Project Manual

(Specifications)

DPW PROJECT # 24-246

ISU: REPAIR UTILITY TUNNEL, PHASE 3

IDAHO STATE UNIVERSITY

95% CONSTRUCTION DOCUMENTS

POCATELLO, IDAHO

PROJECT NO. 208106-119

PREPARED BY:

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And

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Idaho Power Furnished, Contractor Installed Products.
4. Idaho Power Furnished, Idaho Power Installed Products.
5. Access to site.
6. Protection of Buildings, Contents, and Grounds.
7. Coordination with occupants.
8. Work restrictions.
9. Permits.
10. Waste Disposal.
11. Testing and Inspection.
12. Specification and drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: DPW 24-246

B. Project Location: Idaho State University, Pocatello, ID

C. Owner: State of Idaho; Division of Public Works
   a. Owner’s Representative:
      1) Project Manager: Gary Groff, gary.groff.@adm.idaho.gov, 208-332-1919
      2) Field Representative: Fred Richards, fred.richards@adm.idaho.gov, 208-269-0639

D. Agency: Idaho State University
   a. Agency's Representative:
      1) Project Manager, Cole Elquist, coleelquist@isu.edu, 208-282-2472

E. Engineer (Design Professional): Keller Associates, Inc., Kris Wiese, kwiese@kellerassociates.com

F. Engineer's (Design Professional's) Consultants: The Architect or Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:

a. Mechanical: Heath Engineering, Andy Paskett, apaskett@heatheng.com, 801-322-0487

b. Electrical: Musgrove Engineering, Matthew Bradley, matt@musgrovepa.com, 208-523-2862

1.4 WORK COVERED BY CONTRACT DOCUMENTS

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

1) The design will include removal and replacement of approximately 350-feet of the utility tunnel, steam and condensate lines, insulation, steam valves, and steam appurtenances from the end of DPW project 21-654 ISU: REPAIR UTILITY TUNNEL which is located at the north corner of the Business Administration Building and continue the tunnel and steam line replacement of tunnel going west to the Liberal Arts Building.

2) New communications conduit bank will be extended approximately 517-feet from a communication box south of the Business Administration Building south to near the NW corner of the Museum and from the Museum west approximately 100-feet to the Fine Arts Building. Also includes approximately 115-feet of conduit to connect to the Pharmacy building.

3) New high voltage Idaho Power conduit bank will be extended approximately 1,000-feet from the north side of the Liberal Arts Building to the south to near the SE corner of the Fine Arts Building to connect to an existing transformer near the Fine Arts Building main entrance and to connect to an existing power conduit bank. Approximately 455-feet of power conduit will be extended to for connections to the exiting transformers for the Liberal Arts and Pharmacy Buildings. Also includes removal of power cables and cable trays from the tunnel system in the lower campus quad.

4) New communications conduit bank extended approximately 400-feet from the Student Union Building and from Gravely Hall to the Administration Building to make connectivity with existing conduits and communications box. Also includes removal communication lines from the tunnel system in the lower campus quad.

5) New high voltage Idaho Power conduit bank will be installed approximately 531-feet from conduit banks and switch gear vault at the SE corner of the Student Union building installed with the G1 Parking Lot Project (DPW 23-881 in 2024) to an existing transformer located between the Administration Building and Gravely Hall.

6) New high voltage Idaho Power conduit bank will be extended approximately 345-feet from an existing transformer on the south side of Humbolt St to the south side of the Heating Plant.

7) New communications conduit bank will be extended approximately 129-feet from existing conduit banks near the transformer on the south side of Humbolt St to new vaults in the Public Safety parking lot.
8) New high voltage Idaho Power conduit bank will also be extended approximately 150-teet from an existing Idaho Power switch gear on the south side of Martin Luther King Jr. Way near the NE corner of the Rendezvous Building under Martin Luther King Jr. Way to the SE corner of the Oboler Library to make connectivity with conduits and communications box being installed with the ISU Tunnel Project (DPW 21-654 in 2024).
9) New communications conduit bank will be extended approximately 78-feet from a new communication box installed in the Public Safety parking lot to the Public Safety Buidling.
10) A new water vault and water line north of the Business Administration Building need to be removed and a new water vault and line installed into the building. The existing water vault is old and is also adjacent to the tunnel being replaced so it will need to be relocated closer to the building and away from the tunnels to provide separation for future maintenance. The existing water line from the vault runs inside the existing tunnel C4/24 and needs to be moved out of the tunnel and relocated along with the vault.

B. Type of Contract:

a. Project will be constructed under a single prime contract per the Division of Public Works Fixed Price Construction Contract between Owner and Contractor.

1.5 IDAHO POWER FURNISHED; CONTRACTOR INSTALLED PRODUCTS

A. Idaho Power will furnish the products indicated. The work for the contractor includes receiving, loading, unloading, handling, protecting, and installing the Idaho Power furnished products.

1.6 IDAHO POWER FURNISHED, IDAHO POWER INSTALLED PRODUCTS

A. Idaho Power will furnish the products indicated. The work for the contractor is to provide access for installation activities by Idaho Power.

1.7 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project, and by use of facility by building tenants in existing tenant improvement Projects.

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

1. Limits: Confine construction operations to the project limits as defined on the design drawings, Sheet CD-101 through CD-116.
2. Driveways and Entrances: Keep driveways entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
    c. Contractor parking shall be limited to those areas coordinated with Owner.
    d. Maintain clear access to project at all times for firefighting equipment. Maintain exit ways from existing building required by authorities having jurisdiction.
    e. Signs: Provide signs adequate to direct visitors per the traffic control plans.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Any damage to the building, due to negligence on behalf of the contractor to not maintain a weather-tight condition, shall be the responsibility of contractors and they shall bear the burden for correction and/or repairs for any damage. Repair damage caused by construction operations.

D. Security: The contractor shall maintain security of the site and any staging areas throughout the project.

E. Behavior and Dress: The Contractor and all Contractors representatives, to include subcontractors, consultants, vendors or other parties hired by the Contractor will maintain professional behavior and wear appropriate attire that always identifies their company while on the job site.

1.8 PROTECTION OF BUILDING, CONTENTS, AND GROUNDS.

A. Construction Site Lay-down and Storage: Contractor may use the Frasier Hall parking lot for construction lay down area. See plans for construction limits.

B. Verify with Agency any specific requirements.

1.9 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than one week in advance of activities that will affect Owner's operations.
3. The Owner will take special care not to damage materials or work completed by the contractor prior to final acceptance. If the contractor occurs any damages, prior to final acceptance, they need to notify the Owner and Architect immediately for verification of damages. If the contractor fails to notify the Owner and Architect within 24 hours of the incident, the contractor shall be responsible for the performance and shall bear the cost of correction.

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work from 7 a.m. to 7 p.m. except on Thursdays limit work to 6 p.m.

1. Weekend Hours: Upon approval from ISU.
2. Early Morning or Late Evening Hours: Upon approval from ISU.

C. Hours for Utility Shutdowns: Coordinate with ISU and Utility.

1. For Power and Data interruptions Notify Idaho State University not less than 30 days in advance of proposed utility interruptions.

2. Notify Idaho State University not less than 2 weeks for short term power outages (1-2 hour shutdowns)

3. Notify Idaho State University not less than 24 hours in advance of proposed disruptive operations.

4. Obtain Idaho State University’s written permission before proceeding with disruptive operations.

D. Hazardous Materials: Notify the Design Professional and Owner immediately upon discovery of existing hazardous materials.

E. Nonsmoking Building: Smoking is not permitted within or around any campus building.

F. Controlled Substances: Use of tobacco products and other controlled substances is not permitted per Section 72-1717, Idaho Code.

G. Employee Screening: Comply with Owner's requirements for screening or Covid-19 testing of Contractor personnel working on Project site.

H. No firearms or weapons are allowed on the campus of Idaho State University.

1. Maintain list of approved screened personnel with Owner's representative.

1.11 PERMITS

A. Furnish all necessary permits for construction of the Work.

1.12 WASTE DISPOSAL

A. The contractor is responsible for any and all demolition and/or removal as necessary and required to fulfill the requirements of the Contract Documents.

1.13 TESTING AND INSPECTION

A. Notify Owner/Engineer at least 24 hours prior to commencement of Work requiring special inspection.

1.14 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

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

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of Engineer and owners, if requested by Engineer.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated, if requested by Engineer.
i. Cost information, including a proposal of change, if any, in the Contract Sum.
j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

1.5 PROCEDURES

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

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 days prior to time required for preparation and review of related submittals.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer 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.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. 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: Engineer will consider requests for substitution if received within 45 days after Notice of Award. Requests received after that time may be considered or rejected at discretion of Engineer.

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 MINOR CHANGES IN THE WORK

A. Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, through Owner's web-based management software (OMS).

1.4 PROPOSAL REQUESTS

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

1. Work Change Proposal Requests issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.
2. Within 7 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

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

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

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use form acceptable to the Engineer.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, the Engineer will complete the Owner’s Change Order Form and attach the Proposal Request and back-up. The Engineer will then forward this documentation to the Owner’s Project Manager who will create a Change Order through OMS for approval of the Owner and Contractor. Note approval is determined after Change Order is approved through OMS.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Work Change Directive: Engineer may issue a Work Change Directive. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment on DPW's Owners web-based management software (OMS).

1.2 SCHEDULE OF VALUES (SOV)

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

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.

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

1. Submit the schedule of values on Owner's or other approved "schedule of values" form to Division of Public Works seven days after contract is approved.
2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts where needed.
3. Provide a separate line item in the SOV for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site.
4. Allowances: Provide a separate line item in the SOV for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling 1%, one percent of the Contract Sum and subcontract amount.
8. Review and approval by the Engineer and Owner (DPW's Project Manager and DPW's Field Representative) is required prior to the first payment application.

1.3 PAYMENT APPLICATIONS

A. Each Pay Application or Invoice shall be submitted via the OMS under the 'Cost Tracking/Contract Mgmt.' module where they will be **electronically approved** by the Contractor, Engineer, and Owner (DPW Field Representative, DPW Project Manager, and DPW Senior Field Representative). The Schedule of Value must be included and attached in OMS with the Invoice.

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

C. Payment Application Times: Create Pay Applications on the Owners web-based management software by the last day of the month and electronically submit for approval. The period covered by each Payment Application is one month, ending on the last day of the month.

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

1. List of subcontractors.
2. Contractor's construction schedule (preliminary if not final).
3. Products list (preliminary if not final).
4. Schedule of unit prices.
5. Submittal schedule (preliminary if not final).
6. Copies of building permits.
7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
8. Initial progress report.
9. Data needed to acquire Owner's insurance.

E. Payment Application at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, upload a Payment Application showing 100 percent completion for portion of the Work claimed as substantially complete.

F. Final Payment Application: After completing Project closeout requirements, submit final Payment Application with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements per Conditions Precedent to Final Payment Form.

2. Marked up Record Drawings and Specifications.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Contractor's Affidavit of Payment of Debts and Claims Form. AIA Document G706.
5. Consent of Surety to Final Payment. AIA Document G707.
6. Release of Claims form, Exhibit H. Evidence that claims have been settled.
7. Confirmation of all required training, product warranties, operating manuals, instruction manuals and other record documents, drawings and items customarily required of the Contractor.
8. Public Works Contract Tax Release from the Idaho Tax Commission.

9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Division of Building Safety inspection approval/occupancy permit.
12. Any and all other items required by the Owner (DPW) under the applicable contract requirements.

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:
1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Design Professional, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Key Personnel Names: Within seven (7) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate

construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

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

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

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

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

   c. Indicate functional and spatial relationships of components of Design Professional, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

f. Indicate required installation sequences.
g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Design Professional indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show Design Professional and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub-framing for support of ceiling [**, raised access floor,**] and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Design Professional will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Design Professional determines that coordination drawings are not being

prepared in sufficient scope or detail, or are otherwise deficient, Design Professional will so inform Contractor, who shall make changes as directed and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
11. Review: Design Professional will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. Design Professional will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

    a. Design Professional makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

1.7 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and upload an RFI in the Owners web-based management software (OMS).

1. Design Professional will approve RFIs with any comments through OMS.

2. Design Professional shall notify DPW of the Design Professional’s Representative who will receive and respond to RFIs.
3. Contractor to upload RFIs in a prompt manner so as to avoid delays in the work or work of subcontractors.
4. Contractor and Design Professional can copy any Team members the question and/or response within OMS.

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

1. Input information required by OMS.
2. Specification Section number and title and related paragraphs, as appropriate.
3. Drawing number and detail references, as appropriate.
4. Field dimensions and conditions, as appropriate.
5. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
6. Attachments: Upload sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. Design Professional's Action: Design Professional will review each RFI, determine action required, and respond. Allow seven (7) working days for Design Professional's response for each

RFI. RFIs received by Design Professional after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

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

2. Design Professional's action may include a request for additional information, in which case Design Professional's time for response will date from time of receipt by Design Professional of additional information.
3. Design Professional's action on RFIs that may result in a change to the Contract Time or the Contract Sum in which case the Contractor may submit a Proposal Request to the Design Professional.

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Design Professional in writing within seven (7) days of receipt of the RFI response.

D. On receipt of Design Professional's action, review response and notify Design Professional within seven (7) days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Design Professional's Data Files: Design Professional **can** provide Design Professional's digital data files for Contractor's use during construction.

B. Use of Design Professional's Digital Data Files: Digital data files of Design Professional's will be provided by Design Professional for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Design Professional makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.

C. Web-Based Project Software: Use **Owner's** web-based management software site (OMS) for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project software site includes the following features for:

    a. Compilation of Project data, including Contractor, subcontractors, Design Professional, Design Professional's consultants, Owner, and other entities involved in Project.

b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents. The 'My Team' module Includes names of individuals and contact information.
c. Document workflow planning, allowing customization of workflow between project entities.
d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
e. Tracking status of each Project communication in real time, and log time and date when responses are provided.
f. Handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of Daily Field Reports
l. Management of construction progress photographs.
m. Mobile device compatibility, including smartphones and tablets.

D. PDF Document Preparation: Where PDFs are required to be submitted to Design Professional, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

A. General: The Design Professional will schedule and conduct bi-monthly meetings at the Project site unless otherwise indicated.

B. Preconstruction Conference: The Owner will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Design Professional.

1. Attendees: Authorized representatives of Owner, Contractor and its superintendent, and major subcontractors shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Owner's standard preconstruction agenda will be used.

3. Minutes: The Design Professional will be responsible for the meeting minutes and will record and distribute via the OMS.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Design Professional and Owner of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Sustainable design requirements.
    i. Review of mockups.
    j. Possible conflicts.
    k. Compatibility requirements.
    l. Time schedules.
    m. Weather limitations.
    n. Manufacturer's written instructions.
    o. Warranty requirements.
    p. Compatibility of materials.
    q. Acceptability of substrates.
    r. Temporary facilities and controls.
    s. Space and access limitations.
    t. Regulations of authorities having jurisdiction.
    u. Testing and inspecting requirements.
    v. Installation procedures.
    w. Coordination with other work.
    x. Required performance results.
    y. Protection of adjacent work.
    z. Protection of construction and personnel.

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

D. Construction Progress Meetings: The Contractor will conduct construction progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Agency, and Design Professional, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Status of sustainable design documentation.
        5) Deliveries.
        6) Off-site fabrication.
        7) Access.
        8) Site use.
        9) Temporary facilities and controls.
        10) Progress cleaning.
        11) Quality and work standards.
        12) Status of correction of deficient items.
        13) Field observations.
        14) Status of RFIs.
        15) Status of Proposal Requests.
        16) Pending changes.
        17) Status of Change Orders.
        18) As-Built Updates.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

4. Minutes: Contractor is responsible for conducting any construction progress meeting and will record and distribute the meeting minutes to each party present and to parties requiring information.

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

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

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

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

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Design Professional and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Design Professional.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.

11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Design Professional.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Design Professional on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Submittals:

1. Upload Submittals on Owners web-based management software (OMS). Contractor to initiate the process via “Construction Management”, then “Submittal” tab within the website.

E. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Software: Prepare submittals in PDF form, and upload to OMS. Enter required data in web-based software site to fully identify submittal.
2. Samples: Prepare submittals and deliver to Design Professional.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

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

1. Initial Review: Allow seven (7) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow seven (7) days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form as initial submittal.

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

F. Use for Construction: Retain complete copies of submittals on Project site, (as needed). Use only final action submittals that are marked with approval notation from Design Professional's action stamp.

1.6 SUBMITTAL REQUIREMENTS

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

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

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

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

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

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

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

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Transmittal: Upload PDF transmittal to the Owners web based management software under submittals. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Software: Prepare submittals in PDF form, and upload to Owners web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal including complete submittal information indicated for samples delivered to the Design Professional.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

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

a. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Design Professional **w**ill return submittal with options selected.

8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and

physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three (3) sets of Samples. Design Professional will retain 2 Sample sets; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least 3 of paired units that show approximate limits of variations.

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

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

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

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

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Design Professional.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, upload to the Owners web-based management software, shall be signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

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

2. Confirm plan review requirements with Division of Building Safety.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before uploading to the Owners web based management software.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp that is indicated on the web-based submittal. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Design Professional will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 DESIGN PROFESSIONAL'S REVIEW

A. Action Submittals: Design Professional will review each submittal, indicate corrections or revisions required-within the “Comment” box on the web site.

1. Submittals by Web-Based Project Software: Design Professional will indicate, on Project software website, the appropriate action.

a. Actions taken by indication on Project software website have the following meanings:

1) Approved, Pending, Overdue, Complete, or Rejected.

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

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

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be rejected for resubmittal without review.

E. Submittals not required by the Contract Documents will be returned by Design Professional without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

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

1. Activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Design Professional, or Owner, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

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

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

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

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

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

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

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 ACTION SUBMITTALS

A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.

1.6 INFORMATIONAL SUBMITTALS

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

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

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

B. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

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

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

1.8 REPORTS AND DOCUMENTS

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

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

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

1.9 QUALITY ASSURANCE

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

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

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

D. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services. These services, or special inspections, provided to the Owner are for the express purpose of meeting the testing requirements required under the authorities having jurisdiction and shall not in any way be considered to replace the Contractor’s responsibility for quality assurance and control for the project.

1. Contractor will coordinate and schedule all testing and special inspections with the Owner’s testing agency.
2. Under no circumstances will the Owner’s testing agency perform quality control or quality assurance work for the Contractor.
3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor**,** and the Contract Sum will be adjusted by Change Order.
4. Initial reports (handwritten as a minimum) will be given to the Contractor by the Owner’s testing Agency before leaving the site the day of the inspection.
5. Final reports will be issued later to the Contractor, Design Professional, and Owner.

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

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

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

3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

D. Testing Agency Responsibilities: Cooperate with Owner, Design Professional, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

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

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

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

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

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

2. Distribution: Distribute schedule to Owner, Design Professional, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

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

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Owner and Design Professional’s reference during normal working hours.

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to testing agencies.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines

2.1 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 INSTALLATION, GENERAL

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

3.3 TEMPORARY UTILITY INSTALLATION

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

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

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

G. Irrigation: Provide temporary irrigation to plants and trees affected by the project.

3.4 SUPPORT FACILITIES INSTALLATION

A. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

C. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

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

C. Temporary Erosion and Sedimentation Control: Comply with requirements of authorities having jurisdiction and requirements specified in Section 311000 "Site Clearing."

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

E. Site Enclosure Fence: Before construction operations begin and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As indicated on Drawings.

3.6 OPERATION, TERMINATION, AND REMOVAL

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

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

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

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

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Design Professional's Action: If necessary, Design Professional will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Design Professional will notify Contractor approval or rejection of proposed comparable product request within seven (7) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

    a. Form of Design Professional's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Design Professional does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

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

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

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

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Design Professional will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

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

    a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.

    a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: …"

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: …"

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.

    a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: …"

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics

that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

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

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Design Professional from manufacturer's full range" or similar phrase, select a product that complies with requirements. Design Professional will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

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

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

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

A. Certificates: Upload certificate signed by licensed surveyor certifying that location and elevation of improvements comply with requirements.

1.3 QUALITY ASSURANCE

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

1. Structural Elements: When cutting and patching structural elements, notify Design Professional of locations and details of cutting and await directions from Design Professional before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Design Professional's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
6. Dates: Indicate on the contractor’s schedule when cutting and patching will be performed.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

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

3.1 EXAMINATION

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

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

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

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Design Professional according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

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

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

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

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

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

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

3.4 FIELD ENGINEERING

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

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

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

C. Benchmarks: Two permanent benchmarks will be set on the Project site. Maintain benchmarks throughout project. Should benchmarks be disturbed, Contractor is responsible for reestablishing and resetting.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

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

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

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

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

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

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.

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

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

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

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

J. Remove and replace damaged, defective, or non-conforming Work.

3.6 CUTTING AND PATCHING

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

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

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

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

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

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

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

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

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

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

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

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

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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

3.7 AGENCY-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner’s and Agency construction personnel.

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

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

3.8 PROGRESS CLEANING

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

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

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

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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

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

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

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

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

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

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls and Section 017419 "Construction Waste Management and Disposal."

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

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

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

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

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

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

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

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

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

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including Fixed Price Construction Contract and other Division 01 Specification Sections, apply to this Section.

