line series.

2.4 POWER DISTRIBUTION PANELBOARDS

A. Circuit Breakers

1. Bolt-on.
2. Breaker Types:
   a. Quick-make, quick-break, thermal magnetic.
3. Trip indicating.
4. Common trip on multi-pole breakers; handle ties not acceptable.
5. Equipped with individually insulated braces and protected connectors.
6. Front faces of all circuit breakers to be flush with each other.
7. Affix large, permanent, individual circuit numbers to each breaker in uniform position.
8. Minimum 35,000 SCCR rated.
   a. NRTL tested and certified series combinations acceptable.

B. Bus Assembly and Temperature Rise

1. Rating: As scheduled.
2. Insulated bus structure.
3. 98 percent conductivity.
4. "Distributed phase" or "phase sequence" type bus bar connections.
5. Adjacent single pole breakers connected to opposite polarities.

C. Wiring terminals

1. NRTL-listed as suitable for type of conductor specified.

D. Cabinet

1. Enclose bus assembly in steel cabinet.
2. Wiring gutter sizes and steel gauge in accordance with NEMA and NRTL standards.
3. Fabricate box from galvanized steel or equivalent rust resistant steel.
4. Furnish **without** pre-punched knock-outs.

E. Fronts

1. Minimum 12-gauge, full finished steel with rust inhibiting primer and baked enamel finish.
2. Circuit directory frame and card with clear plastic covering.

F. Safety Barriers

1. As required by UL or other NRTL.

G. Manufacturer

1. Eaton Pow-R-Line series.

2.5 CABLE TIES

A. Thomas and Betts Company "Ty-Rap" or equivalent.

2.6 PLYWOOD BACKING FOR SURFACE MOUNTED PANELBOARDS.

A. 3/4" grade AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store panelboards in a cool, dry area prior to installation.

3.2 INSTALLATION

A. General

1. Install where shown on Drawings, plumb and level.
2. Top of trim 6'-3" above finished floor for wall-mounted panelboard.
3. Adjust operating mechanism for free mechanical movement.
4. Conductors neatly dressed and banded with nylon cable ties after final load balancing.
5. From each flush installation, stub three additional 3/4" conduits into nearest accessible ceiling space to provide for future utilization of spare circuits.
6. Provide 3/4" plywood backing for all surface-mounted panelboards.
7. Tighten all lugs in accordance with manufacturer's recommendations.
8. For all fusible distribution panelboards, arrange devices in descending order such that bussed space is at top and largest devices are at bottom.
9. Provide individual terminal or lug for each wire. Multiple wires to common terminal, or several terminals for single stranded conductor not acceptable.

B. Identification

1. Identify panelboards and directories in accordance with Section 260553.
2. Provide nameplate similar to following example:

PANEL L6
120/208 VOLT 3∅ 4W
2" C – 4 #3/0
FED FROM SWBD #1

3. When required, provide identification as per NEC 210.5(C) at each branch circuit panelboard.

3.3 TESTS

A. Balancing Load

1. Circuiting shown on Drawings is designed to produce equal loading on all phases.
2. Under actual operating, check and make circuit adjustments as required to produce balanced condition.

3.4 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 262713
ELECTRIC SERVICE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide electrical service from Otter Tail Power Company's point of connection to main switch.

B. Description of System

1. 120/240 V, 1 Phase, 3 Wire

PART 2 – PRODUCTS

2.1 METERING

A. Feed through metering

B. Utility company to furnish all instrument transformers and meters.

C. Meter Sockets: Provide as required by utility company.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify with utility company prior to Bid all specific equipment requirements, installation requirements and fees particular to this service installation and make allowances thereto.

B. Include in Bid all utility company fees and charges associated with service installation.

C. Include in Bid all miscellaneous lugs, ground rods, site and pad conduits, sleeves, and other appurtenances required for service installation and not provided by utility company.

D. Transformer and Equipment Pads

1. Concrete pads provided by Division 26.
2. Size per utility company requirements.
3. Coordinate installation.

E. Contractor totally responsible for all utility company coordination, metering equipment placement, and transformer location, with respect to service installation.

F. Service installation shall comply with utility company rules and regulations.

G. Cabinets

1. Install cabinets in accordance with Code, product listing and manufacturer's recommendations.
2. Install where shown on Drawings.
3. Plumb and level.
4. Top of trim 6'-3" above finished floor.

3.2 IDENTIFICATION

A. Identify cabinets with nameplates in accordance with Section 260553.

B. Inscription as directed by Engineer.

C. Provide available fault current calculations for cabinets based on actual installation criteria (conductor lengths, raceway types, etc.). Include calculation information in Record Manuals.

3.3 CLEAN UP

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 262726
WIRING DEVICES AND DEVICE PLATES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide wiring devices complete with device plates of matching or specified color. Wiring devices include receptacles for the connection of portable equipment and switches used for the control of both lighting and fractional horsepower motor loads. Also included are dimmers, occupancy sensors, photoelectric switches and time switches.

B. Work Installed But Furnished by Others

1. Where indicated, install devices furnished by other Divisions of this Specification.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 GENERAL

A. Device color: Gray or as selected by Architect. Verify with Architect. (Exception: Red devices on emergency circuits where applicable).

B. All devices shall be of the same manufacturer, except where specifically noted otherwise with the phrase "NO SUBSTITUTION".

2.2 SWITCHES

A. AC Toggle and Keyed Switches

1. 20-ampere 120/277 volt AC and HP rated.
2. Industrial Grade.
3. Color coded face or body by amperage.
4. Screw pressure plate back wire and side wire.
5. Federal Spec WS-896 listed.
6. Acceptable Manufacturers:

a.	Cooper	2220 series
b.	Hubbell	1220 series
c.	Leviton	1220 series
d.	Pass & Seymour	PS20AC series

B. Pilot Light Switches

1. Neon lamp in red toggle handle, lit in "on" position.
2. 20 ampere, 120/277 volt AC rated.
3. Manufacturer: As listed above.

C. Time Switches

1. Two Circuit SPST switching, voltage rating as required.
2. Digital display with 7-Day programming.
3. Non-volatile program memory (battery backup unacceptable).
4. Manufacturer: Intermatic #ET2725 series.
5. Other acceptable manufacturer: Tork.
6. Special units as shown on Drawings.

D. Remote Photoelectric Switches

1. Threaded swivel mounting with locking nut and neoprene gasket.
2. Light level adjustment slide.
3. Activation: 1-5 footcandle on, 3-15 footcandle off.
4. Manufacturer: Intermatic #K4200 series, wattage and voltage as required.
5. Other acceptable manufacturers: Paragon, Area Lighting Research, Precision, or Tork.

E. Spring Wound Timer Switch

1. As shown on Drawings.
2. Manufacturer: Intermatic.
3. Other acceptable manufacturers: Area Lighting Research, Rhodes Mark Time, or Tork.

F. Occupancy Sensors

1. Ceiling Mount – Line Voltage
   a. Self-contained line voltage unit with no external relays or power packs required.
   b. Passive dual technology sensing combining passive infrared and ultrasonic/microphonic technology. Selective for initial and maintained triggering.
   c. Rating: 120 VAC @ 800 watts, 277 VAC @ 1200 watts, electronic ballast rating. No minimum load requirements.
   d. Ceiling-mount with 360° conical pattern coverage.
   e. Adjustable time delay, from 5 to 20 minutes.
   f. Automatic adjustment option for continuous time of day usage monitoring with automatic off delay adjustment.
   g. Integral light level sensor to prevent turning lights on at selected light level between 10 and 300 footcandles.
   h. LED activity Indicator.
   i. Manufacturer: WattStopper #DT-355, Sensorswitch CMR-PDT series, Leviton ODC series, Hubbell OMNIDT-BP series, or approved equal.
2. Wall Mount
   a. Self-contained line voltage unit with passive infrared sensing.
   b. Rating: 120 VAC @ 800 watts, 240/277 VAC @ 1200 watts, electronic ballast rating. No minimum load requirements
   c. PIR collector beams view out horizontally 35 feet in a wall-to-wall pattern, with a 20-foot effectiveness for small hand or body motions.
   d. Adjustable time delay, from 5 to 20 minutes, with “OFF” override switch.

e. Automatic adjustment option for continuous time of day usage monitoring with automatic off delay adjustment.
f. Bypass mode to allow override button to act as a standard on-off switch in case of sensor failure.
g. Vandal resistant lens.
h. LED activity Indicator.
i. Multi-way version:
   1) Simultaneous load control from up to four device locations.
j. Dual-level version (ab switching):
   1) Two separate relays with dual override switches.
   2) Independent Auto or Manual mode per relay.
k. Manufacturer: WattStopper PW series, Sensorswitch WSX series, Leviton OSSMT series, Hubbell LHIR series, or approved equal.

3. Wall Mount with 0-10V Dimming
   a. Self-contained line voltage unit with passive infrared sensing.
   b. Rating: 120 VAC @ 800 watts, 240/277 VAC @ 1200 watts. No minimum load requirements.
   c. Class 1 control of 0-10 Volt LED dimming for full range dimming control.
   d. PIR collector beams view out horizontally 35 feet in a wall-to-wall pattern, with a 20-foot effectiveness for small hand or body motions.
   e. Adjustable time delay, up to 30 minutes, with “OFF” override switch.
   f. Multi-location capable.
   g. Manufacturer: WattStopper PW-311, Sensorswitch WSX-D, Hubbell LHD-IRS series, or approved equal.

2.3 RECEPTACLES

A. General Purpose

1. 20 ampere, self-grounding, NEMA 5-20R, industrial specification grade.
2. Nylon face with finder grooves and compact body.
3. Minimum 0.032” triple wipe brass contacts.
4. Corrosion resistant steel strap interlocked with face and body.
5. Screw pressure plate back wire and side wire.
6. Federal Spec WC-596 listed.
7. Acceptable Manufacturers:

a.	Cooper	5362
b.	Hubbell	5362
c.	Leviton	5362
d.	Pass & Seymour	CRB5362

B. GFCI

1. 20 ampere, feed-through type.
2. Two utilization points per device, with vertical orientation.
3. Use Tamper Resistant version in all locations indicated in Part 406.12 of the National Electric Code
4. Manufacturer: As listed above.

C. Damp & Wet Locations

1. All 15 and 20 ampere, 125 and 250 volt non-locking receptacles shall be listed weather-resistant type as per NEC 406.9(A) and 406.9(B)(1).
2. Manufacturer: As listed above.

2.4 DEVICE PLATES

A. Flush Interior

1. Opening for device intended.
2. 430 or 302/304 stainless steel.
3. Manufacturer: Cooper, Hubbell, Leviton and Pass & Seymour.

B. Surface Interior

1. 1/2" raised cover

C. Damp & Wet Locations

1. Damp locations:
   a. Refer to NEC 406.9(A).
   b. Die-cast aluminum construction with stainless steel springs.
   c. Unless indicated otherwise on the Drawings, Manufacturer: Pass & Seymour #4500 series or equivalent.
2. Wet locations:
   a. Refer to NEC 406.9(B).
   b. Unless indicated otherwise on the Drawings, Manufacturer: Red Dot #CKMU (horizontal) or #CKMUV (vertical), or approved equal by Hubbell.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install device and plates where shown on Drawings in accordance with Code, product listing and manufacturer's recommendations.
2. Refer to Section 260534-3.1C for mounting heights.
3. Plumb and level.
4. Tight to wall.
5. Thoroughly cover wall opening around device.
6. Replace all devices and plates that become discolored or burned during construction.
7. Provide blank plates for unused openings.
8. Connect wiring devices by means of single conductor tails. Multiple wire connections not acceptable.
9. Tighten unused connection screws.