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

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

C. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at final completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Idaho Division of Public Works Close-Out requirements, including “Conditions Precedent to Final Payment” list. The “Project Finalization” form is required unless specifications indicate otherwise.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of seven (7) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including as-built documents which indicate any field revisions made to the construction documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number.
5. A final report of Special Inspections to be attached to the Substantial Completion. If no Special Inspections are required, Design Professional can initial as such on the Substantial Completion form.
6. Submit O&M Manuals for compliance with the contract documents.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of seven (7) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders, if required by Owner.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Design Professional will either proceed with inspection or notify Contractor of unfulfilled requirements. Design Professional will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Design Professional, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit final Application for Payment according to Section 012900 "Payment Procedures" via the OMS.
2. Certified List of Incomplete Items: Submit certified copy of Design Professional's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Design Professional. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Idaho Division of Public Works Close-Out requirements.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Design Professional will either proceed with inspection or notify Contractor of unfulfilled requirements. Design Professional will approve/initial punch list after inspection or will notify Contractor of construction that must be completed or corrected before final documents will be signed.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order.
2. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Design Professional will return annotated file.
b. PDF electronic file. Design Professional will return annotated file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Design Professional for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within ten (10) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

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

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by email to Design Professional.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations, as well as any damage to surrounding areas. Repair includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition before requesting inspection for determination of Substantial Completion.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

B. Repair, or remove and replace, defective construction.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

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

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Design Professional and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

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

1. Submit by email to Design Professional. Enable reviewer comments on draft submittals.
2. Submit three paper copies.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 7 (seven) days before commencing demonstration and training. Design Professional and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Design Professional's and Commissioning Authority's comments. Submit copies of each corrected manual within 14 days of receipt of Design Professional's and Commissioning Authority's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

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

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

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

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Design Professional.
8. Name and contact information for Commissioning Authority.

9. Names and contact information for major consultants to the Design Professional that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

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

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

1.5 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.

3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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

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

C. Descriptions: Include the following:

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

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

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

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

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

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

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

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

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

1.8 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

END OF SECTION 017823

SECTION 017839 – PROJECT AS-BUILT DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for as-built documents, including the following:

1. As-Built Drawings.
2. As-Built Specifications.
3. As-Built Product Data.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. As-Built Drawings: Comply with the following:
1. Number of Copies: Submit copies of as-built Drawings as follows:

a. Initial Submittal:

1) Submit 1 paper-copy set(s) of marked-up as-built prints.

b. Final Submittal:

1) Submit 3 paper-copy sets of marked-up as-built prints.

B. As-Built Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. As-Built Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where As-Built Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 AS-BUILT DRAWINGS

A. As-Built Prints: Maintain one set of marked-up paper or electronic copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

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

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

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

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

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

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up as-built prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on as-built prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.

b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "AS-BUILT DRAWING" in a prominent location.

1. As-built Prints: Organize as-built prints into manageable sets. If required, bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. As-Build Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "AS-BUILT DRAWINGS."
d. Name of Engineer.
e. Name of Contractor.

1.4 AS-BUILT SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as As-Built Product Data.

B. Format: Submit as-built Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.5 AS-BUILT PRODUCT DATA

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

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as As-Built Product Data.
5. Note related Change Orders[, as-built Product Data,] and as-built Drawings where applicable.

C. Format: Submit As-built Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include as-built Product Data directory organized by Specification Section number and title, electronically linked to each item of as-built Product Data.

1.6 MAINTENANCE OF AS-BUILT DOCUMENTS

A. Maintenance of As-Built Documents: Store as-built documents in the field office apart from the Contract Documents used for construction. Do not use project as-built documents for construction purposes. Maintain as-built documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project as-built documents for Engineer's reference during normal working hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

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

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

1.5 INSTRUCTION PROGRAM

A. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.

g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Systems and equipment operation manuals.
c. Systems and equipment maintenance manuals.
d. Product maintenance manuals.
e. Project Record Documents.
f. Identification systems.
g. Warranties and bonds.
h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

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

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

1. Schedule training with Owner through Engineer with at least ten (10) days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Cleanup: Collect used and leftover educational materials and remove from Project. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 02 41 00 – DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTIONS

A. Work under this Section includes providing selective demolition of part of the existing facility shown on the drawing and as specified herein.

B. Work under this Section also includes the potential for the existing structures to contain asbestos. Should asbestos be encountered, Contractor to immediately contact the Owner for testing and abatement per EPA.

1.2 SUBMITTALS

A. Contractor to submit a Demolition and Protection Plan, to be approved by the City of Pocatello, prior to commencement of any construction activities while successfully protecting and retaining project referenced structures adjacent and internal to the project. This should include descriptions and/or drawings of the following items, at a minimum.

1. Protect structures, such as signal light poles, pedestrian crosswalk posts, and electrical boxes, as they must remain operational during all construction activities.

2. Protect power and communication lines internal to the tunnel as they must remain in operational condition during construction.

3. Removal of piping, valves, cable trays, etc. within the tunnel.

4. Removal of existing tunnel structure.

1.3 CONDITION OF STRUCTURES

A. Owner assumes no responsibility for actual conditions of items or structures to be demolished. Conditions existing at time of commencement of contract will be the responsibility of the Contractor.

1.4 PROTECTION OF FACILITIES

A. Protect from damage existing finish work that is to remain in place that becomes exposed during demolition operations.

B. Protect adjacent areas with suitable coverings when necessary to prevent surface damage, including protecting existing concrete and asphalt surfaces from concrete staining.

C. Remove protections at completion of work.

1.5 ENVIRONMENTAL CONTROLS

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

1.6 ASBESTOS REQUIREMENTS

A. If asbestos is discovered during the demolition Work, immediately contact the Owner for testing and abatement.

B. The project includes structures with a potential for asbestos containing material (materials other than metal, glass, or PVC plastic). Comply with the following regulations:

1. (NESHAP Regulations 40 CFR 61

2. Toxic Substances Control Act – Asbestos 40 CFR 763

3. Asbestos Hazard Emergency Response Act (AHERA): Immediately contact Owner.

4. Relevant OSHA Standards

1.7 PERMITS

A. Obtain any permits for building, electrical, or plumbing demolition that may be required for the Work at no additional costs.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Clearing and grubbing shall extend to no more than 3 feet outside of the construction limits. The clearing and grubbing operation shall be conducted in a manner which will not damage any vegetation outside of the clearing and grubbing limits. All brush, roots, and other debris within the grubbing limits shall be removed to a depth of 6". Completely remove stumps and other debris protruding through the subgrade surface. The Contractor shall chop all brush and debris resulting from the Clearing and Grubbing operation and haul to a disposal site located by the Contractor off-site. Burning of debris on-site will not be allowed.

3.2 STRIPPING

A. Areas within the limits of the project shall be stripped to remove topsoil containing organic material before construction begins over such areas. The topsoil shall not be used in

construction of onsite fills or trench backfills. The topsoil shall be hauled to a disposal site located by the Contractor off-site.

3.3 TREE REMOVAL

A. Trees shall be removed to their entirety from the site. This includes all branches, limbs, trunks, roots, and debris. Upon removal of the main root ball, a tree killer/sterilant shall be applied to any remaining root systems prior to backfill.

B. Backfill of tree root shall be in maximum 6" lifts to minimize potential for excessive settlement. The backfilled area shall be over-filled by 1-2 inches to allow for settlement.

3.4 INSPECTION

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions of surrounding area that could be misconstrued as damage resulting from selective demolition work.

3.5 PREPARATION

A. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of adjacent facilities to remain.

B. Cease operations immediately if safety of structure or existing facility appears to be endangered. Take precautions to support structure/facilities until determination is made for continuing operations.

3.6 DEMOLITION

A. Demolish concrete flatwork only in areas shown on the drawings to be removed. However, the exact location may be adjusted in the field if required to avoid existing obstacles.

1. The line to be cut shall be marked on the surface along a string-line or straight edge with a marker that will not wash away from the action of the saw's cooling water. All cutting lines shall be marked along straight line prior to cutting.

2. Furnish and operate a power drive, self-propelled wheel mounted pavement sawing machine. The saw blade shall be either a wet cutting or dry cutting type. The depth of the saw shall be controlled by graduated positions set on the machine.

3. Concrete and asphalt slabs shall be cut by saw cutting the slab to full slab depth with one pass of the saw following exactly along the marked cutting line.

B. Where large power driven saws cannot be operated close enough to the end of the slab to completely cut it (i.e. at an abutting wall or foundation) use power driven impact tools and grinders to remove the slab and form a smooth neat joint.

C. Where slab thicknesses exceed the maximum depth of the cutting machine, cut a line as deep as possible with the machine and use power driven impact tolls and grinders to remove the slab and form a smooth neat joint.

D. Remove all foundations shown to be removed. Do not bury unless authorized by the Engineer at the time of demolition.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubble and other materials resulting from demolition work. Haul all materials from demolition to a disposal site obtained by the Contractor.

3.8 CLEANUP AND REPAIR

A. Upon completion of demolition work, remove tools, equipment, and demolished materials from site.

3.9 REPAIR

A. Repair demolition performed in excess of that required. Return structures and surfaces to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02 41 00

SECTION 03 11 00 – CONCRETE FORMING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, and equipment as required for forming cast-in-place concrete, including necessary shoring, bracing, and anchorage.

B. Construct openings in formwork as required for other related work.

C. Provide and install all form accessories such as snap ties, bracing, etc.

D. Stripping of forms from finished concrete.

1.2 QUALITY ASSURANCE

A. The Contractor is responsible for the design and adequacy of formwork and shoring.

B. Submit concrete form designs for review for all forming where the height of the concrete work exceeds four feet. Submit shoring designs for all concrete work where shoring is required.

1. Design and provide forms for pressure resulting from placement of concrete and construction loads while maintaining the specified tolerances.

2. Forming shall have sufficient strength to support loads, lateral pressure, and allowable stresses outlined in ACI 347 and for design considerations including wind load, temporary construction load and construction equipment loads.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Smooth Forms: Pre-manufactured forms or job fabricated forms using plyform faced with material which will produce smooth, hard, uniform texture on concrete.

1. Arrange facing materials orderly and symmetrical, keeping number of seams to a practical minimum.

2. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surfaces.

B. Forming accessories:

1. Do not use nonfabricated wire.

2. Use form ties constructed so that ends or end fasteners can be removed without causing appreciable spalling of concrete faces.

3. After ends or end fasteners of form ties have been removed, embedded portion of ties to terminate not less than two diameters from formed faces of concrete, but in no case less than 3/4-inch.

4. When formed face of concrete is not to be permanently exposed to view, form ties may be cut off flush with formed surfaces.

5. Use ties with 3/4-inch diameter cones and a 1-1/2-inch break back on both ends for water retaining structures. Ties are to be furnished with a water seal or stop.

6. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

7. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made for the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A58 Sure Plug as manufactured by Dayton Superior.

8. Form ties which remain in the corewall of water-retaining structures shall have waterstops and a one-inch minimum breakback or cone depth.

C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

D. Fillets for Chamfered Corners: Wood or plastic strips attached to the inside of forms.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork. Ensure dimensions agree with the Drawings.

3.2 CONSTRUCTION

A. Make forms sufficiently tight to prevent loss of cement paste.

B. Place chamfer strips in corners of forms to produce beveled edges on permanently exposed surfaces.

1. Interior corners on such surfaces and edges of formed joints will not require beveling.

C. To maintain specified finish tolerances, chamfer formwork to compensate for anticipated deflections.

D. Provide positive means of adjustment using wedges or jacks, or shores and struts, and take up all settlement during concrete placing operation.

E. Securely brace forms against lateral deflection.

F. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

G. At construction joints, overlap forms over hardened concrete at least 6 inches. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.

H. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

I. Anchor formwork to shores or other supporting surfaces or members so that upward or lateral movement of any part of formwork system is prevented during concrete placement.

J. Position expansion joint material and other embedded items accurately and support against displacement.

K. The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for Work embedded in or passing through concrete.

B. Coordinate Work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install accessories in accordance with manufacturer's instructions, level and plumb with templates where necessary. Ensure items are not disturbed during concrete placement.

3.4 FORM FINISHES

A. Use smooth forms for natural plywood, grout cleaned, smooth rubbed, scrubbed, or sand floated finishes.

1. Fabricate true-to-line in order that surfaces produced will require little dressing to arrive at true surfaces.

2. Where an as-cast finish is required, no dressing shall be permitted in the finishing operation.

B. Install form panels in orderly arrangement with joints planned in approved relation to building elements.

3.5 FORM COATING

A. Unless otherwise specified or approved, treat surfaces of forms.

B. Cover surfaces of forms with form coating to aid in removal of forms with minimal damage to concrete.

3.6 REMOVAL OF FORMS

A. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

B. Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength as determined by test cylinders.

C. Where reshoring is planned, supporting formwork may be removed when concrete has reached 70 percent of specified strength as determined by test cylinders, provided reshoring is installed immediately.

D. When shores and other vertical supports are so arranged that non-load carrying, form-facing material may be removed without loosening or disturbing shores and supports, facing material may be removed at an earlier age as permitted. Forms may not be removed prior to 24 hours after placement of concrete.

3.7 RESHORING

A. Design, engineering, and construction of reshoring is the responsibility of the Contractor.

B. While reshoring is under way, allow no live load on new construction.

C. During reshoring do not subject concrete in beam, slab, column, or any other structural member to combined dead and construction loads in excess of loads permitted by Engineer for developed concrete strength at time of reshoring.

D. Place reshores as soon as practicable after stripping operations are complete, but in no case later than end of working day on which stripping occurs.

E. Tighten reshores to carry required loads without over stressing.

F. Leave reshores in place until tests representative of concrete being supported have reached specified strength.

G. For floors supporting shores under newly placed concrete, level original supporting shore in place or reshore.

3.8 REUSE OF FORMS

A. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface.

B. Thoroughly clean and properly coat forms before reuse.

END OF SECTION 03 11 00

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and place reinforcing steel and reinforcing steel accessories in accordance with the drawings and as specified herein.

1.2 REFERENCE STANDARDS

A. ACI 318 – Building Code Requirements for Structural Concrete and Commentary

B. ACI SP-66 – ACI Detailing Manual

C. ASTM A615 – Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

D. ASTM A706 – Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

E. ASTM A996 – Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

F. ASTM A1064 – Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

G. AWS D1.4 – Structural Welding Code – Reinforcing Steel

H. CRSI (DA4) – Manual of Standard Practice

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Indicate bar schedules, sizes, spacings, locations and quantities of reinforcing steel, shapes of bent bars, wire fabric, bending and cutting schedules, splicing locations, stirrup spacing, supporting, and spacing devices.

C. Manufacturer’s Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Welder’s Certificates: Submit certifications for welders employed on the project, verifying AWS qualification withing the previous 12 months.

E. Reports: Submit certified copies of mill test report of supplied reinforcement materials analysis indicating physical and chemical analysis

1.4 QUALITY ASSURANCE

A. Fabrication tolerances:

1.	Sheared length	± 1 inch
2.	Overall for stirrups, ties, and spirals	± 1/2 inch
3.	All other bends	± 1 inch

B. Placement tolerance:

1.	Spacing	1/4 inch
2.	Clear distance	+ 1/4 inch
3.	Lengthwise location	2 inches

C. Submit shop fabrication drawings of reinforcement prior to placing concrete.

D. Perform work of this section in accordance with ACI 315 and ACI 318.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code – Reinforcing Steel".

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish steel reinforcing bars of the type and grade as shown on the contract drawings conforming to the following steel reinforcing bars specifications. If bar type and grade are not shown on the drawings, furnish bars conforming to paragraph B below.

B. Reinforcing Steel Bars: ASTM A615, Grade 60 billet-steel deformed bars, uncoated as shown on the plans.

C. Welded Steel Wire Fabric: ASTM A1064 plain type; in flat sheets or coiled rolls uncoated finish as shown on the plans.

D. Low Alloy Reinforcing Steel Bars: ASTM A706, Grade 60 low alloy steel deformed bars, uncoated as shown on the plans.

E. Smooth dowel bars for construction joints: ASTM A29, Grade 60.

1. Where indicated, provide metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section.

2. Provide for movement which equals joint width plus one-half inch.

F. Corrosion Resistant Steel Bars: ASTM A1035-16b, Low Carbon Chromium Steel Reinforcing Bars.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gauge annealed type.

B. Chairs, Bolster, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.3 FABRICATION

A. Fabricate reinforcement in accordance with ACI 315 and CRSI (DA4) – Manual of Standard Practice.

B. Locate reinforcing splices only where shown on the drawings. Indicate location of splices on shop drawings.

C. Weld reinforcing bars only where shown on the drawings. Furnish ASTM A706 reinforcing steel only where welding is required. Weld reinforcing bars in accordance with AWS D1.4.

PART 3 - EXECUTION

3.1 GENERAL

A. Clean reinforcement of loose or thick rust and mill scale, dirt, paint, oil, grease, earth, ice, and other foreign materials that would reduce bond to concrete.

B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

C. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.2 PLACING

A. Place all reinforcement in the exact position shown on the plans and approved shop drawings and secure in position during the placing and compacting of concrete. Wire bars together with No. 16 gauge wire with ties at all intersections except where spacing is less than 12 inches in each direction, in which case tie alternate intersections.

B. Maintain the distance from the forms and between layers of reinforcement by means of prefabricated chairs, precast mortar blocks, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the Work must be approved by the Engineer before any concrete is deposited in the section.

C. Do not tack weld reinforcing bars.

D. Overlap sheets of metal mesh 1 square plus 6 inches to maintain a uniform strength, and securely fasten at the ends and edges, and support to maintain clearances.

E. Support reinforcing steel for formed floor slabs on metal chairs or slab bolsters. Size chairs or bolsters to position the steel in the exact location shown on the plans. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 5 feet on centers in each direction. Plastic coat the portion of the metal support in contact with the forms to prevent rust. Tie down deck steel to beams or forms at regular intervals of not more than 5 feet on centers along the beams to prevent movement of the steel during placing of the concrete.

3.3 SPLICING

A. Furnish all reinforcement in the full lengths indicated on the plans unless otherwise permitted. Splicing of bars, except where shown on the plans, not permitted without written approval from the Engineer. Stagger splices as far as possible.

B. Do not use lap splices on No. 14 and 18 bars.

C. Weld reinforcing steel only if detailed on the drawings

D. Do not bend reinforcement after embedding in hardened concrete.

E. Do not extend bars continuously through any expansion joint except expansion dowels.

3.4 FIELD QUALITIY CONTROL

A. An independent testing agency, as specified in the specifications, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, and equipment required for the construction of cast-in-place concrete as shown on the drawings and as specified herein.

1.2 DEFINITIONS

A. Cold Weather: When ambient temperature is below 40 degrees Fahrenheit or is approaching 40 degrees Fahrenheit and falling.

B. Contractor's Licensed Design Engineer: Individual representing Contractor who is licensed to practice engineering as defined by statutory requirements of professional licensing laws in state or jurisdiction in which Project is to be constructed.

C. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than ¾-inch in diameter, cracks in liquid containment structures and below grade habitable spaces that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.

D. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained.

E. Hot Weather: As defined in ACI 305.1.

F. Hydraulic Structure: Liquid containment structure.

G. New Concrete: Less than 60 days old.

H. Slurry Mixture: Mixture of sand, 3/8-inch maximum nominal aggregate size, cement, and water for wall construction joints with waterstop.

1.3 REFERENCE SPECIFICATIONS

A. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

B. ACI 301 – Specifications for Structural Concrete

C. ACI 302.1R – Guide for Concrete Floor and Slab Construction

D. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete

E. ACI 305R – Guide to Hot Weather Concreting

F. ACI 306R – Cold Weather Concreting

G. ACI 308R – Guide to Curing Concrete

H. ACI 318 – Building Code Requirements for Structural Concrete and Commentary

I. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

J. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

K. ASTM C94 – Specification for Ready-Mixed Concrete

L. ATM C109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch Cube Specimens)

M. ASTM C143 – Standard Test Method for Slump of Hydraulic Cement Concrete

N. ASTM C150 – Specification for Portland Cement

O. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete

P. ASTM C171 – Specification for Sheet Materials for Curing Concrete

Q. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete

R. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

S. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete

T. ASTM C309 – Specification for Liquid Membrane-Forming Compounds for Curing Concrete

U. ASTM C494 – Specification for Chemical Admixtures for Concrete

V. ASTM C618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

W. ASTM C881 – Specification for Epoxy-Resin-Base Bonding Systems for Concrete

X. ASTM C1059 – Specification for Latex Agents for Bonding Fresh to Hardened Concrete

Y. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete

Z. ASTM C1107 – Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink)

AA. ASTM C1240 – Specification for Silica Fume Used in Cementitious Mixtures

BB. ASTM C1315 – Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

CC. ASTM C1602 – Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

DD. ASTM D1751 – Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

EE. ASTM E1155 – Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers

FF. ASTM E1643 – Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

GG. ASTM E1745 – Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

HH. IBC – International Building Code

1.4 JOB CONDITIONS

A. In hot and cold weather, comply with the requirements of ACI 305 and 306.

B. Do not place concrete on frozen ground.

C. Unless adequate protection is provided, do not place concrete during rain, sleet, or snow.

D. Do not allow rainwater to increase mixing water or damage surface finish.

1.5 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Mix Design: Submit mix design to be used for each class of concrete.

1. Submit location of materials source, admixtures to be used, and other related data

2. Submit test reports showing suitability of aggregates used in concrete mixes.

3. Test results of successful ASR mitigation using ASTM C1567.

C. Detailed plan for curing and protection of concrete: Detailed plan for curing and protection of concrete placed and cured in cold weather. Plan shall include, but not be limited to, the following:

1. Procedures for protecting sub grade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.

2. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.

3. Methods for temperature protection during placement.

4. Types of covering, insulation, housing, or heating to be provided.

5. Curing methods to be used during and following protection period.

6. Use of strength accelerating admixtures.

7. Methods for verification of in-place strength.

8. Procedures for measuring and recording concrete temperatures.

9. Procedures for preventing drying during dry, windy conditions.

D. Detailed plan for hot weather placements including curing and protection for concrete placed and cured in hot weather. Plan shall include, but not be limited to, the following:

1. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.

2. Use of retarding admixture.

3. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.

4. Types of shading and wind protection to be provided.

5. Curing methods, including use of evaporation retardant.

6. Procedures for measuring and recording concrete temperatures.

7. Procedures for preventing drying during dry, windy conditions.

E. Informational Submittals:

1. Preinstallation Conference minutes.

2. Manufacturer's application instructions for bonding agent and bond breaker.

3. Manufacturer's Certificate of Compliance to specified standards:

a. Bonding agent.

b. Bond breaker.

4. Statement of Qualification:

   a. Batch Plant: Certification as specified herein.

   b. Mix designer.

   c. Installer.

   d. Testing agency.

5. Field test reports.

6. Recorded temperature data from concrete placement where specified.

7. Tightness test results.

8. Concrete Delivery Tickets:

   a. For each batch of concrete before unloading at Site.

   b. In accordance with ASTM C94, including requirements 14.2.1. through 14.2.10.

   c. Indicate amount of mixing water withheld and maximum amount that may be permitted to be added at Site.

1.6 QUALITY ASSURANCE

A. Concrete construction shall conform to requirements of ACI 117 and ACI 301 except as modified herein.

B. Qualifications:

1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.

2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.

3. Testing Agency: Unless otherwise permitted, an independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

   a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-l or an equivalent certification program.

   b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician

- Grade 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician – Grade II.

C. Preinstallation Conference:

1. Required Meeting Attendees:

a. Contractor, including pumping, placing and finishing, and curing subcontractors.

b. Ready-mix producer.

c. Admixture representative.

d. Testing and sampling personnel.

e. Engineer who authored Statement of Special Inspection Plan or Engineer's designee.

2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.

3. Agenda shall include:

a. Admixture types, dosage, performance, and redosing at Site.

b. Mix designs, test of mixes, and Submittals.

c. Placement methods, techniques, equipment, consolidation, and form pressures.

d. Slump and placement time to maintain slump.

e. Finish, curing, and water retention.

f. Thermal control plan.

g. Protection procedures for weather conditions.

h. Other specified requirements requiring coordination.

4. Conference minutes as specified in Section 01 31 19 - Project Meetings.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: Use Portland cement conforming to the requirements of ASTM C150 Type II for low alkali cement.

B. General Admixtures: Admixtures, other than air-entraining agents, may be used when the type and amount to be used are approved. Calcium chloride will not be allowed as an admixture.

C. Air-Entraining Agents: Use air-entraining agents to the requirements of ASTM C260 added to the mixing water.

D. Water Reducing Agents: Water reducing or water reducing and retarding admixtures may be used to increase workability of the concrete when approved by the Engineer. Use only admixtures produced by a company approved by the Engineer. Use water reducing admixtures conforming to ASTM C494.

E. High Range Water Reducer: Conforming to ASTM C494, Type F or G. The preferred admixture shall be free of chlorides and alkalines. A second-generation-type high-range water reducer shall be Type G and be batch-plant-added.

F. Water: Use potable water for mixing concrete.

G. Coarse Aggregate: Use coarse aggregate that consists of gravel, crushed slag, crushed stone or other approved inert materials, composed of hard, strong and durable particles, free of injurious coatings, and conforming to the requirements of ASTM C33, except as modified herein.

1. Use only aggregates that include deleterious substances not exceeding the following:

	Percent Passing (by weight)
Soft Fragments	0.20
Coal and Lignite	0.30
Clay Lumps	0.30
Other Deleterious Substances	2.00
Minus 200 Material	1.75

2. Use coarse aggregate meeting the following gradations when tested in accordance to the requirements of ASTM C136.

	Percent Passing (by weight)				
Coarse Aggregate Size	1"	3/4”	3/8"	No. 4	No. 8
3/4” to No. 4	100	90-100	20-55	1-10	0-5

H. Fine Aggregate: Use aggregate of natural sand or other approved inert materials composed of hard, strong, and durable particles conforming to the requirements of ASTM C33 except as modified herein.

1. Use only aggregates that include deleterious substances not exceeding the following:

	Percent (by weight)
Clay Lumps	0.50
Coal and Lignite	0.30
Other Deleterious Substances	2.00
Minus 200 Material	1.75

2. Moisture content of fine aggregate shall not exceed 8 percent.

3. Use fine aggregate that is uniformly graded from coarse to fine within the following gradation, when tested in accordance to the requirements of ASTM C136.

Sieve Size	Percent Passing (by weight)
3/8"	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

I. Curing Compounds: Use curing compounds that meet the requirements of ASTM C309.

J. Chemical Hardener:

1. Colorless, aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent.

2. Not less than 2 pounds fluosilicate per gallon.

3. Provide materials which do not react with, inhibit, or otherwise interfere with adhesives and bonding of future floor finishes.

4. Acceptable Products: L&M Chem-Hard by Laticrete; MasterKure HD 300WB by BASF, or approved alternate.

K. Concrete Sealer: Concrete sealer is intended to be used on concrete slabs to prevent dusting and staining. The products listed are not intended to be used as curing compounds or for sealing the slab against water leakage.

1. Manufacturers: One of the following or equal:

   a. Euco Diamond Hard by Euclid Chemical

   b. L&M Seal Hard by Laticrete

L. Waterproofing Admixture: Xypex Admix C-500, MasterLife 300 Series, ADI-CON CW PLUS or Barrier One CSX Extreme Water Proofing Admixture for tunnel footings, walls, slabs, and roof.

M. Waterstops and Joint Fillers:

1. Expansive Water Stop: Expansive waterstop shall be a bentonite/butyl rubber based waterstop that expands on exposure to water. It shall be applied in accordance with manufacturer's recommendations.

2. Joint Filler: Semi-rigid, closed-cell polypropylene or polyethylene foam expansion joint filler that meets ASTM test method D545 for compression recovery and water absorption. Joint filler cannot absorb water, swell or disintegrate.

2.2 PROPORTIONING

A. In proportioning materials for mixing, use certified scales. Do not use volume measurement except for water and liquid admixtures.

B. Proportion the materials to produce concrete having the following properties or limitations:

Property of Mix	5,000 psi Concrete	4,000 psi Concrete	3,000 psi Concrete
Minimum Compressive Strength (at 28 day test) fc (pounds per square inch)	5,000	4,000	3,000
Minimum Compressive Strength (at 7 day test) (pounds per square inch)	2,800	2,600	1,800
Maximum Water Cement Ratio (by weight)	0.40	0.44	0.42
Min. Cement Content (94 pound sacks of cement per cubic yard of concrete)	6.5 sacks	6 sacks	5 sacks
Entrained Air Content (percent by volume)	6 ± 1	6.5 ± 1	5 ± 1
Slump Range (inches)	2-4	2-4	2-5

A. Fly ash may be used to replace a portion of the Portland cement in the concrete mix. The fly ash used shall not exceed 25 percent of the total cement material in the mix. The cement material in the mix includes both Portland cement and fly ash. Fly ash shall be Class F conforming to AASHTO M 295 with the additional requirement that the available alkalis in the fly ash shall not exceed 2 percent.

B. The proposed aggregate for the mix shall be tested for expansion and Alkali-Silica Reaction (ASR) in accordance with AASHTO T 303. Where testing indicates aggregates are reactive, the Contractor shall use fly ash, lithium compound admixtures or both to produce a concrete mix that successfully mitigates ASR. Contractor shall provide test results of successful mitigation using ASTM C1567, with results showing a linear expansion at 14 days not exceeding 0.10 percent when tested.

2.3 READY MIX CONCRETE

A. Ready-mixed concrete shall conform to the provisions in AASHTO M157 regarding batching, mixers and agitators, mixing and delivery, inspection, consistency and air content, and certification of batches.

2.4 GROUT

A. Where grout is shown for leveling, concrete (at least 3,000 pounds per square inch) shall be used.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.

2. Laminated, reinforced 10 mil vapor barrier. Permeance of 0.025 per ASTM F1249.

3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

4. Manufacturers, or Approved Equal:

a. Fortifiber Building Systems Group; Moistop Ultra 10: www.fortifiber.com/#sle.

b. ISI Building Products; Viper VaporCheck II 10-mil (Class-A): www.isibp.com/#sle.

c. Stego Industries, LLC; Stego Wrap, Class A: www.stegoindustries.com/#sle.

d. W.R. Meadows, Inc; PERMINATOR Class A – 10 mils: www.wrmeadows.com/#sle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify lines, levels, and dimensions before proceeding with Work of this section.

B. Coordinate placement of embedded items with erection of concrete formwork and placement form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

2. Use latex bonding agent only for non-load-bearing applications.

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

3.2 CONVEYING

A. Handle concrete from mixer to location of final placing as rapidly as practicable by methods which prevent segregation or loss of ingredients and assure that quality is maintained.

B. Use only equipment conforming to ASTM C94.

C. Use only approved pumping equipment that is rated for the lift and the capacity required for placement.

1. Control pneumatic placement to prevent segregation.

2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches.

3. Do not use aluminum or aluminum alloy pipes.

3.3 PLACING CONCRETE

A. Notify Engineer not less than 24 hours prior to commencement of placement operations.

B. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

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

D. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer. Where approved, record the amount of water added on site and provide with the special inspection reports.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Place concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section.

1. If a section cannot be placed continuously, locate construction joints as indicated, or as approved by the Engineer.

2. If not indicated, locate construction joints not over 20 feet on center.

3. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.

4. Limit size of each placement to allow for strength gain and volume change as a result of shrinkage.

5. Make lifts not over 24 inches.

6. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.

7. Remove temporary spreaders in forms where concrete placing has reached an elevation rendering their service unnecessary.

8. Temporary spreaders may remain embedded in the concrete only if made of metal or concrete, and if prior approval has been obtained.

9. Do not allow concrete to fall over 6 feet, except when starting a wall pour. Do not drop concrete over 24 inches when starting a wall pour.

10. Joints in Footings and Slabs:

a. Ensure space beneath plastic waterstop is completely filled with concrete.

b. During concrete placement make visual inspection of entire waterstop area.

c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, and place remaining concrete to full height of slab.

d. Apply procedure to full length of waterstop.

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

G. Control placement to prevent segregation.

H. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.

2. Minimum Pump Hose (Conduit) Diameter: 4 inches.

3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

I. Minimum Time between Adjacent Placements:

1. Construction or Control Joints: 7 days unless otherwise specified.

2. Construction joint between top of footing or slab, and column or wall: As soon as can safely be done without damaging previously cast concrete or interrupting curing thereof, but not less than 24 hours.

3. Expansion or Contraction Joints: 1 day.

4. For columns and walls with a height in excess of 10 feet, wait at least 2 hours before depositing concrete in beams, girders, or slabs supported thereon.

5. For columns and walls 10 feet in height or less, wait at least 1 hour prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.

J. Hot Weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:

a. Maintain concrete temperature below 90 degrees Fahrenheit at time of placement, or furnish test data or other proof that admixtures and mix ingredients· do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.

b. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.

K. Cold Weather Placement:

1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:

    a. Cold weather requirements shall apply when ambient temperature is below 40 degrees Fahrenheit or approaching 40 degrees Fahrenheit and falling.

    b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.

    c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees Fahrenheit; requirement is applicable to all surfaces including reinforcement and other embedded items.

    d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.

    e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.

        1) Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 pounds per square inch or design compressive strength if less than 3,500 pounds per square inch.

2. Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during specified curing period.

3.4 CONSOLIDATION

A. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items, and into corners of forms to eliminate air or stone pockets.

B. Use internal vibrators with minimum frequency of 8,000 vibrations per minute. Do not use “jitterbugs” or similar devices.

C. Do not use vibrators to transport concrete.

D. Insert vibrators approximately 18 inches apart. Leave in long enough to consolidate concrete without segregation; generally, from 5 to 15 seconds maximum. Insert vibrator through new lift into previous lift to ensure good bond between lifts.

E. Keep spare vibrator available during concrete operations.

F. Vibrate concrete in vicinity of joints to obtain impervious concrete.

G. Where concrete is to have an as-cast or smooth-rubbed finish, bring a full surface of mortar against form by vibration process, supplemented if necessary, by spading, to work coarse aggregate back from formed surface.

3.5 CONSTRUCTION JOINTS

A. Locate construction joints, if not indicated, so as to least impair strength of structure, subject to Engineer approval.

1. In general, locate near middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point. In this case, offset joint in girder a distance equal to twice the width of the beam.

2. Locate joints in walls and columns at underside of floors, slabs, beams or girders, and at tops of footings or floor slabs.

3. Place beams, girders, brackets, column capitals, haunches, drop panels, and slabs concurrently.

4. Make joints perpendicular to main reinforcement.

B. Continue reinforcement across joints.

1. Provide keys and inclined dowels as directed by Engineer.

2. Provide longitudinal keys at least 1-1/2 inches deep in all joints in walls and between walls and slabs or footings.

C. Clean concrete surface at joints.

D. Remove all laitance prior to placing adjoining concrete.

E. When required, obtain bond by one of the following:

1. Use of an approved adhesive.

2. Use of an approved chemical retarder which delays setting of surface mortar. Remove retarded mortar within 24 hours after placing to produce a clean, exposed aggregate bonding surface.

3. Roughen surface of concrete in an approved manner which will expose aggregate uniformly.

F. Dampen, but do not saturate, hardened concrete at construction joints, joints between footings and walls or columns, between walls or columns and beams or floors they support, joints in unexposed walls and all others not mentioned below immediately prior to placing fresh concrete.

G. Dampen, but do not saturate hardened concrete at joints in exposed Work; joints in middle of beams, girders, hoists, and slabs; and joints in Work designed to contain liquids.

1. Thoroughly cover with a coat of cement grout of similar proportions to mortar in concrete.

2. Use grout as thick as possible on vertical surfaces and at least 1/2 inch thick on horizontal surfaces.

3. Place fresh concrete before grout has attained its initial set.

H. Prepare joints receiving an adhesive and apply adhesive in accordance with manufacturer's recommendations prior to placing of fresh concrete.

I. Prior to placing of fresh concrete, prepare surfaces of joints which have been treated with a chemical retarder in accordance with manufacturer's recommendations.

3.6 BLOCKOUTS FOR PIPE AND CONDUIT

A. Where pipe or conduit passes into or through concrete walls, floors, or roof slabs, the Contractor may, to facilitate proper alignment, leave holes through the concrete and pour the concrete opening after the pipe or conduit is in place. The size of such openings shall be 2 inches larger than the outside diameter of the bell, flange, or coupling, and shall conform to the special details for pipe openings shown on the plans. When the piping or conduit is entirely placed and securely anchored, the concrete openings through the walls will be poured in accordance with the requirements for bonding new concrete to old as set forth herein. Concrete used to pour these openings shall consist of 1 part cement, 1 part fine aggregate, 1 part non-shrinking aggregate, and 1-1/2 parts coarse aggregate of maximum size of 1/2 inch when the concrete is part of a basin which must hold liquids. Otherwise, the non-shrinking aggregate in these proportions shall be replaced by fine aggregate. Concrete poured in these openings shall be thoroughly vibrated or rodded to insure a watertight joint between the new and old concrete and the new concrete and the pipe or conduit. The form for the closure shall be constructed with a pouring funnel. A plug of concrete shall be left in the pouring funnel. After the concrete has taken its initial set, the plug shall be removed and the exposed, broken face ground smooth. Pouring of blockout holes shall be done from the pressure side whenever possible. Such joints shall be thoroughly cured by keeping them constantly wet for not less than 7 days.

B. Where approved by the Engineer, blockout holes may be dry packed using non-shrink grout for basins which must hold liquid, and normal grout in other places. Only sufficient water shall be added to make a dry, crumbling mass. When the mixture is pressed tightly together into a ball with the hands, there should not be sufficient water in the mixture to stain the hands, and when such a ball is broken, it should crumble. This mixture shall be tamped or rodded solidly into the space, preferably from the pressure side. A backing board or stop shall be provided at the back side of this space against which the mixture can be tamped. Curing shall be specified as above.

3.7 GROUTING MACHINERY FOUNDATIONS

A. Where machinery is to be secured by anchor bolts set in concrete and supported on foundations which are to be grouted in place, the original concrete pour shall be blocked out or finished off a sufficient distance below the bottom of the machinery foundation to provide for the thickness of grout specified on the plans. After the machinery has been set

in position and wedged to the proper elevation by steel wedges, the space between the bottom of the machinery foundation and the original pour of concrete shall be caulked with a dry-tamped in mixture of non-shrink grout. When the mixture is pressed tightly together into a ball with the hands, there should not be sufficient water in the mixture to stain the hands; and when such ball is broken, it should crumble. This dry mixture shall be tamped or rodded solidly into the space between the machinery foundations and the original concrete. A backing board or stop shall be provided at the back side of this space against which the dry mixture can be tamped.

3.8 PLACING SLABS

A. Preparation of sub-grade for Slabs on Grade:

1. At a minimum, place 6 inches of gravel material and compact to 95 percent of the laboratory maximum density per ASTM D1557. Reference the geotechnical report for all recommendations.

2. Keep subgrade free of frost.

3. If temperature where concrete is to be placed is below freezing, enclose, heat, and maintain temperature above 50 degrees Fahrenheit, long enough to remove all frost from subgrade.

4. Keep subgrade moist at time of concreting. If necessary, dampen with water in advance of concreting. Allow no free-standing water or muddy or soft spots when concrete is placed.

B. Locate Joints in Slabs as Indicated:

1. If saw-cut joints in slabs on grade are required or permitted, time cutting to eliminate raveling during sawing and before shrinkage cracks develop.

2. Cut as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.

3. Compact before shrinkage stresses become sufficient to produce cracking.

C. Thoroughly Consolidate Concrete in Slabs:

1. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

3.9 PATCHING

A. Repair surface defects immediately after form removal. Coat all repaired areas with grey Sikagard 62.

B. Fill and finish tie holds with non-shrink grout and coat with grey Sikagard 62.

C. Repair defective areas.

1. Use of plaster coat embeco or calcium chloride is prohibited.

2. Remove honeycomb and defective concrete down to sound concrete.

3. Make edges perpendicular to surface or slightly undercut.

4. Featheredges are not permitted.

5. Dampen area to be patched and at least 6 inches surrounding it to prevent absorption of patching mortar water.

6. Prepare bonding grout of approximately 1 part cement to 1 part fine sand passing a No. 30 sieve.

D. Make patching mixture of same materials and of approximately same proportions as used for concrete, except omit coarse aggregate.

1. Mortar: 1 part cement to 2 parts sand by damp loose volume.

2. Mix white and gray Portland cement as required to match surrounding concrete.

3. Keep mixing water to a minimum.

4. Mix patching mortar in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.

E. After surface water has evaporated from patch area, brush bond coat into surface.

1. When bond coat begins to lose water sheen, apply patching mortar.

2. Thoroughly consolidate mortar into place and strike-off so as to leave patch slightly higher than surrounding surface.

3. Leave undisturbed for at least 1 hour before final finish.

4. Keep patched area damp for 7 days.

5. Do not use metal tools in finishing an exposed patch.

F. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable by Engineer.

G. Tie Holes: After being cleaned and thoroughly dampened, fill tie holes solid with non-shrink grout and coat with Sikagard 62. Round tie holes less than 1/4 inch diameter by 1-1/2 inch deep in rough form finished surfaces need not be filled.

H. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to a depth of 1 inch and then cutting or removing metal object. Repair chipped out concrete as specified for defective areas.

3.10 SLAB FINISHES

A. Float Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, and surface has stiffness sufficient to permit operation. Re-float slab immediately to a uniform sandy texture.

B. Troweled Finish: Float finish surface first. Power or hand trowel to produce smooth surface relatively free of defects, but which may still show some trowel marks. Final trowel when a ringing sound is produced as trowel is moved over surface. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.

C. Broom Finish: Immediately after concrete has been floated, apply coarse transverse scored texture by drawing broom or burlap belt across surface.

D. "Dry Shake" Finish: Give surface a float finish. Apply mineral aggregate with Portland cement in proportions recommended by manufacturer of aggregate. Begin floating immediately after application of “dry shake."

E. Nonslip Finish: Give surface a "dry shake" application, as specified above, using crushed ceramically bonded aluminum oxide particles. Apply at 25 pounds per 100 square feet.

F. Exposed Aggregate Finish: Immediately after the surface of the concrete has been leveled to tolerance and surface water has disappeared, spread aggregate of the color and size selected by the Engineer uniformly over surface to provide complete coverage to the depth of a single stone. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance. Flow water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.

G. Slab Finish Schedule: The slab finishes are shown on the drawings. Where finishes of slabs are not shown, provide broom finish on exterior slabs and trowel finish on interior slabs.

H. Finish Slab Elevation: Slope slabs to floor drains and gutters. Slabs shall adequately drain regardless of tolerances.

3.11 FORMED CONCRETE FINISH

A. Rough Finish: Patch defects, chip or rub off fins exceeding 1/4-inch in height.

B. Smooth Finish: Patch tie holes and defects and remove fins completely. When surface texture is impaired and form joints misaligned by more than 1/8-inch, grind or bushhammer. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.

C. Rubbed Finish: Remove forms and perform necessary patching as soon after placement as possible. Finish newly hardened concrete no later than day following form removal. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout to be used other than cement paste drawn from concrete by rubbing process.

D. Sacked Finish: Mix one-part Portland cement and 1-1/2 parts fine sand with sufficient water to produce grout having consistency of thick paint or use commercial premixed sacking grout. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly. Immediately after grouting, scrub surface vigorously with cork float or stone to coat surface and fill voids. While grout is still plastic, remove excess grout by working surface with rubber float or sack. After surface whitens from drying, rub vigorously with clean burlap. Keep damp for at least 36 hours after final rubbing.