B. Identification

1. Identify wall switches which control lighting or equipment not in sight.
2. Refer to Section 260553-3.1C.

C. Receptacles

1. Vertical mounting with grounding pole at bottom.
2. Provide GFCI receptacles at NEC 210.8 locations.

D. Photoelectric Switches

1. Install on roof, in center of structure where viewing from ground is minimal.
2. Verify exact location with Architect.
3. Penetrate roof with 3/4" RGSC, securely fastened to structure.
4. Provide flashing to maintain roof integrity.
5. Mount 18" above finished roof surface.
6. Make connections in weatherproof junction box.

E. Occupancy Sensors

1. Provide adequate supports to any structures, ceilings and grid system to safely attach sensors.
2. Mount external power packs (required only for low voltage sensors) within junction box in accessible ceiling space.
3. Verify operating parameters with Engineer.

3.2 TESTS

A. Proper operation of lighting switches, dimmers and occupancy sensors.

B. Duplex Receptacles

1. Proper connections.
2. Test all receptacles with NRTL listed receptacle circuit tester similar to Bryant #5266-PT, or Ideal #EZ Check.

3.3 INSTRUCTIONS

A. Instruct Owner's personnel in proper operation, setting, and maintenance of time switches, dimmers, occupancy sensors, and GFCI receptacles.

END OF SECTION

SECTION 262813
FUSES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all fuses as required.

B. Work Furnished But Not Installed

1. Provide spare fuses for all sizes and classes required.
2. Quantity: 10%, with a minimum of three each rating, including motor starter control transformer fusing.

1.2 SUBMITTALS

A. Record Drawings

1. Indicate actual class, type and size of fuse installed in each device.

B. Record Manuals

1. Submit information in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 FUSES

A. 600 Amperes and Less Protecting Feeders or Combination Motor/Branch Circuit Loads.

1. UL-listed, Class RK-1.
2. Manufacturer: Bussmann LPN-RK/LPS-RK, Littelfuse LLN-RK/LLS-RK, or Brush LEN-R/LES-R.

B. Motor Starter Control Transformers

1. As recommended by manufacturer.

C. Plug Fuses

1. Dual element, UL-listed Type S with adapter.
2. Use only as indicated on Drawings for fused toggle switches.

PART 3 – EXECUTION

3.1 STORAGE

A. Store fuses in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install fuses in accordance with Code, product listing and manufacturer's recommendations.
2. Verify equipment fuse sized for load prior to installation.
3. All fuses shall be of same manufacturer.
4. Do not mix fuse classes in individual applications.
5. Fuses are not required for switchboard devices marked "Spare".

B. Identification

1. Indicate on inside cover with pressure sensitive tape the size, voltage and type of fuse furnished for each device.

END OF SECTION

SECTION 262816
ENCLOSED SWITCHES &
CIRCUIT BREAKERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide disconnects where shown on Drawings or required by Code.
2. Provide enclosed circuit breaker where shown on the Drawings.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate on submittal exact motor or equipment served.
3. Show all details including electrical ratings, enclosure dimensions and other pertinent data.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 DISCONNECT SWITCHES

A. Switch Interior

1. Positive “off” position.
2. Lugs: NRTL-listed for aluminum and copper cable.
3. Plated current carrying parts.

B. Switch Mechanism

1. Quick-make, quick-break operating handle and mechanism.
2. Integral part of box.
3. Enclosures: Code gauge sheet steel (NEMA 1) or Code gauge galvanized steel (NEMA 3R).
4. Treat with rust-inhibiting phosphate primer.
5. Finish: Baked enamel.

C. Ratings

1. 250 or 600 volt.
2. Heavy duty.
3. Horsepower rated.
4. NRTL-listed "Suitable for Use as Service Equipment" when required.

D. Fusing

1. NRTL-listed rejection feature.
2. Reject all fuses except UL-listed Class R.

E. Manufacturer: Panelboard manufacturer.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Breaker Types:

1. Quick-make, quick-break, thermal magnetic unless otherwise indicated.
2. Trip indicating.
3. Minimum SCCR rating:
   a. 10,000 for systems up to 240 volts.
   b. 35,000 for 277/480 volt systems.

B. Manufacturer: Panelboard manufacturer.

2.3 PLYWOOD BACKING FOR SURFACE MOUNTED SWITCHES

A. For interior locations, mount on 3/4" AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store disconnect switches or enclosed circuit breakers in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install all required disconnect switches or enclosed circuit breakers in accordance with Code, product listing and manufacturer's recommendations.
2. Plumb and level.
3. Tighten lugs in accordance with manufacturer's recommendations.

B. Identification

1. Identify disconnect switches or enclosed circuit breakers in accordance with Section 260553.
2. Nameplate required for all disconnect switches. Nameplate to include load served, voltage, horsepower or MCA rating, and fuse size. Nameplate to be installed inside of cover on exterior disconnect switches.

   Example:

   RT-1
   480 Volt, 3 Ø
   35 MCA, 40 A Fuses

3. Do not use schedule number, but indicate load served.
4. Pressure sensitive tape identification for disconnect switches containing fuses.
5. Voltage markers on all disconnect switches containing system voltages in excess of 250 volts to ground.

3.3 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 262913
MOTOR STARTERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide motor starters where shown and scheduled, or as required by Code.

B. Work Installed But Furnished Under Other Directives

1. Refer to Section 260500, Article 1.1, Paragraph D for extent of control devices furnished in other Divisions.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Show all details including electrical ratings, controls, schematic wiring diagrams, enclosure dimensions and other pertinent data.
3. Indicate on submittal exact motor or equipment served.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 GENERAL

A. Product of same manufacturer.

B. Sizing based upon Eaton equipment.

C. Other acceptable manufacturers: Approved equal units by Allen Bradley, Schneider, and Siemens.

D. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for Bid.

2.2 SINGLE PHASE MOTORS WITH INTEGRAL OVERLOAD PROTECTION

A. Horsepower rated toggle switch, pilot handle where not in sight from motor.

2.3 SINGLE PHASE MOTORS WITHOUT INTEGRAL OVERLOAD PROTECTION

A. Manual Motor Starter

1. Manually operated toggle switch with integral overload protection.
2. Rendered inoperative unless thermal unit is in position.
3. Provide pilot light for manual starters not in sight from motor.
4. Provide flush-mounted starters with stainless steel plates.

5. NEMA 1 enclosures for surface-mounted starters unless otherwise required by environment.

B. Fused Toggle Switch

1. 4" square box mounting.
2. Complete with fuse adapter and plug fuse of correct rating.
3. Manufacturer: Bussmann or Reliance.
4. **Use only where specifically shown.**

2.4 THREE PHASE AND SPECIFIED SINGLE PHASE MOTORS

A. Across-the-line

1. Magnetic type, non-reversing unless otherwise scheduled.
2. Rated in accordance with NEMA standards, sizes and horsepower ratings.
3. Provide combination fusible unit with Class R fuse holders, where disconnect and starter are shown at the same location.
4. Minimum size: NEMA size 0.
5. Manufacturer's series: Eaton Freedom series, or approved equal units by Allen Bradley 512 series, Schneider 8538 series or Siemens Class 17 series.

6. Control
   a. 120 volt control transformer
   b. Control fusing:
      1) 250 volt - in accordance with NEC.
      2) 600 volt - primary and secondary fusing regardless of VA rating of control transformer.
   c. Cover-mounted devices for single-speed starters:
      1) Transformer operated LED green pilot light for running indication, with push-to-test feature.
      2) H-O-A selector switch, unless otherwise scheduled.
   d. Cover-mounted devices for two-speed starters:
      1) Transformer operated LED pilot lights for running indication, with push-to-test feature: Green for low speed, amber for high speed).
      2) High-low-off-auto selector switch, unless otherwise scheduled.
   e. Molded coil construction.

7. Overload Protection – exterior locations

   a. Resettable overload protection on all phases.
   b. Class 20 construction.
   c. Starter inoperative if one or more overload units removed.

8. Overload Protection – interior locations

   a. Self-powered.
   b. Solid state construction with adjustable overload protection on all phases.
   c. Manual reset with capability for remote reset function.
   d. Phase loss protection.
   e. Ambient-insensitive within operating range of -25°C to 55°C.
   f. Solid state construction, Class 20.
   g. Starter inoperative if overload unit is removed.

9. Electrical Interlocks

    a. Space for minimum three, any arrangement NO or NC.
    b. Quantity: Two NO per starter.

2.5 PLYWOOD BACKING FOR SURFACE MOUNTED STARTERS

A. 3/4" grade AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store motor starters in cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Plumb and level.
2. Install motor starters in accordance with Code, product listing and manufacturer's recommendations.
3. Tighten all lugs in accordance with manufacturer's recommendations.
4. Verify correct size overload protection with motor nameplate data and manufacturer's recommendations.
5. Where power factor correction is specified for connection to motor terminals (i.e. load side of overload units), reduce overload rating as per manufacturer's recommendations.
6. Provide 3/4" plywood backing where several controls are shown grouped for surface mounting.

B. Identification

1. Identify motor starters in accordance with Section 260553.
2. Provide two nameplates for all motor starters: One for starter, other for equipment. Do not mount equipment nameplate on motor. Rather, mount on equipment, in visible location near motor.
3. Do not use motor schedule numbers, but indicate motor or load served.
4. Provide pressure-sensitive tape identification in accordance with Section 260553 and 262813 for all motor starters containing fuses.
5. Indicate proper thermal overload unit by circling correct number on chart affixed to cover of starter.
6. Provide voltage markers for all motor starters containing a system voltage in excess of 250 volts to ground.
7. Voltage markers not required for motor starters which form a part of a motor control center as specified in Section 262419.

3.3 TESTS

A. Proper operation.

B. Correct rotation.

3.4 INSTRUCTIONS

A. Manufacturer's representative shall instruct Owner in proper maintenance and testing of solid state motor starters. Include name of Owner's representative in letter of verification.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 264313
SURGE PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide integral Surge Protective Device in panelboards and switchboards where indicated and scheduled.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICE (SPD)

A. Provided only in panelboards and switchboards as indicated on the drawings.

B. The panelboard/switchboard manufacturer shall internally install SPD protection within the panelboard and the entire assembly shall be UL 67 listed.

C. SPD requirements:

1. Listed and component recognized in accordance with latest editions of UL 1449, UL 96A and UL 1283.
2. Minimum surge capacity ratings as indicated on the drawings. Operating voltage and configuration as indicated on the drawings
3. 200kA Short Circuit Current Rating (SCCR). SPD devices obtaining SCCRs using upstream over current protection are prohibited.
4. 20kA nominal discharge current.
5. EMI/RFI noise filtering attenuation up to 50dB for 10kHz – 100MHz.
6. Self contained module design, with each suppression element metal-oxide varistor (MOV) based incorporating thermal protection. End of life mode shall be open circuit.
7. Surge current diversion paths between each phase conductor and the neutral conductor, between each phase conductor and the ground and between the neutral conductor and ground. For delta configured systems, the SPD shall have components connected between each phase conductor and between each phase conductor and ground.

8. UL 1449 latest edition listed and recognized component voltage protection rating (VPR) shall not exceed:

VOLTAGE	L-N	L-G	N-G	L-L
240/120 1Ø	700V	700V	700V	1200V
208Y/120	700V	700V	700V	1200V
240D/120	700/1200V	700/1200V	700V	1800V
480Y/277	1200V	1200V	1200V	2000V

9. Designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
10. Equipped with on board visual and audible diagnostic monitoring devices mounted on the front cover of the SPD.
    a. Indicating lights shall provide full time visual diagnostic monitoring of the operational status of each phase of the surge current diversion module.
    b. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm.
    c. LCD display surge counter located on the front cover of the SPD. Counter shall be equipped with a manual reset with protection from accidental operation and utilize non-volatile memory.
    d. A set of Form “C” dry contacts shall be provided for remote annunciation.
11. Warranty: The panelboard manufacturer shall warranty the SPD for full replacement if destroyed by transients, including lightning, for a period of ten (10) years.