E. Formed Concrete Finish Schedule. The finish required for formed concrete is shown on the drawings. Where finishes of formed concrete are not shown, provide rough finish for concrete not exposed to view and rubbed finish for concrete exposed to view.

3.12 CURING AND PROTECTION

A. To preserve moisture in unformed concrete surfaces, apply one of the following immediately after placement and finishing.

1. Continuous mist spray.

2. Waterproof sheet materials, ASTM C171.

3. Curing compound, ASTM C309. Apply in accordance with recommendations of manufacturer immediately after water sheen has disappeared. Do not use on any surface against which additional concrete or other material is to be bonded or adhesively applied, unless it is proven that curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications. Provide curing compound compatible with hardener in areas where hardener is to be used.

B. Continue curing concrete for 7 days.

C. When mean daily outdoor temperature is less than 40 degrees Fahrenheit, maintain temperature of concrete between 50 degrees Fahrenheit and 70 degrees Fahrenheit for concrete placement.

D. Floors and slabs to receive concrete sealer as specified in the Contract Documents and Room Finish Schedule.

1. Apply concrete sealer at a coverage rate not to exceed 300 square feet per gallon.

2. Apply as soon as slab or floor will bear weight.

3. Before applying concrete sealer, sweep entire surface clean with very soft bristled brush that will not mark concrete finish and remove any standing water.

4. Apply concrete sealer with sprayer.

5. Use of paint rollers or mop is not acceptable.

6. Workmen shall wear flat soled shoes which will not mark or scar concrete surface.

7. Do not allow traffic on floors and slabs until concrete sealer has dried and hardened.

3.13 BACKFILL AGAINST STRUCTURES

A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.

B. Refer to General Structural Notes on the Drawings for additional requirements, including elevated slab and diaphragm completion prior to backfill.

C. Unless otherwise permitted, place backfill simultaneously on both sides of structure, where such fill is required, to prevent differential pressures.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland Cement to two and one half parts fine aggregate passing No 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension in solid concrete, but not less than 1-inch in depth. Make edge of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Patch a test area at an inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floor and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.1-inches wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of the same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

5. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

6. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.15 FIELD QUALITY CONTROL

A. The Owner shall obtain and pay for services of certified independent testing agency. They shall perform sampling and testing of installed materials to assure that the requirements of this specification are met.

B. Provide adequate facilities for safe storages and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

C. Unless otherwise specified, sample concrete for testing for making test specimens, from point of delivery.

D. When concrete is pumped, sample and test air content at point of delivery and at point of placement.

E. The frequency herein specified for each field control test is approximate. A greater or lesser number of tests may be made, as required by the Engineer, to verify compliance with these specifications.

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

G. Each 100 tons of fine aggregate and each 200 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136.

H. Entrained air: Test every load of concrete delivered to the project. Air content shall be determined in accordance with ASTM C231.

I. Slump: Test every load of concrete delivered to the project.

J. Pumped Concrete: Take concrete samples for slump, ASTM C143 and test specimens ASTM C31.

K. Strength characteristics: 1 set of 4 concrete test cylinders shall be made for every 40 cubic yards or less of each class of concrete placed each day. 1 additional set shall be taken from each additional 40 cubic yards, or major fraction thereof, placed in any 1 day. 1 cylinder of each set shall be tested at an age of 7 days and 2 cylinders shall be tested at an age of 28 days. The fourth cylinder of the sets shall be tested only if deemed necessary by the Engineer. Test results shall be evaluated in accordance with ACI 214 and 318.

L. 3 additional test cylinders will be taken during cold weather and shall be cured on site under the same conditions as the concrete it represents. 1 cylinder shall be tested at an age of 7 days and the other cylinder at an age of 28 days.

3.16 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances, or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by the Contractor when defective concrete is identified.

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

END OF SECTION 03 30 00

SECTION 03 30 00.20 – STAY IN PLACE FORMING

PART 1 – GENERAL

1.1 WORK INCLUDED

A. This work consists of providing and installing stay in place concrete forming systems for permanent forms used in structural cast in place concrete. The stay-in-place concrete forms are used to create:

1. Bulkheads

2. Slabs above grade

1.2 REFERENCES:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ASTM D1761 Mechanical Fasteners in Wood

2. American Concrete Institute (ACI) ACI 347 Guide to Formwork for Concrete.

3. ACI 318 Building Code Requirements for Structural Concrete.

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 - Submittal Procedures.
   A. Manufacturer's catalog data showing:
      1. Materials of construction
      2. Dimensions, spacings, and construction of planks or panels.

   B. Detail shop drawings showing:
      1. Dimensions
      2. Sectional assembly
      3. Location and identification mark
      4. Size and type of supporting frames required.

B. Shop Drawings: Contractor shall submit shop drawings for all concrete forming materials and fabrications as required.

C. Design Data to support concrete placement rate.

1.4 STORAGE AND HANDLING

A. Materials shall be protected against damage from weather, vandalism, and theft. In the event of freight damage, note freight bill and contact manufacturer immediately.

B. The contractor is responsible for the proper handling and storage of materials upon delivery to the job site.

PART 2 – PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. FRP planks shall be shipped from the manufacturer, palletized and banded with exposed edges protected to prevent damage in shipment.

B. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

C. FRP planks shall be Fiber Reinforced Plastic Panels.

D. Materials

1. The FRP planks shall be manufactured by the pultrusion process. Planks will be manufactured using polyester resin. The glass fiber reinforcement for the planks shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. A synthetic surface veil shall be the outermost layer covering the exterior surfaces.

2. Fiberglass planks shall be made from a fire retardant (select premium polyester or vinyl ester) resin system that meets the flame spread rating of 25 or less in accordance with ASTM E-84, flammability characteristics of UL 94 V0 and meets the self-extinguishing requirements of ASTM D635. UV inhibitors are added to the resin.

A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

B. Design load is considered as uniform loading over the entire decking panels. Design live loads of shall be in accordance with the following minimum design loads based on the latest adopted International Building Code:
--60 psf live load
--150 psf per foot of concrete thickness
-- Limit deflection using an Elastic Modulus of 3,000,000 psi.

C. Decking panels shall not deflect more than ¼" and structural support members shall not deflect more than L/150 of span for structural members unless specifically stated otherwise in drawings and/or supplementary conditions. Connections shall be designed to transfer the design loads.

D. Panels weakened by penetrations, cuts, etc. shall be stiffened or reinforced as necessary to restore their capacity to withstand the specified loading and deflection limits.

E. Design decking panels for in-service temperatures of 125 degrees with ultimate stress retention of 85% for 125 degrees and a modulus of elasticity retention of 90 percent.

PART 3 – EXECUTION

3.1 STAY IN PLACE FORMING

3.01 PREPARATION:

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction.

B. Coordinate delivery of all listed items to project site.

3.02 INSPECTION AND TESTING:

A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

3.03 INSTALLATION, GENERAL:

A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through- bolts, lag bolts and other connectors as determined by the contractor.

B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.

C. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.

3.04 ALL FRP INSTALLATION:

A. If required, all field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer.

A. Install items specified as indicated and in accordance with manufacturer’s instructions.

END SECTION 03 30 00.20

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install miscellaneous metal items as shown on the drawings and specified herein.

1.2 STANDARDS

A. AISC "Code of Standard Practice."

1.3 SUBMITTALS

A. Shop Drawings: Prepare and submit shop drawings for miscellaneous metal items prior to fabrication. Identify items with location and drawing or specifications reference. Show connections, anchors, anchor or fastener spacing dimensions and details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from moisture with waterproof paper, tarpaulin or polyethylene sheeting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Miscellaneous Bolts and Nuts: ASTM A307

B. High Strength Bolts and Nuts: ASTM F3125 Grade A325

C. Concrete Anchors: Use cast in anchor bolts where cast in anchor bolts are shown on the drawings. Provide attachment to concrete with concrete anchors where shown on the drawings conforming to the following types. Use only type of concrete anchor shown on the drawings.

1. Expansion Anchors: Expansion anchors shall be wedge type with a single piece three section wedge to anchor the stud in the hole. The stud nut and wedge shall be ANSI 304 stainless steel.

2. Adhesive Anchors: Adhesive anchors shall be an all thread rod with a nut. The all thread rod and nut shall be ANSI 304 stainless steel. The rod shall be anchored in the hole using a premeasured adhesive capsule consisting of vinyl urethane methacrylate adhesive.

3. Undercut Anchors: Undercut anchors shall be an undercut style with a brazed tungsten carbide edge on the undercutting end to perform the self-cutting undercut as the anchor is installed. The anchor shall cut and undercut bearing area of at least 2.5 times the nominal anchor bolt size. The anchor stud shall be ANSI 316 stainless steel.

D. Stainless Steel Bolts and Nuts: Type 316 Stainless Steel

2.2 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application): Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be steel as indicated herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise indicated, steel for bolt material, anchor bolts and cap screws shall be in accordance with the following:

Structural Connections	ASTM A307, Grade A or B, hot-dip galvanized
Anchor Bolts	ASTM A307, Grade A or B, or ASTM A36, hot-dip galvanized
High Strength Bolts	ASTM F3125 Grade 325
Pipe and Equipment Flange Bolts	ASTM A193, Grade B- 7

B. Stainless steel bolts and nuts for corrosive service

1. Corrosive Service: All bolts, nuts, and washers in the locations listed below shall be stainless steel as indicated below.

a. All buried locations.

b. All submerged locations.

c. All locations subject to seasonal or occasional flooding.

d. Inside hydraulic structures below the top of the structure.

e. Inside buried vaults, manholes, and structures which do not drain through a gravity sewer or to a sump with a pump.

f. All chemical handling areas.

g. Inside trenches, containment walls, and curbed areas.

h. Locations indicated by the Contract Documents or designated by the ENGINEER to be provided with stainless steel bolts.

2. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be Type 316 stainless steel, Class 1, conforming to ASTM A193 for bolts and to ASTM A194 for nuts. All threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless-steel bolts, to meet government specification MIL-A-907E. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

    a. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

    b. Antiseize lubricant shall be "PURE WHITE" by Anti-Seize Technology, Franklin Park, IL, 60131, AS-470 by Dixon Ticonderoga Company, Lakehurst, NJ, 08733, or equal.

C. Bolt Requirements: The bolt and nut material shall be free-cutting steel. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

D. Bolts and nuts shall be installed with washers fabricated of material matching the base material of bolts, except that hardened washers for high strength bolts shall conform to the requirements of the AISC Specification. Lock washers fabricated of material matching the bolts shall be installed where indicated.

E. The length of each bolt shall be such that after the joint is made up, the bolt extends through the entire nut, but in no case more than 1/2-inch beyond the nut.

F. Adhesive Anchors: Unless otherwise indicated, all drilled, concrete or masonry anchors shall be adhesive anchors. No substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Adhesive anchors are required for drilled anchors for indoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring reinforcing bars. Threaded rod shall be stainless steel Type 316. Epoxy adhesive shall be Hilti HIT RE 500 V3.

2. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above and shall be Hilti HVA or Cobra Anchors. Threaded rod shall be galvanized steel.

G. Expanding-Type Anchors: Expanding-type anchors if indicated or permitted, shall be galvanized steel expansion type ITW Ramset/Redhead "Trubolt" anchors; Hilti "Kwik-Bolt;" or equal. Lead caulking anchors will not be permitted. Size shall be as indicated. Embedment depth shall be as the manufacturer recommends for the load to be supported. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.

H. Overhead Applications: Use Hilti HDA undercut anchors.

2.3 POWDER-DRIVEN PINS

A. Power-driven pins to be installed in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank. Complete information describing pin capacities, connections, and proposed use locations shall be submitted to the Engineer.

2.4 IMPACT ANCHOR

A. Impact anchors shall be an expansion type anchor in which a nail type pin is driven to produce the expansive force. The pin shall have a zinc sleeve with a mushroom style head and stainless-steel nail pin. Anchors shall be Metal HIT Anchors, manufactured by Hilti, Inc., Rawl Zamac Nailin, manufactured by the Rawlplug Company; or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Embedded Items: Deliver miscellaneous metal items to be embedded or installed in concrete with setting instruction to concrete contractor for setting. Verify grade and line positioning of items as set, report errors or deviations in order that corrective adjustments may be made before placement of concrete or laying of masonry.

3.2 GENERAL

A. Concrete Anchors: Install concrete anchors in cast in place concrete and masonry according to the details shown on the drawings and as recommended by the anchor manufacturer. When installing concrete anchors in masonry always install anchors in masonry cells that have been grouted solid. Do not install anchors into hollow cell masonry.

B. Expansion, Contraction: Assemble and install work with adequate provisions to prevent objectionable distortion and overstressing from expansion, contraction. Where necessary, provide properly designed expansion joints, construct to be weather tight if to be exposed to the weather.

C. Field Touch-up: After installation of miscellaneous metal items, tough-up field bolts, field welds, uncoated connections and abrasions with ship protective coatings. Clean items of mud, dirt, and other objectionable foreign matter.

END OF SECTION 05 50 00

NOTE: NEED TO ADD HIGH TEMPERATURE PAINT TO THIS SPECIFICATION

SECTION 09 90 00 – PAINTING AND COATING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials and equipment as required for all painting and coatings as specified herein. All materials, equipment, piping and miscellaneous surfaces shall be coated except for those indicated under Part 1.7. Work includes but is not to be limited to cleaning and preparation of surfaces, paint materials, and the application of all paint and other materials. Provide third party inspection of surface preparation, application and testing of coating and painting during application.

1.2 DEFINITIONS

A. The term paint, coatings, or finishes as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. Dry Film Thickness (DFT): The minimum dry film thickness, without any negative tolerance.

C. Submerged Metal: Steel or iron surfaces below tops of channel or structure walls which will contain water even when above expected water level.

D. Submerged Concrete and Masonry Surfaces: Surfaces which are or will be:

1. Underwater.

2. Inside structures which normally contain water.

3. Below tops of walls of water containing structures.

E. Exposed Surface: Any metal or concrete surface, indoors or outdoors that is exposed to view.

F. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.

G. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.

H. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

1.3 REFERENCE STANDARDS

A. Codes and Standards: In addition to the requirements of these Specifications, the work to be performed under this Section is to comply with the following codes and regulations:

1. The Society of Protective Coatings Specifications (SSPC):

a.	SSPC SP-1	Solvent Cleaning.
b.	SSPC SP-2	Hand Tool Cleaning.
c.	SSPC SP-3	Power Tool Cleaning.
d.	SSPC SP-5	White Metal Blast Cleaning.
e.	SSPC SP-6	Commercial Blast Cleaning.
f.	SSPC SP-7	Brush-Off Blast Cleaning.
g.	SSPC SP-10	Near-White Blast Cleaning.
h.	SSPC SP-11	Power Tool Cleaning to Bare Metal.
i.	SSPC-SP-12	High- and Ultrahigh-pressure Water Jetting.
j.	SSPC-SP-13	Surface Preparation of Concrete
k.	SSPC-SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

2. Underwriters' Laboratory (UL):

a.	UL 3P83	Drinking Water System Components - Health Effects.

3. National Association of Corrosion Engineers Standards (NACE):

a.	RP0188-06	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

4. Applicable Standards of American National Standards Institute, Inc. (ANSI)

5. National Association of Pipe Fabricators (NAPF):

a.	NAPF 500-03	Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.

6. American Society for Testing and Materials (ASTM):

a.	ASTM D4262	Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
b.	ASTM D4263	Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
c.	ASTM D4285	Test Method for Indicating Oil or Water in Compressed Air.
d.	ASTM D4541	Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

1.4 QUALITY ASSURANCE

A. Pre-Application Conference: Prior to commencement of any paint application, the Engineer will hold an on-site pre-application meeting. The purpose of meeting is to establish a working understanding between all parties and to discuss items that pertain directly to the paint application.

B. Painter's Qualifications: The work specified under this Section shall be performed by or under the supervision of a qualified painter. The Contractor shall be required to document the painter's experience, competence and ability to comply with the requirements of these Specifications and to complete the work in a timely manner. The Painter or Applicator shall have the following qualifications:

1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work. Provide qualifications of applicator and references listing five similar projects completed in the past two years.

2. Manufacturer approved applicator when manufacturer has approved applicator program.

C. Coatings Inspection: Surface preparation, mixing, thinning, coating application, and measurement of dry film thicknesses shall be performed by a NACE Certified Coatings Inspector. Each requirement of this specification shall be met and approved by the Inspector prior to moving on to the next step in the progression of the coating's specification.

D. Standard Products: All paints in a paint system are to be the standard products. All products applied in any paint and coating system shall be from a single manufacturer.

E. The NACE Inspector must approve all surface preparation prior to the application of coatings. This will include surface cleanliness, the degree of sandblast and surface profiles.

F. At a minimum of every four hours or more often when conditions change during surface preparation and coatings application, environmental conditions IE: Relative Humidity, dew-point, surface temperature and the dew-point/surface temperature depression must be measured and recorded. The use of a sling psychrometer and US weather bureau barometric chart or approved equal such as Defelsko or Elcometer test instruments shall be used to measure the environmental conditions.

G. Warranty Inspection: A warranty inspection will be conducted at the end of the one-year warranty period from the substantial completion date. The Contractor and a representative of the coating material manufacturer may attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the Owner. The Owner may, by written notice to the Contractor, reschedule the warranty inspection to another date within the warranty period.

H. Quality Assurance Responsibility: The Contractor is responsible to obtain and pay for the services of the NACE inspector referred to above.

1.5 SUBMITTALS

A. Before any paint materials are delivered to the job site, submit a complete list of all materials proposed to be furnished and applied under this Section. Include schedule of where and for what use coating materials are proposed in accordance with requirements for Product Data. Any coating or paint materials ordered by Contractor prior to receiving submittal response from Engineer indicating that the submitted material is accepted shall be at the risk of the Contractor.

B. For each paint, furnish the paint manufacturer's specific application instructions and the following information:

1. Paint manufacturer’s data sheet for each product proposed, including statements on the suitability of the materials for the intended use.

2. Surface preparation recommendations

3. Type of primer, if required

4. Maximum dry and wet mil thickness per coat

5. Minimum and maximum curing time between coats, including atmospheric conditions for each

6. Curing time before submergence in water

7. Thinner to be used with each paint

8. General ventilation requirements

9. Atmospheric conditions during which the paint is <u>not</u> to be applied

10. Allowable methods of application

11. Maximum allowable moisture content and minimum age of plaster, concrete and wood surfaces at time of paint application

12. Compatibility of shop and field applied coatings (where applicable)

C. Reports: Submit the following to the Engineer:

1. Reports on visits to project site to view and approve surface preparation of structures to be coated.

2. Reports on visits to project site to observe and approve coating application procedures.

3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are “shop coated.”

1.6 DELIVERY AND STORAGE

A. Deliver, store, and handle products in accordance with manufacturer’s requirements. All materials are to be delivered to the job site in their original, unopened containers bearing the manufacturer's name, brand, batch number, date of manufacture, and any special directions.

B. Only the approved material shall be stored at the job site and stored only in designated areas restricted to the storage of paint materials and related equipment. All paint is to be stored in enclosed structures and protected from weather and excessive heat or cold. Store coatings in well-ventilated facility that provides protection from the sun, weather, and fire hazards. Maintain ambient storage temperature between 45- and 90-degrees Fahrenheit, unless otherwise recommended by the manufacturer.

C. Store flammable materials to conform with State and local safety codes. Protect emulsion type paints from freezing. Take precautions to prevent fire and spontaneous combustion.

D. Materials exceeding storage life recommended by the manufacturer will be subject to rejection.

E. Remove unspecified and unapproved paints from Project site immediately

1.7 SURFACES NOT REQUIRING PAINTING

A. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, aluminum, chromium plate, and weathering steel, except where (1) required for electrical insulation between dissimilar metals, (2) aluminum is in contact with concrete or masonry, and (3) color coding of equipment and piping is required.

B. Copper, bronze, aluminum, weathering steel, and stainless steel,

C. Glass, porcelain, and plastics do not require painting.

D. Prefinished architectural finishes such as acoustical tile, cabinets, and wall panels do not require painting.

E. Prefinished electrical items such as motor control centers, switchboards, switchgear, panelboards, transformers, and disconnect switches do not require painting.

F. Exposed electrical conduits shall be painted to match the color of the adjacent wall or equipment to which they are attached, except that non-submerged conduits attached to unpainted masonry and concrete surfaces need not be painted.

G. Exterior concrete slabs, exterior sidewalks, exterior concrete stairs and exterior concrete curbs.

H. Platform gratings, stair treads, door thresholds, and other walk surfaces, unless specifically indicated to be coated.

1.8 MAINTENANCE

A. Extra Materials: Include minimum 1 gallon of each type and color of coating applied. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type and color.

PART 2 - PRODUCTS

2.1 PAINT AND COATING SYSTEM APPLICATIONS

A. Prepare surfaces and apply paint and coating systems in accordance with the following schedules for all surfaces.

Surface Preparation	Description
SSPC SP-1	Solvent Cleaning
SSPC SP-2	Hand Tool Cleaning
SSPC SP-3	Power Tool Cleaning
SSPC SP-5	White Metal Blast Cleaning
SSPC SP-6	Commercial Blast Cleaning
SSPC SP-7	Brush off Blast Cleaning
SSPC SP-10	Near White Blast Cleaning
SSPC SP-11	Power Tool Cleaning to Bare Metal
SSPC SP-12	High- and Ultrahigh-Pressure Water Jetting
SSPC SP-13	Surface Preparation of Concrete
SSPC SP-16	Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals

C-1	Abrasive blast clean in accordance with ASTM D4259 and fill all holes and imperfections with Sika Mono Top 615.