PART 3 – EXECUTION

3.1 INSTALLATION

A. SPD protection modules shall be factory installed by the panelboard/switchboard manufacturer integral to the panelboards/switchboards indicated on the drawings. Each entire assembly shall be UL 67 listed.

3.2 TESTS

A. Verify all SPD equipment is active and in proper working condition prior to final project inspection.

3.3 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 265100
LUMINAIRES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete luminaire for each lighting outlet.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500 including voltage, housing and door frame material, lens type, diffuser thickness, lumen output, and color temperature.

B. Record Manuals

1. Provide information in accordance with Section 260500.

1.3 COORDINATION

A. Confirm compatibility and interface of luminaire with other materials and job conditions prior to ordering. Report discrepancies to Engineer and defer ordering until clarified.

B. Provide frames, trim rings, and backboxes as required.

C. Coordinate with work of all other Divisions to avoid conflicts between luminaires, supports, fittings and mechanical equipment. Ceiling clearances are minimal. It is imperative that Contractors coordinate conduit and duct runs to facilitate luminaire installation as shown on reflected ceiling plans. Engineer will not be responsible for interferences arising from lack of field coordination between trades.

PART 2 – PRODUCTS

2.1 LUMINAIRES

A. General

1. UL or other NRTL listed.
2. Where shown to be installed in fire-rated assemblies, luminaires shall be listed in accordance with UL Standard 1598. Supplemental penetration protection (tenting) will be accomplished by General Contractor in accordance with UL Fire Resistance Directory. Coordinate installation with General Contractor. Supplemental protection shall be spaced minimum 1/2" away from the luminaire, per UL Standard 1598.
3. Verify ceiling finishes and equip all recessed luminaires with appropriate frames as required.
4. Furnish luminaires intended for use in lay-in grid ceilings with proper clips for compliance with NEC.
5. Refer to Section 260500 for "Prior Approval to Quote" procedure.

B. LED Lighting Systems

1. General: All LED lighting system components must be UL or other NRTL listed.
2. Light Engines:

a. Meets or exceeds 70% lumen maintenance at 50,000 hours based on IESNA LM-79-2008.
b. Minimum 80+ CRI rating.
c. 4000K color temperature, or as scheduled on drawings.
d. Minimum delivered lumens as scheduled on drawings.

3. Electronic drivers for LED's:
   a. Factory installed.
   b. Multi-volt for use on either 120v or 277v systems.
   c. THD: < 20%.
   d. Factory installed quick-disconnect plug internal to the luminaire for driver removal.
   e. Rated for a minimum of 50,000 hours.
   f. 0-10 Volt dimming standard. Provide non-dimming drivers only as scheduled.
      1) Controls and wiring as per manufacturer's recommendations. Provide power packs for wall-box dimmers as required for positive luminaire off.
4. Downlights shall incorporate integral diffuser type lens. Exposed modules not acceptable.
5. Emergency battery packs:
   a. Include self-testing/self-diagnostics with audible alarm option.
   b. Factory installed.
   c. Minimum lumens as scheduled.
6. Spare Drivers:
   a. Luminaire manufacturer shall keep reasonable driver stocks on hand for replacement of defective drivers under guarantee period.
7. Guarantee period: Minimum 60 months from date of substantial project completion.
   a. Guarantee shall include all parts and labor required to bring luminaire to complete operation.
   b. Labor shall be performed by an Owner approved Electrical Contractor licensed in the area the work is to be performed.
   c. Any costs for equipment rentals required to service luminaires under warranty shall be the responsibility of luminaire manufacturer.

PART 3 – EXECUTION

3.1 STORAGE

A. Store luminaires in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install luminaires plumb and true, free of light leaks, warps, dents and other irregularities.
2. Equip any outlets not specifically labeled with a luminaire the same as those in rooms used for similar purposes.
3. Run all directional lenses the same direction in rooms, corridors and other adjacent areas that contain square luminaires.
4. Continuous row luminaires: Hang level in straight line and butt tightly together.
5. Verify exact location of luminaires with reflected ceiling plan. Any discrepancies between the lighting plan, reflected ceiling plan, or installed ceilings shall be brought to the attention of the Engineer for clarification prior to installation.
6. Coordinate with Mechanical Contractor in advance of installation to prevent space conflicts.
7. Connect recessed luminaires to branch circuitry by means of single flexible metal conduit 6'-0" in length.

B. Barriers

1. Required where recessed luminaires are installed in insulated ceilings.
2. Suitable material to satisfy NRTL requirements.
3. Provided by Division 26 when not indicated otherwise.
4. Coordinate installation.

C. Luminaire Supports

1. Provide adequate supports to any structures, ceilings and grid systems to safely suspend or attach luminaires.
2. General Contractor to provide ceiling support systems as required by that portion of the Specifications. Electrical Contractor to provide any additional supports on an "as needed" basis to prevent ceiling from sagging or developing other irregularities.
3. Contractor responsible for providing proper suspension and mounting devices and to safely support all luminaires shown on Drawings, regardless of ceiling systems.
4. Rigidly support surface suspended ceiling system with anchors, hangers or clips designed for the purpose.
5. Support surface-mounted luminaires at four-foot intervals.
6. Install recessed luminaires in accordance with manufacturer's recommendations.
7. Rigidly support recessed luminaires to structural members or properly supported ceiling system with hangers, clips or fasteners designed for the purpose.
8. Support pendant and stem-hung luminaires at four-foot intervals.

D. 0 – 10 Volt Dimming Control Circuits

1. Installed in accordance with NEC Article 725.
2. Class 1 systems
   a. #14 AWG THWN/THHN solid conductors installed in the same raceway as associated power wiring.
3. Class 2 systems
   a. #18/2 non-shielded cable unless otherwise indicated on the drawings.
   b. Plenum rated where required.
   c. Cable shall be installed in raceway when concealed within walls, in mechanical rooms, and rooms without ceilings.
      1) DO NOT INSTALL IN SAME RACEWAY AS POWER CIRCUITRY.
   d. Cable not required to be enclosed in raceway when installed above accessible ceilings.
      1) Route cables parallel or perpendicular to building construction.
      2) Support cables from building structure utilizing approved methods.
      3) Neatly coil excess cable length of pre-terminated assemblies.
      4) All cable runs shall be continuous between devices. NO SPLICING.

3.3 TESTS

A. Upon completion of this portion of the Work and prior to its acceptance by Owner, check for proper alignment and operation of all lighting equipment.

3.4 CLEAN UP

A. Clean all luminaires immediately prior to final inspection.

END OF SECTION

SECTION 266510
OVERHEAD DOOR WIRING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all wiring and control equipment not furnished with overhead door, for complete and satisfactory operation.

B. Overhead door wiring includes:

1. Power connections.
2. Control station installation.
3. Control connections between limit switches, safety devices, and door operator.

C. Work Not Included

1. Refer to overhead door section of specification for extent of material furnished with door.

PART 2 – PRODUCTS

2.1 MATERIAL

A. Disconnect Switches

1. Refer to Section 262816.
2. Separate switches required for each door.
3. Toggle switches acceptable for 115 volt rated motors.

B. Outlet Boxes

1. Refer to Section 260534.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install controller, push-button or key-operated stations for each overhead door. Provide conduit, boxes and wiring material required for electrical connection, including control cable connection to limit switches and safety devices.

B. Where used, locate key-operated control stations on exterior of building, flush mounted. Seal conduit after conductor installation.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. The provisions and requirements of Section 260500 shall be applicable to Division 27.

B. All Division 27 work shall be included under the Division 26 contract.

C. The Contractor shall take special note that any conflicts between the Contractor and any Division 27 subcontractors shall not become an issue of the Engineer or Owner. It shall be the Contractor's responsibility to coordinate with the Division 27 subcontractor/s to determine where their work leaves off and where the subcontractor's work begins. The Contractor shall be responsible for all specified work including the operations of work under Division 27.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide raceways for network systems as shown on the Drawings.

B. Work furnished and installed by others.

1. Local serving telephone utility shall place the service entrance cable to the point of presence, install circuit protection cabinet, protectors, and ground the entrance cable as needed to the service grounding conductor provided under this contract.
2. Owner's network systems supplier shall provide all network cables, devices, faceplates, terminations, data racks, end-user software, programming, computer servers, terminals and personal computers.

PART 2 – PRODUCTS

2.1 GENERAL

A. Main telephone terminal boards (TTB): ¾" grade AD fire-resistant plywood, painted gray (including edges). Dimensions as required by serving utility company.

B. Voice/data terminal board (TTB):

1. ¾" grade AD fire-resistant plywood, painted gray (including edges). Dimension as required by Owner's network system supplier. May be included with main telephone terminal board for single board installation.

C. Raceways:

1. As specified in Section 260533 and sized as shown on Drawings, minimum 3/4".

D. Boxes:

1. 2-1/8" deep unless restricted by wall thickness.
2. As specified in Section 260534 and 260540.

E. Blank plates:

1. As specified in Section 262726, yoke-mounted. Box-mounted plates not acceptable.

F. Firestop Assemblies

1. NRTL listed 4" square pathway with intumescent material designed to seal out fire, smoke, and toxic gases.
2. Quantity shall equal or exceed the width of the associated cable tray. i.e. a 6" wide tray requires two pathways.
3. Include mounting accessories as required by application specifics.
4. Manufacturer: EZ Path Series 44, 3M Model PT4SD or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Serving Communications Utility Requirements

1. Raceways:
   a. Provide telephone service entrance conduit, stubbed to terminal board from property line.
   b. Verify service entrance conduit size and quantity, and property line location with serving utility.
   c. Provide bushing or connector at each conduit stub.
   d. Provide pull wire in each telephone conduit run.
2. Provide surface double-duplex receptacle at main telephone terminal board, fed from dedicated spare circuit breaker. Receptacles to be isolated ground type, with separate grounding conductor connected to panelboard grounding bar.
3. Provide telephone board communication grounding bus as required by serving utility, minimum #6 solid SDBC in conduit, extended shortest and most direct route to ground bar at main switch. Terminate in ground bar affixed to telephone terminal board, location as directed by serving utility.
4. Entire installation to comply with serving utility company requirements.

B. Raceways:

1. Stub from rough-in location into nearest accessible ceiling space, or location as indicated on Drawings.
2. Provide bushing or connector at each conduit stub.
3. Provide pull wire in each voice/data raceway.
4. Provide raceway system where concealed in walls, in mechanical rooms and rooms without accessible ceilings.

C. Provide blank plates for all rough-in boxes not concealed by Owner's voice/data equipment.

D. Entire installation to comply with Owner's network systems supplier requirements.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. The provisions and requirements of Section 260500 shall be applicable to Division 28.

B. All Division 28 work shall be included under the Division 26 contract.

C. The Contractor shall take special note that any conflicts between the Contractor and any Division 28 subcontractors shall not become an issue of the Engineer or Owner. It shall be the Contractor's responsibility to coordinate with the Division 28 subcontractor/s to determine where their work leaves off and where the subcontractor's work begins. The Contractor shall be responsible for all specified work including the operations of work under Division 28.

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete hardwired fire alarm and detection system in accordance with NFPA 72 and this Specification.
2. System to include relays and circuitry as required also maintaining the existing line voltage fire alarm and detection system, and accomplishing all drill, reset and acknowledging functions of existing system only from the new system.

B. Work not included

1. Where required, the Owner shall be responsible for:
   a. Line lease or service fees associated with signal transmission (alarm, supervisory, and trouble) to a remote central station.
   b. Any proprietary interface equipment not specified herein and required by the Owner's monitoring service.

C. Description of System

1. General: Provide a complete, supervised, power-limited, fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the Drawings and as specified herein.
2. System Supervision: The fire alarm system shall be an electrically supervised system which shall monitor the integrity of circuit conductors and power supplies. Performance of the fire alarm circuits shall be in accordance with Class A, Style D operation for Initiating Device Circuits (IDCs), and Class A, Style Z operation for Notification Appliance Circuits (NACs). Remote annunciator LEDs and associated wiring and remote emergency control wiring shall be supervised; whereas, an open condition in the circuit shall cause a trouble indication at the fire alarm control panel
3. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in operation. All software shall be stored in a non-volatile programmable memory within the fire alarm control panel (FACP). Loss of primary and secondary power shall not erase the instruction stored in memory.
4. The ability for selective input/output control functions based on ANDing, ORing, NOTing, and special coded operations is to also be incorporated in the resident software programming of the system.
5. History Logs
   a. The FACP shall have the ability to store a minimum of 50 events in an alarm log plus a minimum of 100 events in a separate trouble log. These events shall be stored in a battery protected random access memory (RAM). Real time and date shall accompany all history event recording.
   b. Logs shall be capable of being viewed separately or shall be selectable for viewing as a combined history log that displays both alarm and trouble events in chronological order.

6. Power Requirements
   a. The FACP shall receive 120-volt AC power via a dedicated 20-ampere circuit breaker from the nearest panelboard. The incoming power shall be supervised so that any power failure will be indicated at the FACP and sound a trouble signal. The primary power branch circuit supplying fire alarm equipment shall supply no other loads. The circuit breaker:
      1) Location shall be permanently identified at the corresponding control unit.
      2) Shall have a listed circuit breaker locking device installed.
      3) Shall have a red marking which shall not damage the overcurrent protective device or obscure the manufacturer's markings.
      4) Shall be permanently identified as to its purpose: "FIRE ALARM" for fire alarm systems, "EMERGENCY COMMUNICATIONS" for emergency communications systems, and "FIRE ALARM/ECS" for combination fire alarm and emergency communications systems.
   b. The FACP shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. System batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
   c. All circuits requiring system-operating power shall be 24-volt DC and shall be individually fused at the control panel.
   d. The system shall support 100% of the initiating devices in alarm operation at the same time, under both primary (AC) and secondary (battery) power conditions.
7. Fire Sprinkler Monitoring
   a. Water Flow: Activation of a water flow switch shall initiate a general alarm operation.
   b. Valve Supervisory Switch (Tamper Switch): The activation of any valve supervisory switch shall activate system supervisory operations.
   c. Activation of either a water flow switch or valve supervisory switch shall distinctly report which initiating device circuit is in alarm at the FACP and any required remote annunciator(s).

1.2 REQUIRED SYSTEM FUNCTIONS

A. Priority of Signals: Alarm events have the highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second-level and third-level priority respectively. Events of a higher-level priority take precedence over events of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

B. Transmission to Remote Central Station: The FACP shall have the capability to automatically route alarm, supervisory, and trouble signals to a central station via Internet Protocol (IP) over the public open Internet.

C. Types of Signaling: The FACP shall be NRTL-listed for the applicable types of signaling methods used, i.e.: Temporal Coded, Non-Coded, March Time and/or Internet Protocol.

D. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and any required remote annunciator(s), indicating the IDC (zone) origination.

E. General Alarm: Activation of an alarm initiating device shall include:

1. Indication of alarm condition at the FACP and any required remote annunciator(s).
2. Identification of the IDC (zone) that is the source of the alarm at the FACP and any required remote annunciator(s).
3. Operation of all audible and visual notification appliances throughout the building until silenced at the FACP and any required remote annunciator(s). Audible alarm notification shall operate steady or match existing building convention.
4. Shutting down designated air handling equipment, and activating smoke dampers and exhaust fans as required by alarm input.
5. Have the capability to automatically route the signal to a Remote Central Station.
6. Record the event in the FACP historical log.
7. Closing doors normally held open by magnetic door holders.
8. Initiate elevator recall in accordance with ASME/ANSI A17.1, when designated fire alarm detectors are activated.

F. Supervisory Operations: Upon activation of a supervisory device such as fire pump failure, low air pressure switch, and tamper switch, the system shall operate as follows:

1. Activate the system supervisory service audible signal and illuminate the LED at the FACP and any required remote annunciator(s).
2. Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the supervisory LED “on” indicating off-normal condition.
3. Record the event in the FACP historical log.
4. Transmission of supervisory signal to Remote Central Station.

G. Alarm Silencing: If the “Alarm Silence” button is pressed, all audible alarm signals shall cease. (Visual signals shall continue to operate.)

H. System Reset:

1. The “System Reset” button shall be used to return the system to its normal state after an alarm condition has been remedied. The FACP display shall step the user through the reset process with simple English language messages. Messages shall provide operator assurance of the sequential steps (i.e.: “IN PROGRESS”, “RESET COMPLETED”, AND “SYSTEM NORMAL”) as they occur, should all alarm conditions be cleared.
2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The FACP audible signal and the Alarm LED shall be on. The FACP display shall indicate the total number of alarms, supervisories, and troubles present in the system along with a prompting to review the points. These points shall not require acknowledgment if they were previously acknowledged.

I. LED Supervision: All salve module LEDs shall be supervised for burnout or disarrangement. Should a problem occur, the FACP shall display the module and the LED location numbers to facilitate location of that LED.

J. Active Status Reminder: Should any Alarm, Supervisory, or Trouble condition be present within the system and the audible signal silenced, the local tone alert shall resound every 8 hours (each change of work shift) to act as a reminder that the fire alarm system is not 100% operational.

K. WalkTest: The system shall be capable of being tested by one person without returning to the control panel to reset the system after each alarm. Enabling the one-person test feature at the FACP shall display a trouble condition at the FACP and activate the “One person Testing” mode of the system as follows:

1. The FACP shall automatically log each alarm and each trouble condition tested (silently), and reset the system for the next condition to be received. Should the walktest feature be left off for a preprogrammed length of time without any activity, the system shall revert to the normal operating mode automatically.
2. Integrity of the installation conductors of IDCs and NACs shall be verified by momentarily opening any circuit.
3. Walktest of ground fault circuit testing shall be verified by operating the audible notification appliances to sound for 4 seconds.

1.3 SUBMITTALS

A. Shop Drawings

1. Provide information in accordance with Section 260500.
2. Indicate:
   a. Mounting details.
   b. Cabinet dimensions.
   c. Wiring diagrams.
   d. Description of devices.
   e. Floor plan layout of fire alarm system indicating location of devices, wiring between devices, and intensities of audible and visual appliances. Upon request, the Engineer will furnish AutoCAD files of the floor plan. Upon Engineer's review, provide **additional four** copies. Submit one copy to Engineer. Remaining copies for Contractor use at the project site and for Record Drawing/Manual submittal at project closeout (redlined to indicate actual conditions of installation).

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include complete data for operation and maintenance of the system, consisting of:
   a. Wiring diagrams.
   b. Testing.
   c. Maintenance.
   d. Description of system operation.
   e. Addition of devices.
   f. Frequency of testing procedures.
   g. All data referenced in NFPA 72, 7.5.
3. Provide multiple copies (including Shop Drawing Connection/Riser Diagram), one to remain in control panel, other copies for Record Manuals.

1.4 MANUFACTURER/SUPPLIER

A. The system specified is based on equipment as manufactured by SimplexGrinnell. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met.

B. Other acceptable manufacturers: Autocall, Edwards Systems Technology, Gamewell-FCI,Potter Electric Signal, Notifier, Silent Knight, or Siemens Fire Safety.

1. Being listed as an acceptable manufacturer in no way relieves obligation to provide all equipment and features in accordance with this specification.

C. All equipment shall be NRTL-listed, and shall be furnished by one manufacturer to ensure listing/equipment compatibility as required by NFPA 72.

D. Supplier providing equipment and services under this Section shall have:

1. A factory-authorized service center located in North Dakota within 250 miles of the project site. Referenced service center shall be under direct control of the Supplier, staffed by employees of the Supplier, and contain an inventory of replacement material requisite for timely maintenance. Referenced service center shall be operational for a minimum five-year period or have equivalent five-year industry experience with installation and programming prior to bid opening.
2. A minimum of one employee at the above referenced service center certified by National Institute for Certification in Engineering Technologies (NICET). Certification shall be in the Fire Protection Engineering Technology field, Fire Alarm Systems sub-field, and shall be minimum Level III.

E. Acceptable Suppliers:

1. ACS, 3410 13th St NE, Minot, ND (701) 446-8840
2. AVI Systems, 1930 East Century Avenue, Bismarck, ND (701) 258-6360.
3. Nardini Fire Equipment Co. Inc., 303 20th St N, Fargo, ND (800) 950-1139.
4. SimplexGrinnell, 2821 Fiechtner Drive, Fargo, ND (800) 342-4668.
5. NewVison, 3320 Hamilton St. Unit 5, Bismarck, ND 58503 (701) 222-8888.
6. Systems Technology, 1424 44th St N, Fargo, ND 58102 (701) 235-0558.

PART 2 – PRODUCTS

2.1 CENTRAL SYSTEM

A. Fire Alarm Control Panel (FACP)

1. General: Comply with UL 864, “Control Panels for Fire-Protective Signaling Systems.”
2. Cabinet:
   a. Steel enclosure with lockable, hinged door for front access. Surface or flush-mount style as indicated on the Drawings.
   b. Color: Red when surface-mounted in equipment rooms, and beige, black or gray when flush-mounted in other locations.
3. The following FACP hardware shall be provided:
   a. Power limited base panel with 120-volt AC input power.
   b. Initiating device circuit (IDC) capacity of 5 zones with 2 notification appliance circuits (NACs). Size for requirements of Drawings and Specifications (SimplexGrinnell #4006 series).
   c. Secondary (emergency) power supply including: battery(s), charger and automatic transfer switch. Battery(s) shall be sealed lead-acid type.
   d. An IP communicator to automatically route the alarm signals to a Remote Central Station.
      1) Designed to monitor the status of the FACP and report to a Remote Central Station as follows:
         a) Alarms.
         b) Troubles.
         c) Supervisory conditions.
      2) The transmission path shall be supervised at an interval of 60 minutes or less.
      3) Module Types:
         a) Direct connect IP communication module.
         b) IP dialer capture module to convert Digital Alarm Communicator information to IP protocol.

B. Alarm Initiating Devices

1. Manual fire alarm station:
   a. Non-coded single action.
   b. Provide one spare rod per station and two spare stations.
2. Automatic area smoke detection station:
   a. Photoelectric with integral 135° fixed temperature thermal device.
   b. Associated twist-lock mounting base with integral zone wire termination points.
   c. Provide three spare stations.
3. Automatic duct smoke detection station:
   a. Photoelectric with associated sampling tubes.
   b. Refer to Motor and Equipment Schedule for equipment requiring duct detection.
   c. Where indicated on Drawings, provide remote alarm indicator/test station. Identify as directed by Engineer.
4. Automatic area heat detection station:
   a. Rate of rise or fixed temperature: Select appropriate rating.
   b. Unless indicated otherwise, 135° F rate of rise understood.
   c. Low profile.
   d. White.
   e. Alarm LED.
   f. Self-restoring.
   g. Associated twist-lock mounting base with integral zone wire termination points.
   h. Provide two spare stations of each type.