Paint and Coating Application Schedule		
Surface to be Painted or Coated	Surface Preparation	Paint System
Ferrous Metal (ungalvanized), Exposed	SSPC – SP-6	System 1
Ferrous Metal (galvanized)	SSPC – SP-1	System 2

2.2 PAINT AND COATING SYSTEMS

A. Furnish primers and finish coatings as shown on the following coating table schedule. If manufacturers have changed their coating products and the products shown below are no longer available, provide the product that the manufacturer recommends as the improved version of the product shown.

B. Where dry film thicknesses are not shown, the DFT shall be as recommended by the manufacturer for the product and service shown in the Application Schedules above.

C. Paint and Coating Systems:

System	Sherwin Williams	ICI Devoe Coatings	Tnemec Company
1	Kem Kromik primer 3-4 mils Industrial Enamel HS 2-3 mils B54 Series, Industrial Enamel 2-3 mils	Devguard 4160 primer Devguard 4308 finish (4550) finish 2 coats, 3.0 mils each	Tnemec 66 primer Tnemec 2H finish 2 coats, 3.0 mills each
2	SHER-CRYL HPA 2 coats, 3-4 mils each	Same as System 1 but for Devoe Coatings but use Devguard 4120 primer	Same as System 1 but pretreat galvanizing

2.3 OTHER COATINGS

A. Factory Applied Coatings and Touchup: Field touchup shall consist of touching up the shop prime coat to achieve the film thickness, continuity and coating specified in accordance with the paint system data sheets. Badly damaged shop coatings shall be removed and the surfaces recoated in accordance with the specified system requirements.

B. Aluminum Metal Insulation: Where aluminum surfaces come in contact with concrete or with metals not compatible with aluminum, paint the dissimilar materials with a prime coat of zinc-chromate primer or a coating of heavy-bodied bituminous paint.

C. Painting and Identification of Piping: All exposed new piping is to be painted and identified in accordance with Section 40 05 97 – Piping Identification.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Prepare all surfaces prior to application of paint or coatings. Comply with surface preparation requirements of the Society for Protective Coatings (SSPC). If the paint or coating manufacturer recommends a surface preparation different than that shown, follow the more stringent surface preparation requirement.

B. ASTM D4259 – Wet Abrasive Blasting, Vacuum Assisted Dry Abrasive Blasting or Centrifugal Shot Abrasive Blasting

1. Shot Blasting – Before blasting fill defects and holes with filler recommended by the coating manufacturer. Blast with dustless steel shot to remove laitance, residue and loose material to roughen the surface to a texture of No. 40 to 60 grit sandpaper.

C. Surface preparation requirements of the Society for Protective Coatings (SSPC) are as follows:

1. SSPC – SP-1 – Solvent Cleaning

2. SSPC – SP-2 – Hand Tool Cleaning

3. SSPC – SP-3 – Power Tool Cleaning

4. SSPC – SP-5 – White Metal Blast Cleaning

5. SSPC – SP-6 – Commercial Blast Cleaning

6. SSPC – SP-13 – Mechanical or Chemical Cleaning

D. Preparation of Concrete and Masonry Surfaces: Unless otherwise specified, concrete surfaces which are to receive any paint coating shall be allowed to age for a minimum of 28 days. Moisture content shall be tested with a Delmhorst Instrument Company moisture detector prior to application of paint or coating. The moisture content of the concrete shall be within the limits recommended by the manufacturer of the paint or coating before any paint or coating is applied.

3.2 APPLICATION

A. Workmanship: All work shall be done in a workmanlike manner so that the finished surface will be free from runs, drips, ridges, waves, laps and unnecessary brush marks. All coats shall be applied in such a manner as to produce an even film of uniform thickness, completely coating all corners and crevices.

B. The Contractor's coating and painting equipment shall be designed for application of materials specified and shall be maintained in a first-class working condition. Compressors shall have suitable traps and filters to remove water and oils from the air. Spray equipment shall be equipped with mechanical agitators, pressure gauges, and pressure regulators. Spray nozzles shall be of the proper sizes.

C. Each coat of paint shall be applied evenly and sharply cut to line. Care shall be exercised to avoid overspraying or spattering paint on surfaces not to be coated. Glass, hardware, floors, roofs and other adjacent areas and installation shall be protected by taping, drop cloths or other suitable measures.

D. Paint Properties, Mixing and Thinning. All paint, when applied, shall provide a satisfactory film and smooth, even surface. Glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application, adhesion and subsequent coats. Paints shall be thoroughly stirred, strained and kept at a uniform consistency during application. Coatings consisting of two (2) or more components shall be mixed in accordance with manufacturer's instructions. Where necessary to suit conditions of the surface, temperature, weather and method of application, and with the Engineer's approval, the paint may be thinned immediately prior to use by the addition of not more than one pint per gallon of the proper thinner; provided that in no case shall the paint be reduced more than necessary to obtain the proper application characteristics. Where specifically permitted by the Specifications, certain paints may be thinned more than the maximum indicated above. Paint thinner shall be as recommended by the paint manufacturer.

E. Atmospheric Conditions: Except as specified or required for certain water-thinned paints, paints shall be applied only to surfaces that are thoroughly dry and only under such combination of humidity and temperatures of the atmosphere and surfaces to be painted as will cause evaporation rather than condensation.

1. In no case shall any paint be applied during rainy, misty weather, or to surfaces upon which there is frost or moisture condensation without suitable protection, as accepted by the Engineer. Where painting is permitted during damp weather or when the temperature is at or below 40 degrees F, the surfaces shall be heated to prevent moisture condensation thereof.

2. Bar metal surfaces, except those which may be warped by heat, may be dehydrated by flame-heating devices immediately prior to paint application.

3. While any painting is being done and for a period of at least eight (8) hours after the paint has been applied, the temperature of the surfaces to be painted, the painted surfaces and the atmosphere in contact therewith shall be maintained at or above 40 degrees F and 5 degrees above the dew point.

4. All paint, when applied, shall be approximately the same temperature as that of the surface on which it is applied. The use of fans or heaters shall be required in enclosed areas where conditions causing condensation are severe.

F. Method of Paint Application: Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors. Color additives shall not contain lead or any lead compound which may be destroyed or affected by hydrogen sulfide or any gas likely to be found in wastewater treatment plants.

G. Electrical and mechanical equipment, on which the manufacturer's coating is found, shall be touch-up primed and painted with two (2) coats of the specified paint system to match the color scheduled. This does not apply to electrical and instrumental equipment otherwise specified in Division 26.

H. No paint shall be applied to any surface until it has been prepared as specified and approved by the Engineer. Unless otherwise specified, the primer or first coat of paint shall be applied by brush to ferrous surfaces. All subsequent coats for all ferrous surfaces may be either brush or spray applied. Unless stated otherwise, prime and finish coats shall be applied at the rate recommended by the manufacturer for the services involved. After prime coat is dry, all suction spots shall be touched up before succeeding coats are sprayed. All coats for concrete and masonry shall be brushed or rolled unless otherwise specified. Before painting or repainting existing surfaces, the Contractor shall test-paint a small area on the actual surface to show that the color matches the existing surfaces.

I. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the prime and intermediate coats have been inspected by the Engineer.

J. Film Thickness and Continuity: The actual surface area covered per gallon of oil and varnish vehicle paint for various types of surfaces shall not exceed those recommended by the manufacturer. All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications. The minimum thickness at any point shall not deviate more than 25 percent from the required average. Except as specified, no less than two (2) coats shall be applied.

K. Special Requirements: Hangers shall be painted, except for the final coat, prior to installation. Paint underside of all ungalvanized equipment bases and supports with at least two (2) coats of rust inhibiting primer prior to setting the equipment in place. Paint bolt and bolt holes in flanges, such as those used with couplings or wager type valves, where hold and bolt as finally installed will be exposed to weather or moisture, prior to assembly to prevent rusting of the unprotected metal.

3.3 FIELD INSPECTION AND TESTING

A. Where two (2) or more coats are required, alternate coats shall contain sufficient compatible color additive to act as indicator of coverage, or the alternate coats shall be of contrasting colors.

B. Unless otherwise specified, do not apply finish coats until all other work in the area is done and until the underlying coats have been inspected and accepted by the NACE Inspector.

C. Film Thickness: All paint and coating thickness stated in this specification are dry film thickness. The first coat on metal surfaces refers to the first full paint coat and not to conditioning or other pretreatment applications. All coatings shall be applied to the thickness in accordance with these Specifications and the Manufacturer's recommendations as stated in the product data sheets. The dry film thickness of each coating application will be measured using the SSPA-2 standard. The minimum/maximum thickness requirements shall meet the perimeters outlined in this standard. Where the minimums and maximums do not meet the requirements of this standard, corrections must be made.

D. Continuity: Holiday testing will be performed in accordance with NACE RP0188. All surfaces below the waterline shall be tested.

In testing for continuity, all pinholes and holidays located shall be repainted to the required dry film thickness. All ferrous metal surfaces shall meet minimum continuity requirements outlined the NACE RP0188 standard. All holiday repairs will be re-tested following the repairs.

E. It is intended that the dry film thickness and the continuity of painted ferrous metal surfaces be subject to continual field check by the Contractor's quality control subcontractor. Dry-film thickness will be measured by an Elcometer or Mikrotest magnetic type dry-film thickness gauge. Continuity will be tested by a low voltage wet sponge transistorized device, as manufactured by Tinker-Rasor (Model M-1), or equal. The Contractor's quality control subcontractor shall use inspection devices that are in good working condition for detection of holidays and measurement of dry-film thickness. The Contractor's subcontractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry-film thickness gauge and certified instrumentation to test accuracy of holiday detectors. Provide safe and suitable ladders or temporary scaffolding and adequate illumination to facilitate inspection.

3.4 PROTECTION OF PAINT SURFACES

A. Where protection is provided for painted surfaces, such protection shall be preserved in place until the paint film has properly dried and the removal is authorized. Items which have been painted shall not be handled, worked on, or otherwise disturbed until the paint coat is completely dry and hard.

B. After delivery at the site of materials for permanent erection or installation, all shop-coated metalwork shall be repainted or retouched from time to time, which specified paint, whenever, in the opinion of the Engineer, it becomes necessary to maintain the integrity of the film.

3.5 CLEANUP

A. Upon completion of all painting, remove all surplus materials, protective coverings and accumulated rubbish and thoroughly clean all surfaces and repair any overspray or other paint-related damage.

END OF SECTION 09 90 00

SECTION 22 1429 - SUMP PUMPS

PART 1 - GENERAL

1.1 PRODUCTS

A. Sump Pump – Simplex – Submersible pump (SP)

1. Extent of Work –

a. Furnish and install submersible pump(s) as indicated, of size and capacity as scheduled on drawings.

2. Pump –

a. Cast iron shell, cast iron impeller, stainless steel shaft, upper and lower bearings lubricated by dielectric oil which fills motor housing, ceramic mechanical seals, no screen on inlet.

3. Motor –

a. Hermetically sealed, submersible type, capacitor-start, with built-in overload protection, electrical characteristics as scheduled. Provide 10' of 3-conductor PVC cord and molded grounding plug.

4. Sump –

a. Concrete sump, see civil and structural plans.

5. Controls –

a. Float-operated mercury switches to control sump level and alarm signal. One (1) such required, i.e., pump off, pump on. Provide float switch with required water proof cabling (20 feet length) for connection to remote mounted control panel.

Furnish with high water bug alarm contact for remote monitoring of high level alarm through building automation system.

6. Sequence of Operation –

On sump level rise switch shall be energized and start pump. With pump operating, sump level shall lower to low switch turn-off setting and pump shall stop.

END OF SECTION 22 1429

SECTION 23 0523 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

B. This section is Division 23 Valves section, and is part of each Division 23 section making reference to valves specified herein.

C. Division 23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

A. Extent of valves required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of valves specified in section include the following:

1. Ball Valves.
2. Check Valves.

C. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.

1.3 QUALITY ASSURANCE:

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Valve Types: Provide valves of same type by same manufacturer.

C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve.

B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of General Conditions.

1.5 REFERENCES:

A. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".

2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL-listed and FM approved.

PART 2 - PRODUCTS

2.1 VALVES:

A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

C. Operators: Provide lever handle for quarter-turn valves, 4" and smaller.

2.2 SUMP PUMP DISCHARGE:

A. Ball Valves:

1. Steel piping, 2-1/2” and smaller: 400 psig WOG @ 250ºF, bronze construction, threaded ends, bubble tight mineral filled PTFE seat at 250 psig under water, hard, stainless steel ball and stem. Operate with flow in either direction. Lever or tee handle as required. Suitable for throttling and tight shut-off. Crane, Keystone, Powell, Nibco/Scott, Milwaukee, Grinnell. All valves of the same type shall be of the same manufacturer. No other manufacturers approved. All drain valves shall be furnished with capped 3/4” threaded hose outlet connection.

B. Non Slam Check Valves -
1. Silent, spring loaded.
2. 125 psig swp
3. 2 Inches And Smaller -
4. All Stainless steel screwed connections.
   a. Approved Manufacturers and Models -
      1) Apco / Valve and Primer Corpor¬ation - Series 300
      2) Durabla - Model WLC
      3) Mueller Steam - 303
      4) Metraflex

PART 3 - INSTALLATION

3.1 VALVE INSTALLATION:

A. Locate all valves in locations which will allow easy operation and facilitate maintenance.

B. Install valves with stems horizontal or above.

E. Valve should be installed with bonnets at least 45 degrees above the horizontal to ensure debris does not collect in bonnet.

END OF SECTION 23 0523

SECTION 260500 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Supporting Devices for Electrical Components
2. Electrical Demolition

1.2 REFERENCES

A. ASTM International (ASTM) Publications:

1. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"

B. American Welding Society (AWS) Publications:

1. D1.1 "Structural Welding Code - Steel"

C. National Fire Protection Association (NFPA) Publications:

1. 70 "National Electric Code"

D. National Electrical Manufacturers Association (NEMA) Publications:

1. 250 “Enclosures for Electrical Equipment (1000 Volts Maximum)”

1.3 PRIOR APPROVAL

A. General:

1. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
2. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Prior approval
   a. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional. All submittals for “or equal” approval shall be made no less than ten days prior to bidding.
   b. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. All work to be in accordance with latest requirements of the NEC and all other applicable codes and regulations of authorities having jurisdiction over the work.

1.6 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels as specified.

D. All electrical drawings are to be read in conjunction with the project specifications and all other related contract drawings.

E. The contractor shall examine the site and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made subsequently in the connection for any error or negligence on the contractor’s part.

F. The contractor shall verify exact location, size and extent of all existing utilities, obstructions and/or other conditions which may affect the proposed work under the project. The contractor shall take every precaution to prevent damage to existing work and shall repair any damage as a result of this work.

G. The contractor shall verify all door swings in the field and mount switches on knob side of doors or as approved by the Design Professional.

H. The contractor shall carefully examine all contract drawings/specifications and be responsible for the proper fittings of materials and equipment at each location as indicated without substantial alteration. The drawings are generally diagrammatic and because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Furnishing such fittings that are required to meet such conditions shall be furnished and installed at no cost.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon-steel wedge or sleeve type.

H. Toggle Bolts: All-steel springhead type.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

E. Coordinate work with other trades and install conduit and boxes to clear embedded ducts, openings, etc. and all structural features.

F. Unless otherwise noted, mounting heights, as shown, are from finished floor to top of panelboard and to centerline of other equipment. Coordinate all mounting heights with contract drawings, local code requirements, and all A.D.A. requirements.

1. Toggle (snap) switch: 4’-0”.
2. Enclosed circuit breaker: 5’-0”
3. Disconnect (safety) switch: 5’-0”.
4. Motor starter: 5’-0”.
5. Panelboard: 6’-6”.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations, Pool Equipment Rooms, Storage Rooms and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.3 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Steel: Welded threaded studs or spring-tension clamps on steel.
   a. Field Welding: Comply with AWS D1.1.
6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
7. Light Steel: Sheet-metal screws.
8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Supporting devices for electrical components.
2. Electrical demolition.

3.5 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260500

SECTION 260519 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 REFERENCES

A. National Electrical Manufacturer’s Association (NEMA) Publications:

1. WC 26 “Binational Wire and Cable Packaging Standard”
2. WC 70 “Nonshielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy”

B. National Fire Protection Association (NFPA) Publications:

1. 70 "National Electric Code"

C. Underwriter's Laboratories, Inc. (UL) Publications:

1. 486A “Standard For Wire Connectors and Soldering Lugs for Use with Copper Conductors”
2. 486B “Standard for Wire Connectors for Use With Aluminum Conductors”

1.3 PRIOR APPROVAL

A. General:

1. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
2. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Prior approval:
   a. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
   b. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.
2. Product Data: For each electrical product indicated.
3. Shop Drawings:
   a. Do not purchase equipment before completion of shop drawing review.
   b. Design Professional will not review shop drawings before the contractor has reviewed the shop drawings. The contractor shall stamp all drawings with a statement that he has reviewed all shop drawings and that they conform to the intent of the drawings and specifications.
4. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.7 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Owner's Representative.

PART 2 - PRODUCTS

2.1 BUILDING WIRES AND CABLES

A. Approved Manufacturers:

1. American Insulated Wire Corp.; Leviton Manufacturing Co. (800-366-2492)
2. Carol Cable Co., Inc. (401-728-7000)
3. Southwire Company (800-444-1700)
4. Alcan Cable Division of Alcan Aluminum Corporation (770-392-2368)

B. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

C. Rubber Insulation Material: Comply with NEMA WC 70.

D. Thermoplastic Insulation Material: Comply with NEMA WC 70.

E. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 70.

F. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 70.

G. Conductor Material: Copper

1. Feeders 100 ampere or greater may be aluminum "Alcan Stabiloy #8000", or approved substitution by listed manufacturers.

H. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

2.2 CONNECTORS AND SPLICES

A. Approved Manufacturers:

1. AMP Incorporated (800-522-6752)
2. General Signal; O-Z/Gedney Unit (203-584-0571)
3. Square D Co.; a Division of Groupe Schneider (888-778-2733)
4. Alcan Cable Division of Alcan Aluminum Corporation (770-392-2368)

B. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type RHW or THWN, in raceway

B. Horizontal Feeders: Type THHN/THWN, in raceway

C. Vertical Feeders: Type THHN/THWW in raceway

D. Horizontal Branch Circuits: Type THHN/THWN, in raceway

E. Vertical Branch Circuits: Type THNN/THWW in raceway

F. Fire alarm Circuits: Power-limited, fire-protective, signaling circuit cable.

G. Class 1 Control Circuits: Type THHN/THWN, in raceway

H. Class 2 Control Circuits: Type THHN/THWN, in raceway

3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 26 05 00 - General Electrical Requirements.

F. Seal around cables penetrating fire-rated elements accordingly.

G. Identify wires and cables according to Section 26 05 53 - Identification for Electrical Systems.

3.4 CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and tap connectors compatible with conductor material.

D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.

E. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 260519

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raceways include the following:
   a. RMC
   b. PVC, schedule 40 or 80
   c. EMT
   d. MC Cable (not used on this project)
2. Boxes, enclosures, and cabinets include the following:
   a. Device boxes
   b. Floor boxes
   c. Outlet boxes

1.2 REFERENCES

A. National Electrical Contractors Association (NECA) Publications:

1. 111 “Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)”

B. National Electrical Manufacturer’s Association (NEMA) Publications:

1. 250 “Enclosures for Electrical Equipment (1000 Volts Maximum)”
2. ANSI/NEMA FB 1 “Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable”
3. ANSI/NEMA OS 1 “Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports”
4. RN 1 “Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit”
5. TC 2 “Electrical Polyvinyl Chloride (PVC) Tubing and Conduit”
6. TC 3 “Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing”

C. National Fire Protection Association (NFPA) Publications:

1. 70 "National Electric Code"

D. Underwriter's Laboratories, Inc. (UL) Publications:

1. 1660 “Liquid-Tight Flexible Nonmetallic Conduit”

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

C. MC: Metal clad cable (not used on this project)

1.4 PRIOR APPROVAL

A. General:

1. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
2. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

1.5 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Prior approval
   a. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
   b. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.
2. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
3. Shop Drawings:
   a. Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
   b. Do not purchase equipment before completion of shop drawing review.
   c. Design Professional will not review shop drawings before the contractor has reviewed the shop drawings. The contractor shall stamp all drawings with a statement that he has reviewed all shop drawings and that they conform to the intent of the drawings and specifications.
4. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

B. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1.6 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)."

C. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:

1. Metal Conduit and Tubing:
   a. Anixter Brothers, Inc. (800-323-8166)
   b. Carol Cable Co., Inc. (401-728-7000)
   c. Wheatland Tube Co. (800-257-8128)
2. Conduit Bodies and Fittings:
   a. Emerson Electric Co.; Appleton Electric Co. (800-727-5102)
   b. Hubbell, Inc.; Killark Electric Manufacturing Co. (314-531-0460)
   c. Lamson & Sessions; Carlon Electrical Products (800-322-7566)
3. Metal Wireways:
   a. Hoffman Engineering Co. (203-425-8900)
   b. Keystone/Rees, Inc. (219-495-9811)
   c. Square D Co.; a Division of Groupe Schneider (888-778-2733)
4. Nonmetallic Wireways:
   a. Hoffman Engineering Co. (203-425-8900)
   b. Lamson & Sessions; Carlon Electrical Products (800-322-7566)
5. Boxes, Enclosures, and Cabinets:
   a. Hoffman Engineering Co.; Federal-Hoffman, Inc. (203-425-8900)
   b. Hubbell Inc.; Killark Electric Manufacturing Co. (314-531-0460)
   c. Thomas & Betts Corp. (800-816-7809)

2.2 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

D. Wireway Covers: As indicated

E. Finish: Manufacturer's standard enamel finish.

2.3 NONMETALLIC WIREWAYS

A. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections using plastic fasteners.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.4 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

2.5 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.6 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and

removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel.
2. Concealed: Rigid steel.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Indoors: Use the following wiring methods:

1. Exposed on ceilings and wall in Mechanical Equipment Rooms galvanized rigid steel conduit.
2. Concealed in spaces above hung ceiling and wall: Electrical Metallic Tubing (EMT).
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Underground or concrete encased:

1. Schedule 40 PVC.

D. MC cable shall not be used on this project.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 3/4-inch trade size (DN21).