C. Alarm Notification Appliances

1. Audible alarm notification appliance:
   a. Piezoelectric type horn.
   b. Flush mount.
   c. Red finish.
   d. UL 464 listed.
   e. Class A operation.
2. Visual notification appliance:
   a. Xenon or LED flash tube and associated lens/reflector system.
   b. Comply with Americans With Disabilities Act (ADA). Provide Candela intensities as dictated by location and NFPA 72, 18.5.
   c. “FIRE” lettering on housing or lens.
   d. Adjustable intensity selector integral to appliance.
3. Where shown ganged together on Plans, combine audible and visual alarm notification appliances into one red device.
4. Manufacturer: Same as control panel.

D. Auxiliary Devices

1. Magnetic door holder:
   a. 24 volt or match existing.
   b. Extra low profile for use with concealed wiring.

E. Manual Shutdown

1. Manual shutdown capability included with motor starter.

F. Automatic Shutdown

1. Automatic shut-down capability for air handling equipment where required by NFPA 90A.
2. Locate fan shutdown relays remote from fire alarm control switch.
3. Refer to Motor and Equipment Schedule for equipment requiring automatic shut-down.
4. Wiring: Two-wire parallel independent circuit to fire alarm control panel.

G. Digital Alarm Communicator

1. Designed to monitor the status of the fire alarm control panel and report to a central supervising station as follows:
   a. Alarms.
   b. Troubles.
   c. Supervisory conditions.
2. Dual telephone line interface.
3. Installed internal to FACP.

H. Fire Sprinkler System Equipment

1. Flow switch(es) and valve supervisory switches furnished and installed by Fire Sprinkler Contractor, wired by Electrical Contractor.
2. Fire sprinkler alarm notification appliance (bell or audible-visual signaling unit) furnished by Fire Sprinkler Contractor, installed and wired by Electrical Contractor.

PART 3 – EXECUTION

3.1 STORAGE

A. Store fire alarm components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install in accordance with Code, product listing, and manufacturer's recommendations.
2. Wiring to comply with all National, State and Local Fire Codes.
3. All fire alarm circuitry shall be installed in raceway unless otherwise noted. Refer to Section 260533 for acceptable raceways.
4. Conductors:
   a. Quantity as required by manufacturer.
   b. Initiating device circuits (IDCs):
      1) Solid, #16 AWG minimum.
      2) NFPA 72 Class B.
   c. Alarm notification appliance circuits (NACs):
      1) Solid, #14 AWG minimum.
      2) NFPA 72 Class B.
      3) Audible appliances (horns) controlled separately from visual appliances.
      4) All visual appliances shall flash in synchronization.
   d. Miscellaneous Circuits: (such as magnetic door holders & etc.)
      1) Solid, #14 AWG minimum.
   e. Size conductors for maximum 5% voltage drop.
   f. Color Coding: Manufacturer/supplier requirements.
   g. Enclosed in raceway (i.e. conduit).
   h. To ensure proper supervision of initiating and indicating circuitry, two wires maximum per wire nut.

5. Raceway Systems:
   a. Size raceway systems and junction boxes per NEC.
   b. All junction boxes, junction box covers and raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent bright red paint suitable for the purpose, to easily distinguish from other communication or power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit (Fire AlarmTM EMT), acceptable.
   c. Route outgoing and return conductors in separate conduits (exceptions as per NFPA 72, 12.3.8.1 acceptable).
   d. Multiple circuits acceptable in same raceway system.
6. Terminations:
   a. Connect all devices according to manufacturer's data.
   b. Made on terminal strips with separate joint for each conductor.
   c. Number-identify all strips as shown in wiring diagram included with manual.
   d. Number-identify all conductors to agree with terminal strip numbering.
   e. When required, end of line devices to be mounted on terminal strips.
   f. Wire-nut terminating not acceptable.
7. Do not zone alarm notification appliances. Rather, route NACs with IDCs. Terminate and jumper as required to maintain supervision on identified terminal strips.
8. Locate devices as generally shown on Drawings and as specifically indicated on installation instructions.
9. Remote fan shutdown relays to be mounted near controller or equipment.
10. Provide 3/4" fire resistant, gray, painted plywood backing for surface fire alarm control panel.
11. Provide 1/2" conduit from fire alarm control panel to nearest network rack offering internet access. Provide a four-pair minimum Category 5e UTP data cable terminated to the IP communicator module. Ensure owner’s internet access equipment complies with secondary power requirements as required by NFPA 72. If owner provided internet access is not available, provide additional dedicated IP equipment as required to obtain internet service in conformance with NFPA 72.
12. Provide elevator/fire alarm interface as per Section 262822.

B. Smoke Detectors

1. Locate as generally shown on Drawings and as specifically indicated in NFPA 72 and on installation instructions.
2. Provide protective plastic wrapping to prevent entrance of construction dust. Field-install during construction. Remove immediately prior to supplier testing. Replace protective plastic wrapping and remove day of final inspection.
3. All smoke/heat detection devices shall be located a minimum of 3’ from any supply, return, or exhaust air diffusers/grills.

C. Duct Detectors

1. Installed and arranged to automatically initiate general alarm.
2. Provide at a suitable location in the return air stream prior to exhausting from building or being diluted by outside air.
3. Provide at a suitable location in main supply duct on downstream side of filters.
4. Refer to Motor and Equipment Schedule for equipment requiring duct detection.
5. Locate as specifically indicated in NFPA 72 and on installation instructions. Coordinate with supplier's representative prior to installation, exact location to assure accurate sampling of air stream. Provide quantity as required by duct geometry.
6. Do not install head on sampling tube base in housing until final supplier testing, unless protective cover is included with detector head.

7. Include Duct Detection Summary Sheet with Letter of Verification.

D. Fire Sprinkler System Equipment

1. See Mechanical Drawings and Specifications for locations and quantities.
2. Valve supervisory switches:
   a. Integral contact shall serve as supervisory initiating device for a separate IDC (zone). Unless indicated otherwise on the Drawings, supervisory switches located on the same fire sprinkler main riser (maximum of 20) shall be permitted on a single IDC.
   b. Supervisory only. Will not sound general alarm, or "Trouble".
3. Flow Switch
   a. Consists of two form C (NO-NC) contacts.
   b. One contact shall serve as alarm initiating device for separate IDC (zone). Unless indicated otherwise on the Drawings, a maximum of 5 flow switches shall be permitted on a single IDC.
   c. Second contact shall control fire sprinkler alarm notification appliance. Connect to nearest 120 volt egress circuit. Provide transformer and relay as required.

3.3 TESTS

A. Prior to final inspection, verify that the fire alarm system is in proper working condition, free from false alarms. Furnish a letter of verification to Engineer indicating that the system has been tested by manufacturer's representative and is found to be complete and functional. List date of test and name of manufacturer's representative. Indicate in letter that testing was in accordance with NFPA 72, Chapter 14, including re-acceptance testing when applicable. Include copy in FACP and each Record Manual.

B. Notify Owner, Engineer, and local Fire Marshall or Fire Chief one week in advance of scheduled tests. Electrical Contractor responsible for test coordination and scheduling.

3.4 INSTRUCTIONS

A. Manufacturer's representative shall instruct Owner in proper operation, maintenance and testing of complete fire alarm and detection system. Indicate on letter of verification, name of Owner's representative receiving instructions.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum** interior to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION (NOTE: MAJORITY OF THIS WORK BY CITY OF BOTTINEAU_)

A. This Section of the Project Manual includes all site demolition work necessary for the construction as shown on the Drawings and as specified herein.

1. Site Demolition may include but is not necessarily limited to salvage or removal of the following:
    a. Side walks
    b. Curb and gutter
    c. Bituminous pavements and driveways
    d. Concrete pavements and driveways
    e. Existing Building Structures.
    f. Sanitary Sewer pipelines and structures
    g. Water pipelines, valves, fittings, fire hydrants
    h. Propane Tanks.

02 QUALITY ASSURANCE

A. All site demolition and disposal work shall be performed in compliance with applicable requirements of governing agencies having jurisdiction, and according to the Drawings and as specified herein.

B. Ensure safe passage or persons and vehicles around areas of demolition.

1. Operations shall be conducted so as to prevent damage to adjacent buildings, structures, utilities, and other exterior improvements and injury to persons.

1.03 SUBMITTALS

A. Shall be in accordance with **SECTION 01 33 00 SUBMITTAL PROCEDURES**.

B. The Contractor shall submit a proposed schedule of operation coordination for shutoff, capping and continuation of utility services as required.

C. A detailed sequence of site demolition and removal work to ensure an uninterrupted progress of Owner's on-site operations shall also be submitted.

D. The Contractor shall submit photographs of areas and buildings and exterior improvements adjacent to areas of site demolition work.

E. The Contractor shall submit proposed methods of security where demolition work will breach existing security measures.

1.04 JOB CONDITIONS

A. The Owner assumes no responsibility for the actual condition of structures and existing improvements exterior which are to be removed or salvaged.

B. Protection

1. Prior to the removal of any wall, beam, column, or cutting of any openings, the Contractor shall examine the existing structure and, when required, shall protect the structure by shoring, bracing or underpinning.

2. All new and existing equipment, buildings, tanks and other exterior improvements and materials for the construction shall be protected by the Contractor from dust, dirt, debris, and damage by covering with planking and tarpaulins during demolition.

3. The Contractor shall have barricades and traffic control in place prior to commencement of

demolition on public right-of-ways or other areas open to the public.

4. Barricades and other protection measures shall be in place prior to the commencement of demolition to protect entry into the work area by anyone other than the necessary workers.

C. Contractor shall be responsible for disconnecting existing utilities such as electrical power or gas from items that are to be removed or salvaged.

1. Contractor shall utilize lockout/tag-out procedures to prevent utilities from becoming re-activated during and after removal or salvage operations.

D. The use of explosives shall not be permitted.

PART 2 PRODUCTS (NOT USED)

PART 3 CONSTRUCTION REQUIREMENTS

3.01 REMOVAL

A. All materials designated for removal shall become the property of the removal contractor (CITY where appropropriate) and shall be disposed of off-site in a manner satisfactory to/by the owner(s) of the property on which the material is being disposed and all governing agencies.

B. Copies of all agreements with property owners and permits from governing agencies shall be furnished to the Owner's Representative.

3.02 CLEANUP

All debris, rubble, unusable materials, and items not salvaged shall become the property of the Contractor and shall be removed from the site.

END OF SECTION

SECTION 31 2200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site.

C. Finish grading.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Topsoil excavated on-site.
   1. Graded.
      a. Topsoil shall be fine graded to particle sizes not exceeding 1/4 inch.
   2. Free of roots, rocks larger than 1/4 inch, subsoil, debris, large weeds and foreign matter.
   3. Contractor shall remove existing topsoil and import new topsoil material necessary for project if unable to fine grade existing salvaged topsoil.
   4. Import topsoil if necessary for quantity.

PART 3 EXECUTION

3.01 **CONSTRUCTION REQUIREMENTS**

3.02 PREPARATION

A. Protect existing utilities from damage.
   1. The contractor shall contact ND One-Call at 800-795-0555 prior to beginning any excavation.
   2. The contractor shall notify the various utility companies if work will expose, affect, or endanger any existing utility.
   3. The contractor shall support, protect or relocate existing utilities affected by the work.
      a. Means and methods shall be approved by the utility owner.

B. Identify required lines, levels, contours, and datum.

C. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

D. Protect site features to remain, including but not limited to paving, from damage by grading equipment and vehicular traffic.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

F. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

A. Remove excess topsoil from site.

3.05 **FINISH GRADING TOPSOIL AREAS**

A. Before Finish Grading:
   1. Verify subgrade has been compacted.

B. Remove debris, roots, branches, stones, in excess of 1/4 inch in size.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

E. Place topsoil in areas not designated in the plans as pavement or landscape mulch/rock.
   1. Include all areas graded as part of this project as well as all adjacent turf areas disturbed by construction

F. Place topsoil where required to level finish grade.

G. Place topsoil to the following compacted thicknesses:
   1. Areas to be seeded or sodded with Grass: 4 inches, minimum.

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Fine grade topsoil.
   1. Rake, chain drag and lightly roll topsoiled areas, remove all ridges and fill all depressions.
   2. Use hydraulic power box rake or similar mechanical equipment to remove soil lumps, rocks and debris, fill and level low areas; and correct other grading deficiencies in preparation of seed or sod bed.
   3. Maintain profiles and contour of subgrade.
   4. Lightly compact placed topsoil to prevent sinkage pockets when watered.

3.06 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

END OF SECTION

SECTION 31 2316
EXCAVATION

ART 1 GENERAL:

1.01 SECTION INCLUDES

A. Site excavation.

B. Trenching for site utilities.

1.02 RELATED REQUIREMENTS

A. Section 31 2323 - Fill

1.03 PROJECT CONDITIONS

A. Verify that survey benchmark and intended elevations for the Work are as indicated.

1.04 DEFINITIONS

A. Subgrade: Top of excavation or fill located at the bottom of the aggregate base at pavement and similar construction areas such as curb and gutter and sidewalks or bottom of topsoil or landscape material in non-pavement areas.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION:

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect existing utilities from damage.
   1. The location of existing utilities shown on the plans were either marked by their Owner(s) or taken from maps provided by their Owner(s).
      a. The Contractor is responsible for investigating and determining the accuracy or completeness of actual locations.
   2. The Contractor shall contact ND One-Call at 800-795-0555 prior to any excavation.
   3. The Contractor shall notify the various utility companies if work will expose, affect, or endanger any existing utility.
   4. The Contractor shall support, protect, or relocate existing utilities affected by the work.
      a. Means and methods shall be approved by the utility Owner.

C. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Protect plants, lawns, and other features to remain.

3.02 EXCAVATING

A. Salvage existing topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Excavate to accommodate construction operations.

C. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

D. Cut utility trenches wide enough to allow inspection of installed utilities.

E. Contractor shall maintain utility trenches by pumping ground water seepage out of trenches during excavation and backfilling operations.

F. When the bottom of the trench excavation is not suitable to provide a uniform base for the pipe, or to correct areas that are over-excavated or disturbed, the trench shall be undercut as necessary to provide crushed rock (3/4 inch to 1-1/2 inch diameter) of sufficient depth to provide an acceptable base.

G. Hand trim excavations. Remove loose matter.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Provide positive site drainage during construction.
   1. Do not allow water to pond on the site during construction.

J. Remove excavated material that is unsuitable for re-use from site.

K. Site Subgrade Preparation
   1. Compact and shape the subgrade to produce the required density and stability in the top 12 inches of the subgrade and the required elevation.
      a. Density and stability shall be in-place at the time the aggregate base is placed at pavement areas.
   2. Compaction Density as per ASTM D 698, unless otherwise specified or indicated:
      a. Under Site Concrete and Asphalt Paving areas: Scarify a minimum of 12 inches of the exposed soils at the subgrade elevation and recompact the soils to 95 percent of maximum dry density.
         1) Moisture condition the soils as necessary after scarifying and prior to recompacting.
   3. The required stability shall be such that no rutting or displacement of the subgrade shall occur from construction vehicles and equipment.
   4. Completed subgrade shall be within 1/4 inch (0.02 ft) of plan elevation.
   5. Placement of Aggregate Base Course shall not take place until the results of density tests are known, the final elevations have been checked, and given notice to proceed from the Engineer.

L. Remove excess excavated material from site.

3.03 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 2323
FILL

PART 1 GENERAL:

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for site earthwork
B. Backfilling and compacting for site utilities.
C. Finish grading.

1.02 DEFINITIONS

A. Subgrade: Top of excavation or fill material located at the bottom of the aggregate base at pavement and similar construction areas such as curb and gutter and sidewalks or bottom of topsoil or landscape material in non-pavement areas.

PART 2 PRODUCTS:

2.01 FILL MATERIALS

A. General Fill:
    1. Subsoil excavated on-site.
        a. Graded.
        b. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
    2. Imported Subsoil, if necessary.
        a. Natural, non-organic soils native to the project area.
        b. Graded.
        c. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
        d. Course grained soils with more than 12 percent passing the 200 sieve or fine grained inorganic soils as per the Unified Soil Classification System.
            1) Similar to existing on-site subsoils.
B. Site Pipe Bedding: free of silt, clay, loam, friable or soluble materials, and organic matter.
    1. Graded in accordance with ASTM C136; within the following limits:
        a. 1/2" sieve: 100 percent passing.
        b. No. 4 sieve: 60 to 85 percent passing.
        c. No. 200 sieve: 0 to 10 percent passing.
C. Topsoil: If Required Import Topsoil excavated off-site.
    1. Free of roots, rocks larger than 1/2-inch, subsoil, debris, large weeds and foreign matter.

PART 3 EXECUTION:

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

3.02 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.
B. Employ a placement method that does not disturb or damage other work.
C. Maintain optimum moisture content of fill materials to attain required compaction density.
D. Soil Fill: Place and compact material in equal continuous layers not exceeding 9 inches or less when heavy, self-propelled compaction equipment is used.
    1. 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack, plate compactor, etc.) is used.
E. Correct areas that are over-excavated.

1. Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

F. Compaction Density as per ASTM D 698, unless otherwise specified or indicated:
   1. Under paving and similar construction: After scarifying, moisture conditioning, and recompacting the top 12 inches of the existing exposed soils to 95% of the Standard proctor maximum dry density:
      a. Compact the fill soils to not less than 95% of the Standard proctor maximum dry density.
   2. The required stability shall be such that no rutting or displacement of the subgrade shall occur from construction vehicles and equipment used during the placement of the pavement section materials.
   3. At other locations: 90 percent of maximum dry density.

3.03 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Buried Site Utilities in Trenches:
   1. Contractor shall maintain utility trenches by pumping ground water seepage out of trenches during excavation and backfilling operations.
   2. Bedding: Use Site Pipe Bedding as per the Plan details.
      a. Compact at midpoint of pipe with pneumatic (mechanical) tamper on each side of pipe.
   3. Cover with general fill.
   4. Compact trench, beginning at a point two feet above the pipe, with motorized compaction equipment in maximum 12-inch lifts to 95 percent of maximum dry density.

3.04 FINISH GRADING

A. Before finish grading.
   1. Verify backfilling has been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove soil lumps, grass, weeds, debris, roots, branches, stones in excess of 1/2 inch in size.
   1. Dispose of removed material off site.

C. Thoroughly cultivate topsoil by roto-tilling or hand methods to break all soil lumps.

D. Where topsoil is to be placed, scarify subgrade surface to a depth of 2 inches.

E. Place topsoil over all areas disturbed by construction that are not designated for pavement, or landscaping mulch or rock.

F. Place topsoil where required to level finish grade.
   1. Minimum compacted thickness shall be 4 inches in grass turf areas.

G. Near plants, buildings, and other structures spread topsoil manually to prevent damage.

H. Fine grade topsoil.
   1. Rake, chain drag and lightly roll top soiled areas, remove all ridges and fill all depressions.
   2. On large areas, use hydraulic power box rake or similar mechanical equipment to remove soil lumps, rocks, and debris; fill and level low areas; and correct other grading deficiencies in preparation of seed or sod bed.
   3. Maintain profiles and contour of subgrade.
   4. Lightly compact placed topsoil to prevent sinkage pockets when watered.
   5. When topsoil will abut existing turf, cut turf to form a straight joint with the new seeded or sodded areas.

3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus 0 inches or minus 1/2 inch from required elevations.

C. Top Surface of Topsoil: Plus or minus 1/2 inch.

3.06 CLEANING

A. Remove excess materials from Owner's property, leave area in a clean and neat condition.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Section 01 4500 - Testing Laboratory Services.
B. Section 31 2200 - Site Grading: Topsoil removal from construction site surface and rough and finish grading.
C. Division 32, Concrete Paving, Sidewalks, Curb/Gutter.
D. Divisions 22/23 - Trenching and backfill inside building for Mechanical Work.
E. Division 26 - Trenching and backfill for Electrical Work.
F. Division 31 - Civil/Site Site Structure Excavation, Site excavation, Site Fill.

1.02 PRODUCT DATA:

A. Submit in accordance with Section 01 3300.

1.03 LAYOUT OF WORK:

A. Contractor is responsible for correct alignment of new Work on the site, running of axis lines locating Work, establishment and marking of correct datum points and maintenance of each line and point to ensure accuracy.

B. Take measurements and verify dimensions of existing Work that affects new Work.

1.04 QUALITY ASSURANCE:

A. Reference Standards:
1. ASTM D-698, Test for Moisture-Density Relations of Soils (Standard Proctor).
2. ASTM D-1556, Test for Density of Soil in Place by the Sand Cone Method.
3. ASTM D-2487, Classification of Soils for Engineering Purposes.

B. Geotechnical Inspection by Section 01 4500:
1. Observe (excavation observation) cut and fill operations.
2. Verify that the soil is adequate for footing bearing, prior to placement of concrete footings.
3. Determine field compaction densities as specified.
4. Examine and approve backfill material.
5. Report test results.

1.05 PROTECTION:

A. Protection of Persons and Property:
1. Barricade open excavations and post with warning lights.
2. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

B. Maintaining Traffic:
1. Provide temporary passage as required by Chapter 33, "Protection of Pedestrians During Construction or Demolition," International Building Code (current applicable edition).
2. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.

3. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from Owner and other authorities having jurisdiction.
4. If required by governing authorities, provide adequately signed alternate routes around closed or obstructed traffic ways.
5. Inspect roadways used for temporary routing and record by drawing or photograph the condition of surfaces prior to use.
6. Repair existing surfaces which are damaged to no less than original condition.

PART 2 - PRODUCTS:

2.01 SUBBASE MATERIAL:

A. Unwashed pit run or crushed gravel, crushed stone, or crushed slag, naturally or artificially graded with maximum aggregate size of 1-1/2 inches, as acceptable to Owner's Testing Laboratory.

B. The final 6" of subbase material directly under floor slabs shall be "Clean Subbase" having no more than 5% passing the #200 sieve.

2.02 SUBSOIL MATERIAL:

A. Soil materials free of debris, waste, frozen matter, vegetable and other deleterious matter; excavated or off-site material; as acceptable to testing laboratory.

PART 3 - EXECUTION:

3.01 LAYOUT OF WORK:

A. Contractor is responsible for correct alignment of new Work on the site, running of axis lines locating Work, establishment and marking of correct datum points and maintenance of each line and point to ensure accuracy. Use registered civil engineer or registered land surveyor to accomplish this Work.

B. Take measurements and verify dimensions of existing Work that affects new Work.

C. Contractor alone is responsible for correctness of measurements and for verification of grades, lines, levels, elevations or dimensions shown on Drawings.

3.02 EXISTING UNDERGROUND UTILITIES:

A. Indicated locations are approximate; determine exact locations before commencing earthwork.

B. Notify utility companies to remove and relocate lines which are in the way of excavation.

C. Maintain, reroute or extend as required, existing utility lines to remain which pass through Work area.

D. Pay costs for this Work, except those covered by utility companies.

E. Protect utility services uncovered by excavation.

F. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.

G. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record Documents.

3.03 EXCAVATION:

A. Excavate subsoil in accordance with lines and levels required for construction of the Work, including space for forms, bracing and shoring, and to permit inspection.