C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Section 26 05 00 - Common Work Results for Electrical.

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit or rigid steel conduit, before rising above floor.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

P. Tighten set screws of threadless fittings with suitable tools.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

T. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

W. Flexible Connections: Use maximum of 6 feet of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

X. Do not install aluminum conduits embedded in or in contact with concrete.

Y. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

Z. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

AA. Set floor boxes level and adjust to finished floor surface.

BB. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

CC. Size all conduits supplying motors and associated control equipment to include equipment grounding conductor sized per NFPA 70 whether or not shown on the drawings or specified.

DD. Unless otherwise noted, terminate all conduits stubbing up inside rooms or roof as follows:

1. Conduits for AC power: Stub up 6" above finished floor and provide concrete sill to protect stub-ups.
2. On PVC conduit for AC power and control cable, provide PVC to galvanized steel rigid conduit adaptor.
3. Plug or cap all conduits during construction or until permanent conductors are installed. Taped ends will not be allowed.

EE. In exposed conduit runs longer than 300 feet, expansion fittings shall be installed. Where embedded conduit crosses a structural expansion joint, expansion and deflection fitting shall be installed.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.2 REFERENCES

A. American National Standards Institute (ANSI) Publications:

B. National Fire Protection Association (NFPA) Publications:

1. 70 "National Electric Code"

1.3 PRIOR APPROVAL

A. General:

1. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
2. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Prior approval
   a. Catalog and manufacturer's numbers are for the purpose of establishing standards of quality and types of materials to be used. Products of other manufacturers may be used if equal in quality and design in the opinion of the Design Professional and are specifically approved by the Design Professional, in writing, 10 days prior to close of bidding.
   b. Any conflict arising from the use of substituted equipment shall be the responsibility of the supplier of that equipment. The contractor and his supplier shall bear all costs required to make equipment comply with the intent of the plans and specifications.

2. Product Data: For each electrical identification product indicated.
3. Shop Drawings:
   a. Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
   b. Do not purchase equipment before completion of shop drawing review.
   c. Design Professional will not review shop drawings before the contractor has reviewed the shop drawings. The contractor shall stamp all drawings with a statement that he has reviewed all shop drawings and that they conform to the intent of the drawings and specifications.
4. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:

1. Brady USA, Inc. (800-541-1686)
2. Panduit corp. (800-777-3300)
3. Seton Identification Products (800-571-2596)

2.2 RACEWAY AND CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

1. Color: Black letters on orange field.
2. Legend: Indicates voltage

B. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

C. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

D. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

E. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

G. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

H. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

2.3 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.

E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: According to color-coding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:

1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
3. Apply the following colors to the systems listed below:
   a. Fire Alarm System: Red.
   b. Fire-Suppression Supervisory and Control System: Red and yellow.
   c. Combined Fire Alarm and Security System: Red and blue.
   d. Security System: Blue and yellow.
   e. Mechanical and Electrical Supervisory System: Green and blue.
   f. Telecommunication System: Green and yellow.

F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

G. Circuit Identification Labels on Boxes: Install labels externally.

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
2. Concealed Boxes: Plasticized card-stock tags.
3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

H. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

I. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.

1. Color-code 240/120-V single phase system as follows:
   a. Phase A: Black
   b. Phase B: Red
   c. Neutral: White
   d. Ground: Green
2. Color-code 208/120-V single phase system as follows:
   a. Phase A: Black
   b. Phase B: Red
   c. Phase C: Blue
   d. Neutral: White
   e. Ground: Green
3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
   a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
   b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.

1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties.
3. Band Fasteners: Integral ears.

K. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

L. Apply warning, caution, and instruction signs as follows:

1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

M. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch high lettering on 1-1/2-inch high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Electrical switchgear and switchboards.
4. Label inside of all switch plates and cover plates with panel and circuit numbers.

END OF SECTION 260553

SECTION 260943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a networked lighting control system comprised of the following components:

1. System Software Interfaces
   a. Visualization Interface
2. System Backbone and Integration Equipment
   a. Existing Gateway
3.
4. Wired Networked Devices
   a. Wall Stations
   b. Power Packs and Secondary Packs

B. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.

C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 SUBMITTALS

A. Submittal shall be provided including the following items.

1. Bill of Materials necessary to install the networked lighting control system.
2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
3. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
8. Hardware and Software Operation Manuals.

1.3 APPROVALS

A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.

C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.

D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.4 QUALITY ASSURANCE

A. Product Qualifications

1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
5. All components and the manufacturing facility where product is manufactured must be RoHS compliant.

B. Installation and Startup Qualifications

1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements

1. Phone Support: Toll free technical support shall be available.
2. Remote Support: The bidder shall offer a remote support capability.
3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.5 PROJECT CONDITIONS

A. Only install indoor equipment after the following site conditions are maintained:

1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
2. Relative Humidity: less than 90% non-condensing

B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.

C. Only properly rated equipment and enclosures, installed per the manufacturer’s instructions, may be subjected to dust and moisture following installation.

1.6 WARRANTY

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.

B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.7 MAINTENANCE & SUSTAINABILITY

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 - EQUIPMENT

2.1 MANUFACTURERS

A. Acceptable Manufacturers

1. Acuity Brands Lighting, Inc.

B. Basis of Design System: Acuity Controls nLight

2.2 SYSTEM COMPLIANCE

A. System components shall comply with UL 916 and UL 924 standards where applicable.

B. System components shall comply with CFR Title 47, Part 15 standards where applicable.

C. System components shall comply with ISED Canada RSS-247 standards where applicable.

D. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture

1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
3. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system

backbone (see Control Zone Characteristics sections for each type of network connection, wired or wireless).

4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as "distributed intelligence."
    a. Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.
6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
7. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
8. The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
9. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

B. Wired Networked Control Zone Characteristics

1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
2. Devices in an area shall be connected via a "daisy-chain" topology; requiring all individual networked devices to be connected back to a central component in a "hub-and-spoke" topology shall not be permitted, so as to reduce the total amount of network cable required for each control zone.
3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.
4. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton). The "out of box" default sequence of operation is intended to provide typical sequence of operation so as to

minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
7. Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
   a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
   b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.
8. Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.
9. Wired networked Wall stations shall provide the follow Scene Control Capabilities:
   a. Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
   b. Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
   c. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” preset scene and profile scene control.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:
   a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.
   b. The system shall support reading of individual device status information. The

available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.

c. The system shall support activation of pre-defined system Global Profiles (see Supported Sequence of Operations for further definition of Global Profile capabilities).

2. The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)
3. The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.

D. Supported Sequence of Operations

1. Control Zones
   a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.
2. Wall station Capabilities
   a. Wall stations shall be provided to support the following capabilities:
      1) On/Off of a local control zone.
      2) Continuous dimming control of light level of a local control zone.
   b. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support “multi-way” switching and/or dimming control.
3. Schedule Capabilities
   a. System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.
   b. System shall support blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule. Wall stations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.
4. Global Profile Capabilities
   a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
   b. Global profiles may be scheduled with the following capabilities:
      1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or

operation of Global Profiles.

2) Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after "n" recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

3) Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.

4) Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

5) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.

c. System Global Profiles shall have the following additional capabilities:

1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.

2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.

3) Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

d. A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.

5. System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response.

2.4 SYSTEM SOFTWARE INTERFACES

A. Visualization and Programming Interfaces

1. System shall provide an optional web-based visualization interface that displays graphical floorplan.
2. Graphical floorplan shall offer the following types of system visualization:
   a. Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined. This shall include, but not be limited to, the following:
      1) Wall Switches and Dimmers
      2) Networked Relays
   b. Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor's master graphic.
   c. A mouse click on any control device shall display the following information (as applicable):

1) The device catalog number.
2) The device name and custom label.
3) Device diagnostic information.
4) Information about the device status or current configuration is available with an additional mouse click.

2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller

1. Product Series: Existing Gateway 2

2.6 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers

1. Product Series: nPODM,
2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
6. Devices with mechanical push-buttons shall be made available with custom button labeling.
7. Wall switches & dimmers shall support the following device options:
   a. Number of control zones: 1, 2 or 4
   b. Control Types Supported:
      1) On/Off
      2) On/Off/Dimming
      3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
   c. Colors: Ivory, White, Light Almond, Gray, Black, Red

B. Wired Networked Power Packs and Secondary Packs

1. Product Series: nPP16,
2. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
3. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
4. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
5. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.
6. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
7. Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.
8. Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
9. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
10. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. Installation Procedures and Verification

1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
   a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
   b. Length
   c. Insertion Loss

B. Coordination with Owner's IT Network Infrastructure

1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
   a. The bidder shall provide to the owner's representative all network infrastructure

requirements of the networked lighting control system.

b. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.

C. Documentation and Deliverables

1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
   a. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
   b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
      1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
      2) Titleblock
      3) Text- Inclusive of room names and numbers, fixture tags and drawings notes
      4) Fixture wiring and homeruns
      5) Control devices
      6) Hatching or poché of light fixtures or architectural elements
      7) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.2 SYSTEM STARTUP

A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.

1. For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.

B. System start-up and programming shall include:

1. Verifying operational communication to all system devices.
2. Programming the network devices into functional control zones to meet the required sequence of operation.
3. Programming and verifying all sequence of operations.

C. Initial start-up and programming is to occur on-site.

3.3 PROJECT TURNOVER

A. System Documentation

1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
2. Installing contractor to grant access to the owner for the programming database, if requested.

B. Owner Training

1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION 260943

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior Lighting Fixtures
2. Exit Signs
3. Emergency Lighting Units
4. Lamps
5. Accessories

1.2 REFERENCES

A. American National Standards Institute (ANSI) Publications:

1. C82.4 “Ballasts for High – Intensity – Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type)”

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE) Publications:

1. C62.41 “Surge Voltages in Low-Voltage AC Power Circuits”

C. National Fire Protection Association (NFPA) Publications:

1. NFPA 70 "National Electric Code"
2. NFPA 101 “Life Safety Code®”

D. Underwriter's Laboratories, Inc. (UL) Publications:

1. 486A “Standard For Wire Connectors and Soldering Lugs for Use with Copper Conductors”
2. 486B “Standard for Wire Connectors for Use with Aluminum Conductors”
3. 924 “Emergency Lighting and Power Equipment”

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
   a. Dimensions of fixtures.
   b. Certified results of laboratory tests for fixtures and lamps for photometric performance.
   c. Emergency lighting unit battery and charger.

d. Types of lamps.
e. Photometric data.

2. Dimming Ballast Compatibility Certificates: Signed by manufacturer of ballast certifying that ballasts are compatible with dimming systems and equipment with which they are used.
3. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
4. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described in Division 1 Section that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

PART 2 - PRODUCTS

2.1 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Approved Manufacturers:

1. Subject to compliance with requirements, provide the products indicated for each designation in Lighting Fixture Schedule as shown on drawings.
2. All alternate light fixture packages shall be submitted a minimum of 10 days prior to bid for approval.

B. Metal Parts: Free from burrs, sharp corners, and edges.

C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

E. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

F. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

2.2 FLUORESCENT LAMP BALLASTS

A. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output.
2. Total Harmonic Distortion Rating: Less than 20 percent.
3. Sound Rating: A.

B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Certified Ballast Manufacturer Certification: Indicated by label.
2. Encapsulation: Without voids in potting compound.
3. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.

C. Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:

1. Type: Electronic fully encapsulated in potting compound.
2. Power Factor: 90 percent, minimum.
3. Operating Frequency: 20 kHz or higher.
4. Flicker: Less than 5 percent.
5. Lamp Current Crest Factor: Less than 1.7.
6. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.

D. Ballasts for Dimmer-Controlled Fixtures: Comply with general and fixture-related requirements above for electronic ballasts.

1. Compatibility: Certified by manufacturer for use with specific dimming system indicated for use with each dimming ballast.

E. Ballasts for Low-Temperature Environments: As follows:

1. Temperatures 0 Deg F Above: Electronic or electromagnetic type rated for 0 deg F starting temperature.
2. Temperatures Minus 20 Deg F and Above: Electromagnetic type designed for use with high-output lamps.

2.3 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. General: Comply with ANSI C82.4. Unless otherwise indicated, features include the following:

1. Type: Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.
2. Operating Voltage: Match system voltage.
3. Minimum Starting Temperature: Minus 22 deg F for single lamp ballasts.
4. Normal Ambient Operating Temperature: 104 deg F
5. Open-circuit operation that will not reduce average life.
6. Auxiliary, Instant-on, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.

2.4 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

B. Internally Lighted Signs: As follows:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:

1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
4. Integral Time-Delay Relay: Arranged to hold unit on for fixed interval after restoring power after an outage. Provides adequate time delay to permit high-intensity-discharge lamps to restrike and develop adequate output.

2.6 FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 00 "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.7 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
2. Metallic Finish: Corrosion resistant.
3. Colors as indicated in Light Fixture Schedule.

PART 3 - EXECUTION

3.1 DEMOLITION:

A. Contractor shall disposal of all removed material off site and in compliance with local, state and federal laws appropriate for types of materials disposed of. Disposal

programs must be submitted to Idaho State University Environmental Health and Safety Department for approval prior to removal and disposal of light fixtures, lamps, ballasts and other materials removed as part of this project.

3.2 INSTALLATION

A. Light fixtures in ceiling grid shall be mechanically attached to grid per NEC 410-16 (two per fixture unless independently supported).

1. Surface-mounted fixtures shall be attached to grid.
2. Pendant-hung fixtures shall be directly supported from structure with 9-gauge wire (or approved alternative).
3. Rigid lay-in or can light fixtures:
   a. <10 lbs. - one wire to structure (may be slack).
   b. 11 to 56 lbs. - two wires from housing to structure (may be slack).
   c. >57 lbs. - supported directly to structure by approved method.

3.3 CONNECTIONS

A. Ground Equipment:

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: As follows:

1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
3. Verify normal transfer to battery source and retransfer to normal.
4. Report results in writing.

E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

F. Corrosive Fixtures: Replace during warranty period.

3.5 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 265100

SECTION 271500 – COMMUNICATIONS CABLING

PART 1 - GENERAL

A. This document is general in nature and not specific to a particular project. It is, however, the minimum standard by which all construction documents, particular to any telecommunications project, should be based. Any modifications to this document to fit a particular project must be approved by NetCom prior to being put in a construction document.

B. NOTE: This specification may impact other trades. When there is a conflict in the construction document between trades, this General Structured Cabling Minimum Specification prevails.

C. As an example, the construction document may instruct the electrical contractor to provide telecommunications grounding/bonding and conduit runs in the electrical section of the construction document. If there is a conflict between the electrical specification and the telecommunications specification, the telecommunications specification prevails.

1.2 STANDARDS

A. Building structured wiring systems shall meet the cabling conventions of Idaho State University (ISU) Networking & Telecommunications Department (NetCom) to include adherence to the most currently available Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual (TDMM 13th Edition), the most current ANSI/TIA/EIA Telecommunications Building Wiring Standards, National Electrical Manufacturer's Association (NEMA) NEMA WC 26, and National Electrical Code 2017 NFPA 70 manuals as adopted by ISU. In projects involving new construction.

B. Bidders shall be fully acquainted with the above referenced standards and be fully qualified, as outlined in the Telecommunications contractor qualifications. Bidders shall have manufacturer authorization, qualifications and certifications to install and test a Category 6/6A (CAT 6/6A) Ortronics/Superior Essex nCompass 1G Channel Solution and 1000BaseTX/FX intra-building backbone. The network cabling infrastructure must be installed by manufacturer approved designers and certified contractors at the Certified Installer Plus-Enterprise Solutions Partner (CIP-ESP) tier or Certified Installer Plus (CIP) tier in accordance with manufacturer's installation instructions and specifications.

C. All station and riser cabling shall be tested and certified by successful bidder to support 1000BaseTX/FX technology. The successful bidder will be required to meet with and coordinate with a representative of ISU NetCom prior to work beginning, and a minimum of weekly, during the installation process to ensure work is meeting ISU conventions and standards. Meetings may include a site inspection to ensure compliance with the defined standards contained in this document. The successful electrical and telecommunications contractor(s) shall follow appropriate installation

guidelines, as contained in the most currently available BICSI TDMM, ANSI/TIA/EIA, NEMA WC 26, and NFPA 70 manuals. Additionally, contractor will work with ISU NetCom to ensure proper placement and routing of cable and support hardware. The specified Structured Cable Wiring Standards are to be used as a minimum requirement.

1.3 TELECOMMUNICATIONS CONTRACTOR QUALIFICATIONS

A. ISU requires only qualified and experienced Telecommunications contractors perform design, project management, and installation services in the construction of the ISU structured cabling infrastructure. Pursuant to this, ISU wants to ensure that successful contractors have the manufacturer authorizations, capabilities, qualifications, financial stability, and experience to complete Telecommunications installations using common industry practices (i.e. BICSI TDMM, ANSI/TIA/EIA, NEMA, NFPA,etc) while meeting all requirements of this specification.

B. A contractor, by responding to a bid, represents that their company possesses the manufacturer authorizations, qualifications, certifications, capabilities, test equipment, expertise, and personnel necessary to provide an efficient and successful installation of properly operating components, as specified.

C. Bidder must meet the requirement of having continuously performed Telecommunications installation work for a period of at least five (5) years. The Telecommunications contractor must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-ESP). A copy of certification documents must be submitted prior to construction in order for such bid to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CIP Program. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under the Ortronics CIP Program. At least 30 percent of the copper installation and termination crew must be certified by BICSI and Ortronics, with a BICSI Technician Certification.

D. Bidder is required to carefully consider the amount and character of the work to be done, as well as the difficulties involved in its proper execution. Bidder should include in their bid all costs deemed necessary to cover contingencies essential to successfully installing the specified system. Any cost not specifically itemized in the proposal shall not be incurred unless specifically agreed upon by all parties and documented in writing. No claims for compensation will be considered or allowed for extra work resulting from lack of knowledge of any existing conditions on the part of the bidder.

E. ISU requires references from projects of a similar size and nature. Names of the officers of the company and resumes of those to be assigned to the project, including subcontractors, must be provided. Telecommunications contractor shall, at all times during performance of work, and until work is completed and accepted, have on the premises a competent supervisor satisfactory to ISU and with authority to act for the Telecommunications contractor regarding work schedules and any changes to the scope of work. The supervisor must be a BICSI certified Technician and a BICSI member in good standing.

F. As a requirement to bidding and performing awarded work, Telecommunications contractor shall have currently trained, registered, and certified BICSI Technicians and at least (1) Registered Communication Distribution Designer (RCDD) on staff. A copy of the RCDD certifications and BICSI member number must be provided prior to construction.

G. Telecommunications contractor must provide at least one project manager or lead technician on site at all times during project whom is a BICSI trained, certified, and registered Technician and a BICSI member in good standing. A copy of certificate and BICSI member number must be provided prior to construction. Inspections and approval of all work performed shall be conducted by an ISU supplied BICSI Registered Communications Distribution Designer (RCDD).

H. Telecommunication contractor must be skilled and proficient in both inside cable plant (copper and fiber optics) installation, as well as outside cable plant (copper and fiber optics) installation, termination, splicing, and testing. Telecommunications contractor must be certified by the manufacture of the structured cable system specified in this document. (See 1.5 Materials)

1.4 PROGRESS MEETINGS

A. The successful bidder will be required to meet with and coordinate with a representative of ISU NetCom prior to work beginning, and a minimum of weekly, during the installation process.

B. Meetings may include a site inspection to ensure compliance with established standards. The successful electrical and Telecommunications contractor(s) will follow appropriate installation guidelines, as contained in the most currently available BICSI TDMM, ANSI/TIA/EIA Wiring Standards, NEMA and NFPA 70 National Electrical Code manuals. Additionally, contractor will work with ISU NetCom to ensure proper placement, routing, labeling, and documentation of cable and support hardware.

1.5 DOCUMENTATION

A. Prior to system acceptance, the successful bidder shall submit to the owner fully documented 8.5" x 11" scale drawings of the entire fiber optic and copper distribution system. Documentation shall be provided in both a hard copy binder and a digital copy capable of being viewed and edited in MS Visio. This will include building and floor layouts with appropriate labling and locations of workstation Telecommunications Outlet (TO), Equipment Room/Telecommunications Room (ER/TR), Main Cross Connect/Intermediate Cross Connect (MC/IC), cable routes, interconnect locations, riser locations, and all other information pertinent to the installation.

B. Successful bidder will be responsible for accurately labeling and identifying all relevant components of the cabling system, including, but not limited to: Telecommunications Outlet (TO) face plate labeling; patch panel and block labeling and color-coding; backbone cable labeling at entrance to MC, BEF/IC/ER, and HC/TR; fiber optic patch panel labeling and color-coding, cables at each end, conduits at each end, and

grounding system. Reference BICSI TDMM, 13th Edition, Telecommunications Administration. The successful bidder will consult with ISU NetCom's representative in regard to labeling and identification.