B. Machine or Hand slope banks. See **Cut lines on drawings** for depth of excavations.
   1. Testing Lab will be on site during excavation to review soils exposed in the excavation.

C. Hand trim excavations and leave free from loose or organic matter.

D. When complete, verify soil bearing capacities, depths and dimensions.

E. Correct unauthorized excavation as directed, at no cost to Owner.

F. Excavations are not to interfere with normal 45-degree bearing splay of any footing. Excavations shall be oversized to meet the lateral 1 to 1 requirements of the footing.

G. Excavations shall be kept dry by means of dewatering equipment.

H. Stockpile excavated subsoil for reuse where directed by OWNER. Coordinate placement of stockpile with other site Work. Allow acceptable material, not required for backfilling, to be used by Section 31 2200 for rough grading.

3.04 DEWATERING:

A. Provide sumps to keep excavation free of standing water. One or more sumps will be required for the removal of seepage and runoff from the excavation. As constructed, all sumps shall consist of a 2 foot x 2 foot or larger plan dimension excavation (depending upon depth, it may be wider), located adjacent to and directly exterior to the excavation oversize limit for structural engineered fill.

B. Sump excavations should extend a minimum of 2 feet below the base of the excavation for the collection of seepage and runoff water.

C. Line sumps with a non-woven, needle punched, geotextile fabric as previously specified. A perforated standpipe of 12” diameter or larger, should be centered within the sump excavation. Extend the standpipe to the ground surface to facilitate pumping during project construction.

D. Use 1-½” to ¾” clean rock placed between the standpipe and walls of the sump excavation.
   1. Pumping of sump should continue until completion of the construction or until the Geotechnical Engineer indicates such pumping is no longer necessary.
   2. Abandon sump per methods required by Geotechnical Engineer and Federal, State and local government statues.
   3. Discharge water form sumps should be piped away from the site and be disposed of within storm water systems or other systems complying with Federal, state or local statutes.

3.05 FILL TYPES AND COMPACTION:

A. General: Control backfill compaction during construction providing minimum percentage of density specified for each area classification.

B. Use vibratory compactors for the compaction of backfill. Utility trenches shall use special trench compactors.

C. Do not backfill on frozen subgrade.

D. Percentage of Maximum Density Requirements: Compact backfill to not less than the following percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D-698, Standard Proctor.

E. Exterior Side of Foundation Walls:
   1. Use subsoil material.
   2. Compact each layer to 95% of maximum density
   3. Provide field density tests of compacted backfill in number determined by Soils engineer.

F. Placement of exterior backfill against at-grade foundation walls should be performed concurrent with the placement of interior backfill to minimize differential loading, rotation, and/or movement of the foundation wall or pier system.

G. Interior Side of Foundation Wall:
   1. Use granular subbase material.
   2. Compact each layer to a minimum of 95% of maximum density.
   3. Provide field density tests of compacted material in number determined by Soils engineer.

H. Building Slabs and Steps:
   1. Use Clean subbase material.
   2. Compact Clean subase course under slabs to a minimum of 95% of maximum density.
   3. Provide field density tests of clean base course in number determined by Soils engineer.

3.06 FILLING INSIDE FOUNDATIONS & BACKFILLING OUTSIDE FOUNDATIONS:

A. Coordinate with Section 07 2000 to permit placement of perimeter insulation.

B. Ensure areas are free from debris, snow, ice and water, and that ground surfaces are not in a frozen condition.

C. Do not fill over existing subgrade surfaces which are porous, wet or spongy.

D. Compact existing subgrade surfaces if densities are not equal to that required for subbase or subsoil materials.

E. Place granular subbase material inside foundations from bottom of stripping or excavations to underside of concrete slabs. Place and compact in continuous layers not exceeding 9" loose depth. Provide in depth as required.

F. Place subsoil material outside foundations to grades, contours, level and elevations indicated on Drawings allowing for 6" of topsoil or to underside of subbase for paving or surfacing. Place and compact in continuous layers not exceeding 12" loose depth.

G. Use methods so as not to disturb or damage perimeter insulation.

H. Maintain optimum moisture content of subbase and subsoil materials to attain required compaction density.

3.07 EXCESS SOIL:

A. Remove excess or unsuitable excavated or imported material from site.

3.08 CONSTRUCTION REQUIREMENTS:

A. Responsibility Regarding Existing Utilities and Structures:
   1. The existence and location of underground utilities indicated on the plans are not guaranteed and shall be investigated and verified in the field by the Contractor prior to starting work.
   2. Excavation in the vicinity of existing structures and utilities shall be carefully done by hand.

B. Unsuitable Materials:
   1. If during the grading operations unsuitable soils are encountered, the Owner's representative may order such soils to be removed to a designated depth and disposed of at his direction.

C. Preparation of Site Subgrade:
   1. All soft or yielding material and other portions of the subgrade which will not compact readily shall be removed and replaced with suitable material (as determined by Testing Agency) and the whole subgrade brought to a line and grade, providing a uniform firm foundation for newly placed soil.
   2. Where the existing subgrade is of a compacted nature(as determined by Owner's representative), it shall scarified to a depth of 6" for the full width of the subgrade , and the loose materials shall be spread and manipulated, compacted, so as to bring all the material to a uniform density.

3.09 ADDITIONAL WORK:

A. If additional excavation is required, whether directed by a Soils Engineer or by Architect, the procedure should be as follows:
   1. Before additional excavation is started the Contractor shall call a meeting of the Owner, CM and Soils Engineer to review the area and depth of the additional excavation and to determine the additional in-place cubic yards required to be excavated and filled which will be paid for per unit prices for excavation and fill. No additional compensation will be paid for additional excavation and backfill unless above procedure is followed.

END OF SECTION

SECTION 32 05 00
COMMON WORK RESULTS FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.01 DESCRIPTION

This section of the Project Manual includes work common to exterior site improvements including pavements, curb and gutter, sidewalks and all work included thereto as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

The following items of related work are specified and included in other sections of this Project Manual:

SECTION 31 22 00	**FINISH GRADING**
SECTION 31 23 13	**EXCAVATION AND FILL**
SECTION 32 1000	**Sidewalks, Concrete Paving &Surfacing**

1.03 REFERENCE SPECIFICATIONS

A. References made in **DIVISION 32 EXTERIOR IMPROVEMENTS** to the NDDOT Specifications shall be taken to mean the North Dakota Department of Transportation's Standard Specifications for Road and Bridge Construction, 2022 Edition unless otherwise specified.

B. The referenced sections and appurtenant sections thereto of the NDDOT Specifications shall be considered as a part of this Specification.

C. Provisions of the NDDOT Specifications are subject to modification by these Specifications.

D. All testing noted by the NDDOT Specifications to be performed by the Construction Representative shall be performed by the independent testing laboratory retained by the Contractor.

E. Conform to applicable codes for marking handicapped parking and include signs and pavement markings.

PART 2 PRODUCTS

2.01 CONCRETE

All concrete for pavements, curb and gutter, driveways and walks shall be as specified in **SECTION 32 1000 CONCRETE PAVING** of this Project Manual.

PART 3 CONSTRUCTION REQUIREMENTS

3.01 GENERAL

A. These general construction requirements apply to all exterior site improvement work.

B. The limits of construction are shown on the Drawings or shall be established by the Owner’s Representative.

1. The Contractor shall confine construction operations within these limits.
2. All surface objects, trees, stumps, roots, and other obstructions that are not designated to remain shall be cleared and disposed of as specified.

C. The removal of surface improvements (pavement, curb and gutter, walks) shall be held to a minimum.

1. All materials to be removed and means of replacement shall be subject to the approval of the Owner’s Representative where said removals are not detailed on the Drawings.
2. All materials that are removed shall be disposed of off-site at a location provided by the Contractor.
3. All pavements, walks or curb and gutter that are to be removed shall be sawn at full depth to provide

a neat and true edge.

3.02 TESTING

A. The Contractor shall be responsible for obtaining test results showing the moisture-density relationships (Standard Proctor) of representative samples of the materials to be used in all embankment and backfill construction including excavated material, engineered fill and borrow material.

B. The Contractor shall be responsible for obtaining Job Mix Formulas for bituminous pavement mixtures of each type.

C. Testing shall be performed by an independent testing laboratory in accordance with the requirements of ASTM D698.

3.03 CLEANUP

A. Cleanup of the site shall be completed before final acceptance of the work can be made.

B. Cleanup shall include the removal and disposal of all unsuitable materials.

C. All equipment shall be removed from the site. The site shall be left in a manner so as to present a clean and neat appearance.

3.04 MISCELLANEOUS

A. All surplus waste materials remaining after completion of the exterior site improvements shall be disposed of in an acceptable manner within 24 hours after completing the work on each area of the site.

1. Disposal at any location within the project limits shall be as specified, or as approved by the Owner's Representative; otherwise, disposal shall be accomplished outside the project limits at a location provided by the Contractor.

2. The waste disposal operations shall be a part of the work required under the exterior site improvement work, not as work that may be delayed until final cleanup.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED WORK:

A. Soil Investigation Data: Informational references to subsurface conditions.
1. Section 01 4500 - Testing Laboratory Services.
2. Section 31 1100 - Site Clearing.(Majority by CITY OF BOTTINEAU)
3. Section 31 2210 - Site Grading: Topsoil removal, rough grading of subsoil to receive topsoil and finish grading of topsoil.
4. Site Excavation, - Section 31 2316. Site Fill: Section 31 2323.

1.02 PRODUCT DATA:

A. Submit in accordance with Section 01 3300.

1.03 SUBMITTALS:

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1.04 QUALITY ASSURANCE:

A. REFERENCE STANDARDS:
1. ACI 301, - Specifications for Structural Concrete for Buildings.
2. ACI 522.1 - Specification for Pervious Concrete Pavement.
3. ASTM D-698, Test for Moisture-Density Relations of Soils (Standard Proctor).
4. ASTM D-1556, Test for Density of Soil in Place by the Sand Cone Method.
5. ASTM D-2487, Classification of Soils for Engineering Purposes.
6. ASTM C-94, Ready-Mixed Concrete.
7. FS TT-C-800, Curing Compound, Concrete, for New and Existing Surfaces.
8. Standard Specifications for Road and Bridge Construction, North Dakota State Highway Department. (ND Spec.).
9. Standard Specifications for Concrete Sidewalks, Curbs and Gutters, and Driveways, City of Bottineau. City's Engineer will be inspecting all work on city berm or property areas
10. Geotechnical Inspection by Section 01 4500:
11. Design concrete mixes for each specified strength.
12. Verify concrete strength by performing cylinder compression tests.
13 Examine and approve gravel fill material.
14. Determine field compaction densities as specified.
15. Report test results.

1.05 PROTECTION:

A. Protection of Persons and Property: Barricade open excavations and post with warning lights.

B. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

C. Maintaining Traffic:
1. Provide temporary passage as required by Chapter 44, "Protection of Pedestrians During Construction or Demolition," Uniform Building Code (current applicable edition).

2. Ensure minimum interference with roads, streets, driveways, sidewalks and adjacent facilities.
3. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.
4. If required by governing authorities, provide adequately signed alternate routes around closed or obstructed traffic ways.
5. Inspect roadways used for temporary routing and record by drawing or photograph the condition of surfaces prior to use.
6. Repair existing surfaces which are damaged to no less than original condition.