1.6 MATERIALS

A. Idaho State University has selected the Ortronics/Superior Essex nCompass Structured Cabling Solution for all campus cabling. ISU desires to protect it's investment in training, certifications, and inventory, therefore, all new construction and remodel projects shall include the Ortronics/Superior Esssex nCompass Cabling Solution products as specified.

B. The Telecommunications contractor must be an approved Ortronics Certified Installer at a Plus tier (CIP, CIP-ESP). A copy of certification documents must be submitted prior to construction for such bid to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Ortronics CIP Program. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under the Ortronics CIP Program. At least 30 percent of the copper installation and termination crew must be certified by BICSI and Ortronics, with a BICSI Technician Certification.

C. Bidder should expect to present quotes based on the following itemized manufacturer's products. The horizontal workstation structured cabling system shall be an Ortronics/Superior Essex nCompass Cat 6/6A U/UTP Channel Solution. Bidder shall be authorized and certified, by the manufacturer's representative, to install, certify and warranty the structured cabling system.

D. The specified Ortronics/Superior Essex nCompass channel solution is not substitutable. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NetCom once the Telecommunications contractor fulfills all requirements under Ortronics CIP Program.

E. Horizontal Work Station Cable-

1. Superior Essex Series 77 CAT 6, POP Box, CMP, Category 6, 4 twisted pair, 23 AWG, FEP, Station Wire for Plenum air return systems.
2. Wireless Access point location Cable-
   a. Superior Essex 10 Gain CAT 6A, POP BOX, CMP, Category 6A, 4 twisted pair, 23AWG, FEP, Station Wire for Plenum air return systems.

Flame Rating	Jacket	Color	Part No.

CMP Plenum	PVC Alloy	Blue	Cat6-- 77-240-2B Cat6A-- 6A-272-2B
		Light Gray	Cat6—77-240-3B

b. NOTE: Irrespective of air handling space, ISU requires the use of CMP Plenum rated cable for smoke and fire mitigation.

F. Intra-Building Backbone Cable-

1. Superior Essex Power Sum CMP, 51-478-48, Category 5e, 25 twisted pair, 24 AWG, FEP, Riser Cable for Plenum riser systems.
2. Corning fiber optic riser cable to TR/HC, (12) strand single-mode, MIC, TBII tight buffer tube construction, FEP.

G. Workstation Telecommunications Outlet (TO)-

Description	Part No.
Ortronics HDJack Cat 6	HDJ6-13 Ivory Jack
Ortronics HDJack Cat6	HDJ6-36 Dark Blue Jack
Ortronics HDJack Cat6A	HDJ6A-00 Black Jack
Ortronics HD Face Plate	406HDJ13-13 3-Port Wall Plate
Ortronics HD Blank Modules (Pk of Twenty)	OR-HDJB20 Ivory Blank

H. IC/HC ER/TR Patch Panel Data Termination-

Description	Ports	Part No.
Ortronics HD modular patch panel	24	OR-PHDHJU24
	48	OR-PHDHJU48

I. Patch Cords-

Description	Length	Part No.
CAT6 Blue, 4-pair	3 ft.	OR-MC603-06
	5 ft.	OR-MC605-06
	7 ft.	OR-MC607-06
	9 ft.	OR-MC609-06
	15 ft.	OR-MC615-06
	20 ft.	OR-MC620-06
	25 ft.	OR-MC625-06

CAT6A Blue, 4-pair	3 ft.	OR-MC6A03-06
	5 ft.	OR-MC6A05-06
	7 ft.	OR-MC6A07-06
	9 ft.	OR-MC6A09-06
	15 ft.	OR-MC6A15-06
	20 ft.	OR-MC6A20-06
	25 ft.	OR-MC6A25-06

J. IC/HC ER/TR 110 Block Voice Termination-

Description	Part No.
100-pair wall mount 110 Field Termination Block with (20) 110C4 and (4) 110C5 connecting blocks and snap-on label designation field.	OR-110ABC5E100
110C5 Connecting Blocks, five-pair, Pk of ten.	OR-30200110

K. Outside Cable Plant and Termination-

1. Copper and fiber optics pair/strand count, composition and termination to be specified by ISU NetCom per specific project. See 2.2

L. BEF/IC/HC ER/TR Fiber Optic Cabinet and Termination-

1. For Hubbell Next Frame Rack Installations:
   a. Corning CCH-04U Fiber Distribution Center 72/288 fiber optic enclosure.
   b. Corning CCH-CP12-A9 Single-Mode LC connector 12 strand pre-loaded panel.
2. For Hubbell RE4X Cabinet Installations:
   a. Corning SPH-01P 12-Fiber wall panel with LC connectors
   b. Corning CCH-CP12-A9 Single-Mode LC connector 12 strand pre-loaded panel.

M. Grounding and Bonding-

1. Chatsworth Products 40153-012 12” TMGB Pattern ANSI/EIA/TIA Grounding busbar.

N. Equipment Racks and Cabinets-

1. For Standard Equipment and Telecommunications Room Installations:
   a. Hubbell Next Frame 19" x 7’ Equipment rack with 6" Vertical Organizer - 6" wide Z Channel and cover and Horizontal Cable Management. Black finish.
2. For Computer Labs, corridors and/or Zone Installations:
   a. Hubbell RE4X REBOX® Commercial Cabinet, 42.2"H x 24.2"W x 10"D, Light Gray, Pre- Configured.

O. Other-

1. Panduit HLT21-XO Black Velcro 8" Tie Wrap, 10 pack.
2. ERICO, Inc., CADDY CableCat Fasteners ("J" Hooks).
3. Carlon CF4X1C-5200 corrugated FEP orange inner duct.

PART 2 - CABLE PLANT

2.1 EQUIPMENT AND TELECOMMUNICATIONS ROOM REQUIREMENTS

A. Each BEF/IC/ER and HC/TR shall be a stand-alone wiring closet located centrally such that no single UTP horizontal cable run shall exceed 90 meters, when terminated at each end, nor shall horizontal cable runs span floors. There shall be a minimum of one (1) ER/TR per floor in a multi level building. BEF/IC/ER and HC/TR shall not be co-located in custodial, mechanical or other shared space where damage to critical electronics may occur. Each room shall be sized according to use, and meet the below listed criteria. Coordinate with a representative of ISU NetCom prior to installation of backboard, grounding and bonding system, and electrical service.

B. Each BEF/IC/ER shall have a minimum of (2) 4" inside diameter EMT conduits run to each HR/TR. Each conduit shall have (3) 1” corrugated inner-duct installed. (See Conceptual Conduit and Riser drawing at the end of this document)

C. No right angle bends or LBs allowed. 60 degree sweep maximum allowed.

D. Fiber optic cable must be ran in innerduct unless the fiber is an armored fiber.

E. General Requirements

1. Floor Size: BEF/IC/ER 10' x 12' Minimum
2. Floor Size: HC/TR 8' x10' Minimum
3. Floor Surface: Treated concrete or tile.
4. Floor loading: 50 lb/ft2 minimum or as required by applicable codes.
5. Ceiling Height: 8.5 ft above finished floor
6. Door Size: 3' wide and 6.7' tall w/1800 swing awayfrom backboards and racks.

F. Wall Lining (backboard): AC-grade 3/4" x 4' x 8' sheets plywood, with no voids, covered on all sides with two coats flat white fire-retardant paint.

G. Lighting: Minimum 500 lux measured at 3' above finished floor

H. Power: Provide (6) dedicated, isolated, non-switched, 4-way, 120Vac 20Amp circuits. Provide (2) dedicated, isolated, non-switched 30Amp twist lock circuits near equipment rack.

I. Grounding and Bonding: Install a contiguous Intra-building grounding and bonding system in compliance with TIA/EIA-607 using a minimum conductor size of 6 AWG to be located on each plywood backboard with Grounding Bus Bar as directed.

J. Security: Unique telecom key separate from building master, custodial, or mechanical. Location: Room shall be located such that no single horizontal workstation cable shall exceed 90 meters from the TO to the TR/ER termination.

K. HVAC: Maintain constant temperature of 640 - 750 F with minimum of one air change per hour. Networking/Telecommunications equipment heat disapation is estimated at 3000 Watts per hour.

1. 3.7 x 3000 = 11,100 BTU per hour.

2. Fire Protection: As required by applicable codes.

L. Equipment Rack: 7' x 19" equipment rack with wire management (as specified in materials list) and ladder rack shall be provided and installed as directed.

M. No Intra or Inter-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as ballasts, generators, fans, motor control units, motors, etc.

N. The BEF/IC/ER and HC/TR structured cable system shall be constructed using materials as specified in the materials list. Horizontal station cable, riser cables, and fiber optics shall be terminated in the appropriate location on the racking system. Voice cables shall be terminated on the appropriate 110 system. Data cables shall be terminated in the appropriate patch panels. Fiber optics shall be terminated in the appropriate fiber optic termination assembly. Cable termination, order of termination, color-coding, grouping, numbering plan, and labeling shall be performed in accordance with BICSI TDMM Telecommunications Administration and ISU NetCom conventions. Entrance facilities shall be terminated on the backboard with appropriate building entrance protection as specified by ISU NetCom. Riser shall be extended from the backboard building entrance protection panel to the 110 system on the rack. Coordinate with a representative of ISU NetCom prior to installation of BEF/IC/ER and HC/TR distribution and termination hardware.

2.2 ENTRANCE FACILITIES

A. Outside cable plant facility requirements shall be coordinated with ISU NetCom. A minimum of (2) 4" inside diameter schedule 40 PVC conduits shall be run from the BEF/IC/ER to the designated vault or tunnel system. One of the 4" conduits shall have installed (3) 1" corrugated orange inner- duct. Conduits shall be buried a minimum of 24" from the surface on a foundation of 10" wet sand fill. A metallic locator ribbon shall be installed 12" above and parallel to the conduit. There shall be a minimum horizontal separation of 24" from co-located buried electrical service.

B. Outside plant requirements are determined per project. At a minimum, contractor shall ensure entrance facilities will support a multi-exchange carrier WAN environment with provisions for (1) DS3 circuit and (25) pair copper facilities with future expansion to OC48 and (100) pair copper facilities.

C. Grounding and Bonding shall conform to NEC Article 250 and TIA/EIA-607 using a minimum conductor size of 6 AWG.

D. No right-angle bends or LBs allowed. 60 degree sweep maximum allowed.

2.3 HORIZONTAL WORKSTATION CABLE

A. Each Workstation Telecommunications Outlet (TO) shall have (1) Category 6 cable.

B. Each Wireless Access point Telecommunications Outlet (TO) shall have (1) Category 6A cables.

C. In area where an analog connection is deemed necessary a gray Cat6 cable and Ivory jack shall be installed. This cable should run to the closest TR with a 110/66 block.

D. The gray cable and ivory jack shall be designated as analog voice and the blue cable and jack shall be designated for data communications.

E. Each Computer Lab TO shall have (1) Category 6 cable. The blue cables and jacks shall be designated for data communications.

F. Each Telecommunications Outlet (TO) shall have (1) jacks in each outlet plate as follows:

1. Install (1) Blue CAT 6 4-Pair UTP cable terminated at the TO in a Blue RJ45 CAT 6 jack and at the HC/TR in the rack mounted patch panel system.

2. In Areas where an analog connection is deemed necessary a gray CAT6 4-Pair UTP cable and Ivory CAT6 jack shall be installed. This cable should run to the closest TR with a 110/66 block.
3. Each Wireless Access Point Outlet (TO) shall have (1) jacks in each two port housing as follows: Install (1) Blue CAT 6A 4-Pair UTP cable terminated at the TO in a Black RJ45 CAT 6A jack and at the HC/TR in the rack mounted patch panel system.
4. Cables shall be distributed in a horizontal star topology from each TO to the HC/TR. Total terminated length of cable from TO to HC/TR shall not exceed 90 meters total length. Each horizontal cable shall be installed in a "home-run" configuration. No "daisy chained" conduit or cables shall be allowed. No horizontal cable run shall span between floors. A minimum 12” service loop shall be provided at each TO and 24” at each HC/TR.

G. All cables shall be installed using conduit, cable tray, or "J" hooks. Where cables are not installed in conduit or cable tray, the cable shall not be pulled or installed directly across suspended ceiling tiles or fluorescent lights without proper suspension and consideration of possible electrical interference. If "J" hooks are used, avoid placing any pressure or creating stress points on the cable. Maximum spacing between "J" hooks shall not exceed five feet. Suspended ceiling support wires shall not be used to support cables or cable support system(s).

H. At no time shall pulling tension exceed 25 lbs. on horizontal cables. Exceeding the maximum recommended pulling tension during installation of cables will compromise wire integrity. If wire integrity is compromised, the wire may not pass testing and certification standards required for a 1000BaseTX infrastructure. The installing contractor will be responsible for replacement of any cable system that does not pass required certification standards. A representative from ISU NetCom may randomly test cable installations during weekly coordination meetings.

I. Traditional nylon synch style Tie Wraps shall not be used to bundle cables. Only Velcro Tie Wraps are acceptable to bundle cables. Cables shall be dressed in loose, neat

bundles.

J. No Intra-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as ballasts, generators, fans, motor control units, motors, etc.

K. Horizontal UTP station cable shall be terminated at the HC/TR in a manner such that each workstation location will be numbered and terminated in sequential order. Voice (Gray) cable shall be terminated at the 19" x 7' stand alone rack in rack mounted (or backboard mounted) 110 blocks as specified in materials list. Each 100 pair 110 block will support (24) 4-pair cables. Designator strips shall be blue in color. Data (Blue) cables shall be terminated in Ortronics High Density T568A/B wired Patch Panels as specified in materials list and shall be located in 19" x 7' stand alone rack as specified in materials list. Horizontal and vertical fiber optic cable shall be terminated at BEF/IC/ER and HC/TR in Corning fiber optic distribution centers as specified in materials list.

L. Coordinate with a representative of ISU NetCom prior to installation of BEF/IC/ER and HC/TR distribution and termination hardware.

M. Each TO location shall use Ortronics TracJack hardware as specified in materials list. The gray CAT 6 cable shall be terminated in an Ivory HD jack. The Blue and CAT 6 cable(s) shall be terminated TIA/EIA T568A in (1) Blue RJ45 jacks. Striping of cable jacket, untwisting of conductor pairs and termination shall be done using TIA/EIA conventions. 12" of excess, jacketed, cable shall be coiled in the outlet box to accommodate future re-termination. Maintain UTP cable pair twists up to the point of termination (maximum of up to 1/4" jacket removal allowed) at both the station/outlet end as well as patch panel/ block end for each horizontal cable. Take caution as to refrain from physically changing or damaging the shape or geometry of the cable during installation, i.e., do not cinch cable ties too tightly; avoid kinks and sharp bends in cable. Do not place bundles in such a way that the weight of large bundles is damaging the cables on the bottom of the bundle. Each TO wall plate shall be numbered sequentially, consistent with the HC/TR number layout using an acceptable labeling system. Coordinate with a representative of ISU NetCom prior to installation of TO termination hardware.

N. Successful bidder shall test and certify that building wiring meets or exceeds all applicable TIA/EIA 568, 569, 606, 607, etc. conventions and standards. Successful bidder shall test and certify tha building wiring shall support 1000Base TX/FX (gigabit) Ethernet technologies. Ortronics/Superior Essex will extend a nCompass Limited Lifetime Warranty to ISU NeTel once the Telecommunications contractor fulfills all requirements under Ortronics CIP Program. All test results shall be supplied at completion of the project.

2.4 VERTICAL RISER CABLE

A. Install a minimum of (2) 4" conduit paths between the BEF/IC/ER and each HC/TR.

B. No right angle bends or LBs allowed. 60 degree sweep maximum allowed. Any conduit exceeding 100' shall have a pull box every 100'.

C. For each (12) telephone workstation locations there shall be a (25) pair copper riser from the HC/TR to the BEF/IC/ER. Copper riser cable shall be of a 25 Pair Category 5E FEP rated construction as specified in materials list. All riser cable shall be terminated using 110 wiring

D. Distribution systems as specified in materials list. Riser cable shall be terminated on a separate 100 pair block from horizontal station cable. Designator strips shall be gray in color. Coordinate with a representative of ISU NetCom prior to installation and termination of riser cable and termination hardware.

E. Each TR/HC shall have a (12) strand single-mode, MIC, TBII tight buffer tube construction. Fiber optic cable shall be terminated in a Corning cabinet at the BEF/IC/ER and each HC/TR. See materials list.

F. Coordinate with a representative of ISU NetCom prior to installation of fiber optic riser cable.

2.5 PATHWAY SUPPORT SYSTEM

A. All horizontal cable shall be installed using a home-run configuration. Conduit, cable tray or "J" hooks are acceptable in any combination to support the cable system.

1. NOTE: In open ceiling environments, where cable is intentionally or unintentionally exposed to view, the cable shall not be painted,
   a. Cable should be protected from exposure to paint.
   b. Paint products may deteriorate the cable sheath and compromise the integrity of cable conductors.

B. Conduits shall be dedicated, using no smaller than a 1" inside diameter per workstation outlet. There shall be no daisy-chain conduit runs. Each workstation location shall require one 1" conduit, which is a home run back to the appropriate HC/TR or appropriate tray/support system. Provide pull boxes in telecommunications conduit runs spaced not greater than 100 feet apart with no more than two right angle bends. If more than two bends are in any 100-foot section, increase the conduit by one trade size. See TIA/EIA-569-A Section 4.4. Place a "TELECOMMUNICATIONS" label on all pull and junction boxes. If a cable tray system is installed, the conduit shall be a home run from the workstation outlet jack to the tray. Conduit runs shall not exceed 40% fill capacity and bend design as specified in TIA/EIA-569-A documents. Conduits should be sized appropriately.

1. Workstation conduits shall be dedicated 1:1 ratio of conduit to workstation outlet.
2. Workstation conduits shall not be daisy chained or shared between workstation outlets.
3. Conduit runs shall have no more than (2) right angle bends.
4. Conduit fill shall not exceed 40%.
5. Fiber must be ran in innerduct unless the fiber is an armored fiber.

C. Traditional nylon synch style Tie Wraps shall not be used to bundle cables. Velcro style Tie Wraps are the only acceptable method to secure cable bundles. See materials list. At

no time shall pulling tension exceed 25 lbs on horizontal cables. Exceeding the maximum recommended pulling tension on Category 6/6A cables will compromise cable integrity. If wire integrity is compromised, the wire may not pass testing and certification standards required for a 1000BaseTX infrastructure. The installing contractor will be responsible for replacement of any cable system that does not meet required standards.

D. No intra/inter-building telecommunications cable shall be run adjacent and parallel to power cabling. A minimum of 5" distance is required from any fluorescent lighting fixture or power line up to 2kVA and 24" from any power line over 5kVA. Similarly, cable should be routed and terminated as far as possible from sources of EMF, such as generators, motors etc.

2.6 GROUNDING AND BONDING

A. Telecommunications bonding and grounding are additional bonding and grounding installed specifically for telecommunications systems. From a safety code standpoint, the NEC and NFPA 780 already cover such bonding and grounding, however, these codes are established primarily for safety. There are many situations where these codes can be interpreted or implemented in different ways. Some of these ways may not be as suitable as others for equipment protection, reliability, and performance.

B. Establishing a suitable telecommunications ground is critical in protecting and equalizing telecommunications equipment. A proper grounding and bonding infrastructure is essential for the reliable operation of today's sensitive telecommunications equipment and systems.

C. Telecommunications cabling and electrical power cabling must be effectively equalized.

D. The grounding and bonding infrastructure is to originate at the service entrance (electrical power) ground and extend throughout the building to each telecommunications room.

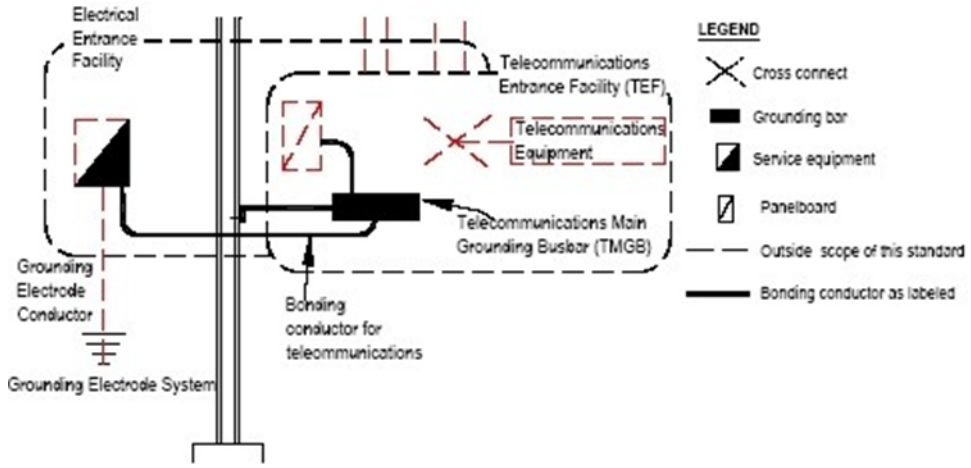
E. Building steel, neither water pipes, nor electrical service sub-panels are acceptable grounding points.