1.07 GRADES:

A. Carefully compare new grade requirements with existing contour lines.

B. Provide all necessary earth, grading and shaping Work.

C. No extra payment will be allowed due to overage or shortage of material.

PART 2 - PRODUCTS:

2.01 SUBSOIL MATERIAL:

A. Material excavated under Section 02 2250 or other material acceptable to testing laboratory.

2.02 SUBBASE/GRAVEL MATERIAL:

A. Class 5, Gravel, Section 808, North Dakota Reference Specifications.

2.03 SAND FILL:

A. Washed sand free of any debris or other foreign matter.

2.04 CONCRETE:

A. Alkali resistant Ready Mixed product meeting ACI 301 Chapters 2, 3, 7, 8 and 12;
B. 4,000 psi concrete at 28 days with maximum slump of 3 inches, one-inch maximum aggregate
C. Cement content - not less than 6.0 sacks per cy;
D. Water-cement ratio: not more than 0.50.
E. 6% AEA; Air entraining admixture shall meet ASTM C260, and water reducing agent shall meet ASTM C494-77, Type A and free of added lignin and chloride.

F. Fine and Coarse Aggregates: ASTM C33
Coarse Aggregates shall meet size number 56 or 67.
The following percentages shall not be exceeded for Coarse Aggregated
1. Shale:
a. Maximum 0.5% by weight of the plus no.4 fraction at Sidewalks
b. Maximum 3% by weight of the plus no. 4 fraction all other ext. concrete
2. Iron oxide particles: Maximum 4% by weight of the plus No. 4 fracktion.

G. Fly Ash: ASTM C618, Class C or F. Maximum 30% cementitious by Weight

H. Cement: ASTM C150, Type 1/1A Portland Cement. All cementitious materials from same source.

I. Chemical Admixtures: ASTM C494 Type A water Reducing. Calcium Choride admixtures not allowed.

J.

2.05 CONCRETE REINFORCEMENT:

A. ACI 301 Chapter 5, deformed billet steel bars; intermediate grade deformed bars conforming to the requirements of ASTM A15 and A305. Provide bar supports and spacers shall be of steel and of suitable design and strength to hold reinforcement accurately in place before and during the placing of concrete.

B. Reinforcing steel, except as otherwise specified, shall be intermediate grade deformed bars rolled from take-out billet stock and shall conform to the requirements of ASTM A15 and ASTM A305 as to deformations:
   1. Dowel bars shall be intermediate grade plain bars rolled from take-out billet stock and shall conform to the requirements of ASTM A15.
   2. Wire mesh reinforcement shall comply with the requirements of ASTM A185.
   3. Bar supports and spacers shall be of steel and of suitable design and strength to hold reinforcement accurately in place before and during the placing of concrete.
   4. Hy-chairs shall be of welded steel construction and all spacers, bar supports and chairs shall be approved by the Engineer.
   5. Tie wire shall be No. 16 gauged annealed wire.
   6. Joint Sealer: Hot poured sealer for concrete and asphalt pavements conforming to ASTM D3405.

2.06 FORMWORK AND ACCESSORIES:

A. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete, ACI 301.

B. Joint Filler: Minimum 1/2 inch thick fiberboard, ASTM D-1751.

C. Waterproof Paper for Curing: Conform to ASTM C171-69.

D. Polyethylene Film for Curing: Conform to ASTM C171-69.

E. Curing Compound: At Concrete paving and curbs provide White pigmented, water emulsion wax based curing compound conforming to ASTM C309, such as WR Meadow's 1600 series. Provide clear at sidewalks, such as WR Meadows, 1300 series.

F. Sealant: Polyurethane base, single or multicomponent, chemical curing; Type 1, self-leveling, FS TT-S-0027E, Class A, nonstaining and nonbleeding or polyurethane base, moisture-curing; Type 1, self-leveling; FS TT-S-230C, nonstaining and nonbleeding. Equal to Sikaflex's self leveling grade.

PART 3 - EXECUTION:

3.01 LAYOUT OF WORK:

A. Contractor is responsible for correct alignment of new Work on the site, running of axis lines locating Work, establishment and marking of correct datum points and maintenance of each line and point to insure accuracy. Use registered civil engineer or registered land surveyor to accomplish this Work.

B. Take measurements and verify dimensions of existing Work that affects new Work.

C. Contractor is responsible for corrections of measurements and for verification of grades, lines, levels, elevations or dimensions shown on Drawings.

D. Work on city property will be inspected by City Engineer to verify compliance with City of **Bottineau** specifications.

3.02 PLACEMENT OF SUBBASE/GRAVEL MATERIAL:

A. Place and level material over prepared subgrade to a compacted depth indicated on Drawings true to lines and levels.

B. Compact to 95% maximum density.

C. Provide minimum of two field density tests of compacted subbase per 1000 sf or less.

D Spread aggregate from dumped pile onto fabric using tracked equipment. Traffic directly on geotextiles is not permitted.

E. Use smooth drum roller to achieve density. Vibratory compaction shall not be used on initial lift over geotextiles.

3.03 PRELIMINARY CONCRETE TESTING:

A. Product aggregate and mix design testing is to be paid for by Contractor or material supplier.

B. Concrete Aggregate Test:
1. By independent testing laboratory per ASTM C-33, made no sooner than 4 months prior to submittal. Mix no concrete until approval of report by Architect.

C. Concrete Mix Designs: By independent testing laboratory for each herein specified concrete strength. Mix no concrete until approval of report by Architect.
1. The mix design shall include the following information:
   a. Fine and coarse aggregate gradations per ASTM C33
   b. Method of determination the mix design proportions.
   c. Water/Cement Ratio
   d. Air content of plastic and hardened concrete
   e. Compressive strengths at 7 and 28 days per ASTM C39
   f. Chloride ion content of the concrete per ASTM C 1218
   g. The proportions and types of all materials.
   h. The shale content of all aggregates used.

3.04 CONCRETE WORK:

A. During concrete placement, keep cushion sufficiently moist to prevent excessive absorption of water from freshly placed concrete.

B. Forming:
   1. Place and secure forms to correct location, dimension and profile.
   2. Arrange and assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Placing Reinforcing:
   1. Reinforce concrete paving as detailed. Allow for minimum 1-1/2 inches concrete cover.
   2. Do not extend reinforcing through expansion and contraction joints. Provide dowelled joints through expansion and contraction joints, with one end of dowels allowing free movement.

D. Forming Expansion and Contraction Joints:
   1. Place expansion and contraction joints at 20-foot intervals. Where possible, make joints of curbs coincide with joints in walks. Form contraction joints with powered saws equipped with proper blades. Fill all joints with
   2. Fit joints with filler of required profiles, set perpendicular to longitudinal axis of walks, curbs and gutters. Recess 5/8 inch below finished concrete surface.
   3. Control joints in sidewalks shall be placed not over 5”-0” on centers each way. Reinforcing to extend thru joints with joint scored by finishing tool to depth of 1/4 of slab thickness.
   4. Sealant: Install at all expansion joints filling to within 1/16" below finished concrete. Surface install using equipment and methods recommended by manufacturer.

E. Placing Concrete:
   1. Place concrete in accordance with ACI 301.
   2. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
   3. Place concrete continuously between predetermined construction joints.
   4. Avoid working mortar to surface.
   5. Round all edges, including edges of expansion and contraction joints, with 1/2 inch radius edging tool.
   6. Where paved surfaces are adjacent to walks, make concrete curbs coincide with walk joints. Provide dummy joint at line between walks and curbs.
   7. Provide exposed surface of walks, curbs and gutters with broom finish.
   8. Ensure finished surfaces do not vary from true lines, levels or grade by more than 1/8 inch in 10 feet when measured with straightedge.
   9. Apply curing compound on finished surfaces immediately after placement. Apply in accordance with manufacturer's instructions.
   10. Employment of laboratory shall in no way relieve Contractor's obligations to perform Work of the Contract.
   11. Moist cure concrete flatwork for a minimum of 3 days.
   12. Immediately after placement, protect from premature drying, excessive hot or cold temperatures and mechanical injury.

3.05 JOINTS:

A. Construction expansion, contraction and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Concrete Pavement:

1. Contraction Joints: Provide contraction joints, sectioning concrete into areas such that joint spacing in feet does not exceed two times the slab thickness in inches (4" slab - 8 ft centers; 5" slab - 10ft centers; 6" slab - 12 ft centers on joints) and in no case greater than 15 feet. Form contraction joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded or otherwise damaged by cutting action.
2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than ½ hour, except where such placements terminate at expansion joints.

C. Concrete Sidewalks:
1. Contraction Joints: Where not indicated, locate control joints not over 5 feet on center each way.
   a. Extend reinforcing through control joints and score joint with a finishing tool to depth of ¼ of slab thickness.

D. Expansion Joints: Locate as indicated on Drawings:
1. Where not indicated, locate not over 20 feet on center each way and where exterior slabs abut restraining walls.
   a. Do not run reinforcing through joints.
2. Use ½-inch thick asphalt impregnated joint filler extending through concrete.
3. Hold joint filler 3/8-inch back from face and seal joint with joint sealer.

E. Concrete Curbs and Gutters:
1. Contraction Joints: Locate as indicated on Drawings:
   a. Where not indicated, locate control joints not over 10 feet on center and at point of tangents in radii.
   b. Extend reinforcing through control joints.
   c. Form ¼-inch wide joints at least two inches deep using oiled steel plates.
   d. Remove plates as soon as concrete has adequately set.
2. Expansion Joints in Curbs and Gutters:
   a. Locate 40 feet on center maximum.
   b. Form with ½-inch thick, asphalt impregnated joint filler extending through concrete. Tool exposed edges of all joints with a jointing tool.
   c. During concrete placement, keep cushion sufficiently moist to prevent excessive absorption of water from freshly placed concrete.
3. Forming:
   a. Place and secure forms to correct location, dimension and profile.
   b. Arrange and assemble formwork to permit easy stripping and dismantling without damaging concrete.
   c. Placing Reinforcing: Reinforce concrete paving as detailed. Allow for minimum 1-1/2 inches concrete cover.
4. Placing Concrete:
   a. Place concrete in accordance with ACI 301.
   b. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
   c. Place concrete continuously between predetermined construction joints.
   d. Avoid working mortar to surface.
   e. Round all edges, including edges of expansion and contraction joints, with 1/2 inch radius edging tool.
   f. Where paved surfaces are adjacent to walks, make concrete curbs coincide with walk joints. Provide dummy joint at line between walks and curbs.
   g. Provide exposed surface of walks, curbs and gutters with broom finish.

h. Ensure finished surfaces do not vary from true lines, levels or grade by more than 1/8 inch in 10 feet when measured with straightedge.

i. Apply curing compound on finished surfaces immediately after placement. Apply in accordance with manufacturer's instructions.

j. Immediately after placement, protect from premature drying, excessive hot or cold temperatures and mechanical injury.

3.06 CONCRETE WORK - FIELD TESTING: Paid for by OWNER

Note: where non-compliance is indicated in the test the contractor will be responsible for paying for the retest costs.

A. Concrete Cylinder Compression Tests:

1. Securing Cylinders: During process of concrete Work per ASTM C-31.
2. Quantity of Cylinders: No less than 4 cylinders per test. Additional may be required by Architect if there is possibility of surrounding air temperature falling below 40 degrees F. Because concrete must reach 80% of design strength before shoring can be removed. Contractor may choose to take additional job cured cylinders to ascertain when this strength has been reached.
3. Quantity of Tests: Take one test (4 cylinders) from each part of structure (including sitework) placed on any one day. If daily pour exceeds 50 cubic yards, take additional tests for each 50 cubic yards or fraction thereof.
4. Curing of Cylinders: ASTM C-31, average of two 7-day and one 28-day lab cured. Curing cylinders for determining form removal shall be stored as near as possible to portion of structure they represent and receive same protection.
5. Testing of Cylinders: ASTM C-39.
   a. Average Strength of Laboratory Cured Cylinders: Section 504 of ACI-311.

END OF SECTION