F. Grounding and Bonding shall conform to NEC Article 250 and TIA/EIA-607-A using a minimum conductor size of 6 AWG.

1. Install a contiguous Intra-building grounding and bonding system in compliance with NEC Article 250 and TIA/EIA-607-A.
2. Use a minimum conductor size of 6 AWG
3. Install a grounding busbar on each plywood backboard in each telecommunications room as directed.
4. The grounding and bonding system shall originate at the service entrance (electrical power) ground and be a contiguous intra-building bus as shown in the example drawings.
5. Bond all telecommunications equipment racks, backboards, conduits, and cable trays as

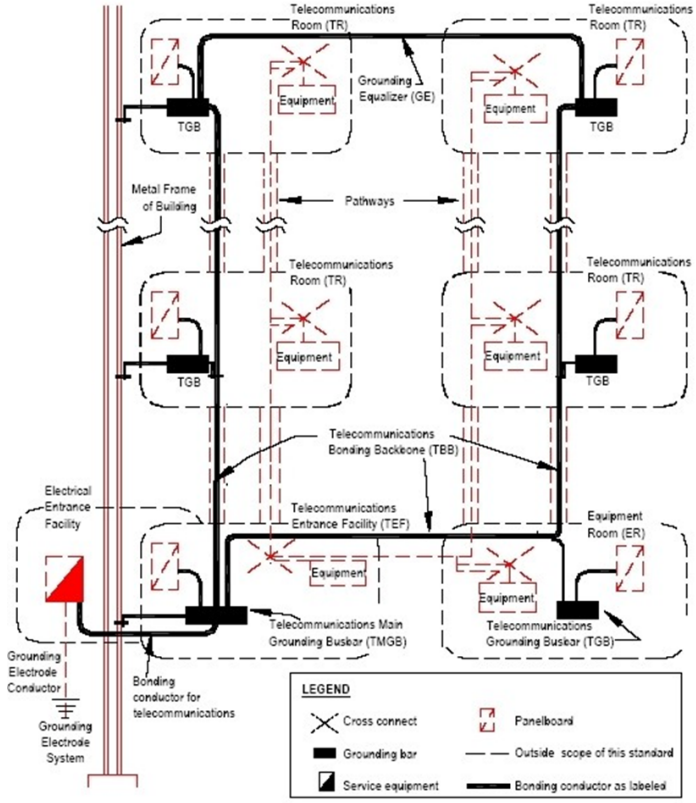
specified in TIA/EIA-607 as shown in example drawings.

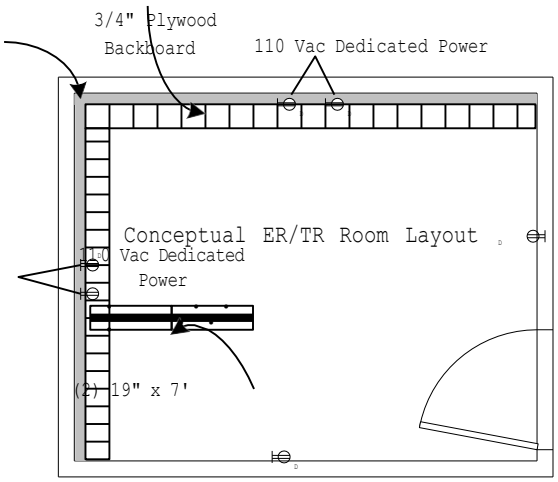
G. Small building grounding and bonding conceptual drawing:

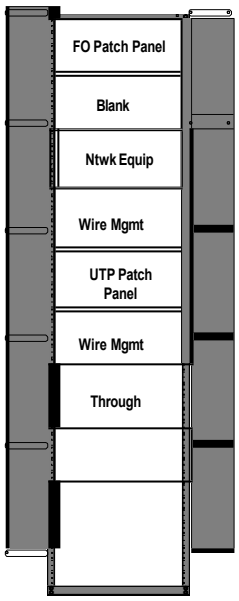


H. Large building grounding and bonding conceptual drawing:

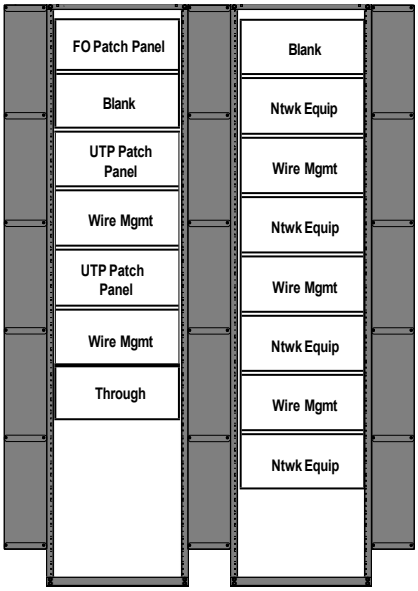
1. Ladder Tray







Conceptual (1) Rack Layout



Conceptual (2) Rack Layout

Glossary:

BDF	Building Distribution Frame	
BEF	Building Entrance Frame	
BET	Building Entrance Termination	
BICSI		Building Industry Consulting Service International
	ER	Equipment Room
HC	Horizontal Cross Connect	
IC	Intermediate Cross Connect IDF	
		Intermediate Distribution
	Frame MC	Main Cross Connect
MDF		Main Distribution Frame
RCDD		Registered Communications Distribution Designer
	TO	Telecommunications Outlet
TR	Telecommunications Room	
UTP	Unshielded Twisted Pair	
FO	Fiber Optics	

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SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, and equipment as required for all excavation, grading, providing borrow materials, hauling, placing and compacting earthwork materials to construct the site to the grades shown on the plans.

B. Prior to commencement of any earthwork, the Contractor shall review the geotechnical reports. The geotechnical report is on file at the office of the Engineer for information only and the Contractor is responsible for making any interpretations there from.

C. Submit to the Engineer's Field Representative load tickets on all materials delivered to the site.

1.2 REFERENCE STANDARDS

A. ASTM D 136 Sieve Analysis of Fine and Coarse Aggregates

B. ASTM D 422 Method for Particle - Size Analysis of Soils

C. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregated Mixtures, Using 5.5-lb Rammer and 12-inch Drop

D. ASTM D 1556 Density of Soil by the Sand-Cone Method

E. ASTM D 1557 Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures, Using 10 lb. Rammer and 10 inch Drop

F. ASTM D 1633 Test Method for Compressive Strength of Molded Soil-Cement Cylinders

G. ASTM D 2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate

H. ASTM D 2487 Classification of Soils for Engineering Purposes

I. ASTM D 2901 Test Method for Cement Control of Freshly-Mixed Soil Cement

J. ASTM D 2922 Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

K. ASTM D 4254 Test Methods for Minimum Index Density of Soils and Calculative of Relative Density

L. OSHA - 1926.650-651 and other applicable sections.

1.3 SUBMITTALS

A. The Contractor shall submit test results of all materials proposed to be used in work in accordance with the requirements of Section 01 33 00 - Submittal Procedures.

B. Submit sieve analysis, moisture density relationship test for both ASTM D698 and D1557, and sand equivalency. The sieve analysis and moisture density relationship tests must have been completed within 12 calendar months from the date of submittal.

1.4 DEFINITIONS

A. Backfill or Fill: (a) Material used to replace material removed during construction or (b) The act of replacing or placing material during construction.

B. Backfill Operation or Fill Operation: The method and the activity required to fill surface depressions and excavations, or to construct fills to required grades.

C. Common Fill: Fill or borrow materials which are naturally occurring and not meeting a specific gradation or classification.

D. Structural Fill: The act of placing common or imported fill material under controlled operation to a certain density.

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. The following types of suitable materials are defined (see Execution for the location where the materials are approved for use or where identified in other specifications and drawings):

1. Common Fill: Fill or borrow materials which are naturally occurring, not meeting a specific gradation or classification, are not Unsuitable Materials, and can be placed in a controlled operation to a certain density.

2. Sand Backfill (Bedding Sand): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a Number 4 sieve and less than 3% passing the No. 200 sieve.

3. Crushed Stone Backfill (Bedding Chips): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements:

Sieve Size	Percent Passing By Weight
1”	100
3/4"	80 - 100
3/8”	20 - 70
No. 4	5 - 20

Sieve Size	Percent Passing By Weight
No. 200	0 - 3

4. Foundation Stabilization Backfill: Uncrushed gravel, and sand with the gradation requirements below. The material shall have a minimum sand equivalent value of 28, sand equivalent not required if less than 5% passing the No. 200 sieve.

Sieve Size	Percent Passing By Weight
3”	100
No. 4	25 - 60
No. 200	0 - 12

5. Coarse Gravel (Drain Rock): Crushed rock or gravel which is free of shale, clay, friable materials, and or debris that conforms to the gradation below. Drain Rock shall have a minimum of 35% Air Voids as determined by ASTM C 29 Standard Test Method for Unit Weight and Voids in aggregate, Jigging Procedure.

Sieve Size	Percent Passing By Weight
3”	100
1”	25 - 60
3/8”	0 - 4
200	0 - 2

6. Aggregate Base (3/4” Road Mix): Crushed aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base. The material shall meet the following gradation requirements:

Sieve Size	Percent Passing By Weight
1”	100
3/4"	90 - 100
No. 4	40 - 65
No. 8	30 - 50
No. 200	3 - 9

a. The sand equivalent value shall be not less than 30, sand equivalent not required if less than 5% passing the No. 200 sieve

b. The material shall have a Los Angeles Abrasion of 35% or less.

7. Aggregate Subbase (Pit Run): Uncrushed rock aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable subbase. The material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
4”	100
3”	90-100
No. 4	30-75
No. 200	0 – 15.0

a. The sand equivalent value shall be not less than 30, sand equivalent not required if less than 5% passing the No. 200 sieve.

b. The material shall have a Los Angeles Abrasion of 40% or less.

8. Imported Trench Backfill (8” Pit Run): Uncrushed rock aggregate material that can be compacted readily by watering and rolling to form a firm stable trench. The sand equivalent value shall be not less than 25, sand equivalent not required if less than 5% passing the No. 200 sieve, and the material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
8”	100
No. 4	15 - 60
No. 200	0 - 12

9. Granular Borrow: Provide sand, sand and gravel, or sand and rock mixtures with a sand equivalent greater than 30. Sand equivalent is not required if the material has less than 5 percent passing the No. 200 sieve.

10. Trench Plug Material: Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10.

11. Topsoil: Excavated material that has a friable, loamy character and contains organic matter amount normal to the region. Obtain soil from well-drained arable land that does not contain subsoil, refuse, roots, heavy or stiff clay, stones larger than 1-inch, coarse sand, sticks, brush, litter, pesticides, contaminated soil, noxious weeds, or other material detrimental to vegetative growth and establishment. Test sources if noxious weeds are located within or adjacent to the source site and obtain approval from the Owner that the source is acceptable to use on the project site. Incorporate vegetative matter into topsoil, except brush, trees, or noxious weeds. Other deleterious material (e.g. plastic, glass, metal, rocks) will not exceed 0.1 percent by weight or volume. Remove and dispose of vegetation at topsoil sources before taking materials from the source. Topsoil material shall meet the following gradation and chemistry requirements:

Sieve Size	Percent Passing By Weight
1”	98 - 100
No. 4	95 - 100
No. 8	80 - 100
No. 200	15 - 80

Property	Minimum	Maximum
pH[1]	5.5	7.8
ESP[2]	--	10.0
EC[3]	--	8.0
Organic Material	0.5	15.0

[1] pH: Negative logarithm of the hydrogen ion concentration

[2] ESP: Exchangeable sodium percentage

[3] EC: Electrical conductivity, milliohms per cm at 77 °F

12. Rip Rap: Riprap material shall be hard, durable, angular in shape and free from overburden and organic material. The breadth or thickness of any stone shall not be less than one-third of its length. The minimum unit weight of the stone shall be 165 pounds per cubic foot. Riprap material shall have less than 10 percent loss after five cycles in the sulfate soundness tests and shall conform to the following gradation:

Weight of Stones	Percent of Total Weight Less than the Stone Weight
200 lbs	100
130 lbs	80
90 lbs	50
25 lbs	10 max.

13. Gravel Surfacing: Meet the following requirements for gravel surfacing, including added binder or blending material:

Sieve Size	Percent Passing By Weight
3/4"	100
No. 4	40-80
No. 10	25-60
No. 200	8-20

a. Dust Ratio: the portion passing the No. 200 (0.075 mm) sieve cannot exceed two-thirds of the portion passing the No. 40 (0.425 mm) sieve.

b. For material passing the No. 40 (0.425 mm) sieve, the liquid limit must not exceed 35 and the plasticity index must not be below 6 or above 12.

c. A wear factor not exceeding 40% at 500 revolutions.

d. At least 35% by weight of the aggregate retained on the No. 4 (4.75 mm) sieve must have one fractured face.

14. RAP Surfacing: Unprocessed Recycled Asphalt Pavement (RAP) that has not been processed for gradation and binder content uniformity. RAP stockpile may be from different sources of unprocessed RAP together provided it is generally free of contamination from dirt, debris, clean stone, concrete, etc. Provide unprocessed RAP that has 100 percent passing the 5/8-inch sieve.

15. Non-Frost Susceptible Material: Granular material with the following gradation and a Plastic Index less than 6 for the material passing the No. 40 sieve. The material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
3/4"	100
1/2"	70 - 95
No. 4	40 - 75
No. 8	25 - 55
No. 40	10 - 30
No. 200	0 - 6

16. MSE Wall Backfill: Sand and gravel or sand and rock mixture with a Plastic Index less than or equal to 6. The Material shall meet the following requirements:

Sieve Size	Percent Passing By Weight
1”	100
3/4”	75 - 100
No. 4	40 - 70
No. 40	10 - 60
No. 200	0 - 5

17. Athletic Field Root Zone Mix: Material to be pre-mixed off-site and delivered to site. Comprised of snake river dredge sand and 10-15% soil compost by loose volume.

    a. Snake River Dredge Sand: A coarse, washed, river sand.

    b. Soil Compost: Well-composted organic matter following the guidelines and tested to meet the US Composting Council's seal of testing assurance. The material shall have particle sizes ranging from 1/8" to 3/16". Material which is coarser or finer or that contains decomposed peat moss is not acceptable.

18. Filter Sand: Aggregate of natural sand or other approved inert materials composed of hard, strong, and durable particles conforming to the requirements of ASTM C-33 except as modified herein.

    a. Use only aggregates that include deleterious substances not exceeding the following:

Type	Percent Passing By Weight
Clay Lumps	0.50
Coal and Lignite	0.30
Other Deleterious Substances	2.00
Deleterious Material passing No. 200	1.75

    b. Moisture content of fine aggregate shall not exceed 8 percent.

    c. Aggregate that is uniformly graded from coarse to fine within the following gradation as follows:

Sieve Size	Percent Passing By Weight
3/8”	100
No. 4	95 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	2 - 10
No. 200	0 - 4

2.2 UNSUITABLE MATERIALS

A. Unsuitable material include the materials listed below:

1. Soils which, when classified under ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the classification of Pt, OH, CH, MH, or OL.

2. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use.

3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.

4. Soils that contain greater concentrations of chloride or sulfate irons, or have a soil resistively or pH less than the existing on-site soils.

PART 3 - EXECUTION

3.1 PREPARATION

A. Notify Engineer prior to starting any grading operations.

B. Identify required lines, levels, contours and datum.

C. Identify and flag surface and aerial utilities, known underground utilities locations.

D. Maintain and protect existing utilities which pass through the work area.

3.2 SITE CONTROL

A. Unfavorable Weather: Do not place, spread, or roll any fill material during unfavorable weather conditions. Do not resume operations until moisture content of material is satisfactory.

B. Flooding: Provide berms or channels to prevent flooding or saturation of subgrade. Promptly remove all water collecting in depressions.

C. Softened Subgrade: Where soil has been softened or eroded by flooding or placement during unfavorable weather, remove all damaged areas and recompact as specified for fill.

D. Dust Control: Use all means necessary to control dust on and near the work and on and near all off-site borrow areas as specified in Section 01 50 00 – Temporary Facilities and Controls. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors, residents, properties, and concurrent performance of other work on the site.

E. Noise Control: Use equipment that is equipped with adequate noise attenuation devices.

3.3 OFF-SITE IMPACTS

A. Comply with all traffic and hauling requirements of the State and County.

B. Provide all signing, flagmen, or other special traffic control required to provide for the safety of the public.

C. Use only vehicles approved for highway use and comply with all load requirements.

D. Provide wheel cleaning as required to minimize the tracking of materials onto public roadways.

3.4 PROTECTION

A. Protect trees and other features to remain as a portion of the final landscaping or project.

B. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from equipment and vehicular traffic.

C. Protect above and below grade utilities which are to remain.

D. Notify Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume work.

E. Protect bottom of excavations and soil adjacent to and beneath foundation from frost.

F. Grade excavation top perimeter to prevent surface water runoff into excavation.

3.5 EXCAVATION

A. Excavate all cut areas to the grades shown on the plans.

B. Excavate all areas that have excessive moisture content and cannot be compacted to the required densities.

C. Correct unauthorized excavation at no cost to the Owner.

D. Excavate or scarify and aerate soils with excessive moisture content, and allow to dry.

3.6 SUBGRADE PREPARATION

A. Excavate to subgrade elevation.

B. In the presence of a materials testing company, thoroughly proofroll with a loaded tandem-axle dump truck with a minimum weight of 20 tons, or 40-ton static roller.

C. Areas where soft or disturbed conditions are identified, excavate, remove and dispose of unsuitable soft spot material. If the material is suitable except for excessive moisture content, scarify and dry the material to the acceptable moisture content, or replace with Engineer approved materials, and recompact to the density of the material to place over the area. Soft sport repair shall be incidental to the Work. No special payment will be made for soft spot repair.

D. The Contractor’s materials testing company to submit a subgrade inspection report noting the means and methods used to proofroll the subgrade and any corrections or repairs made.

3.7 PREPARATION OF FOUNDATION

A. Building Subgrade:

1. Pers Specification.

B. All other areas:

1. Per Specification.

3.8 CONSTRUCTION OF EMBANKMENTS

A. Fill areas to contours and elevations as shown on the plans. Do not use frozen materials.

B. Place and compact fill materials in continuous lifts not exceeding six (6) inches in depth, unless specifically allowed.

C. Employ a placement method so as not to disturb or damage utilities in trenches.

D. Maintain optimum moisture content of materials to attain required compaction density.

E. Make smooth changes in grade. Blend slopes into level areas.

3.9 IMPORTED STRUCTURAL FILL

A. Aggregate Subbase and Base, granular borrow, and common fill material under parking areas, drive lanes, and vehicle traffic areas, shall be compacted to at least 95% of the maximum dry density as determined in accordance with ASTM D698. Maximum loose lift thickness for aggregate base shall not exceed 8 inches. Maximum loose lift thickness for aggregate subbase, granular borrow, and common fill shall not exceed 10 inches.

B. Aggregate Subbase and Base material under buildings, including 4 feet outside the building area, and under equipment pads shall be compacted to at least 95% of the maximum dry density as determined in accordance with ASTM D1557. Maximum loose lift thickness for aggregate base shall not exceed 8 inches and aggregate subbase shall not exceed 10 inches.

C. Granular material with more than 30% by weight retained on the 3/4-inch sieve shall be compacted to a minimum 75 percent of maximum index density as determined by ASTM D4253 and D4254. Drain rock and crushed stone backfill material does not require compaction.

3.10 DISPOSAL OF WASTE SOIL

Contractor shall dispose of waste material at an off-site location determined by the Contractor.

3.11 QUALITY CONTROL

A. Material & Compaction Testing: All soils testing of samples submitted by the Contractor will be done by an independent testing laboratory mutually agreed upon by Contractor and Owner and at the Owner's expense. If tests indicate work does not meet specific compaction requirements, remove work, replace, and retest at the Contractor's expense.

1. Qualifications of testing company

a. Basic requirements of ASTM E 329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials as Used in Construction" and ASTM D 3666, "Standard Specification for Minimum Requirements for Agency Testing and Inspecting Bituminous Paving Materials", as applicable.

b. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

2. Frequency of Compaction Tests

a. Curbs and sidewalks: In horizontal plane, test at start with subsequent tests a maximum of every 250 feet. At landscape islands test each island at one location. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change. Perform a minimum of two (2) tests at finished grade.

b. Parking and vehicle areas, roadways: In horizontal plane, test each backfill area with subsequent test for every 2,500 square feet of backfill surface area. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change.

c. Concrete slabs for buildings, patios, concrete plaza, and entry slabs: In horizontal plane, test each backfill area with subsequent test for every 1,000 square feet of backfill surface area. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change.

d. Linear foundations and footings: In horizontal plane, test at start with subsequent tests a maximum of every 100 feet, and where elevation changes between adjacent footings. At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change. Perform a minimum of two (2) tests at finished grade.

e. Along exterior basement walls and retaining walls: In horizontal plane, test each backfill area with subsequent test for every 100 lineal feet of wall, a minimum of two test per exterior wall side, At every horizontal location, obtain one test at subgrade. Perform subsequent tests every 12 inches of compacted depth and at top of backfill or when materials or procedures change.

3.12 TOLERANCES

A. Finished grade of graded areas shall meet the following requirements:

1. In paved areas including roadways, sidewalks, parking lots, etc., plus or minus 0.10 feet from the grade shown on the plans.

2. Building pads, plus or minus 0.05 feet from the grade shown on the plans.

3. In landscaped areas or similar areas, plus or minus two (2) inches.

4. Differential grades between walking surfaces shall not exceed 1/4-inch.

5. Landscape finish grade adjacent to concrete walks shall be minus 1-inch from walking surface elevation.

END OF SECTION 31 00 00

SECTION 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all excavation of trenches, bedding, and backfilling work for construction of piping.

B. Excavation of trenches shall include all material excavated or removed regardless of type, character, composition or condition of the material.

1.2 SUBMITTALS

A. The Contractor shall submit samples of all materials proposed to be used in work. Sample sizes shall be determined by the testing laboratory.

1.3 DEFINITIONS

A. Pipe Zone: That portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane 6 inches above the top of the pipe.

B. Trench Zone: The portion of the vertical trench cross-section lying between the Pipe Zone and a point 18 inches below the finished grade.

C. Final Backfill: The portion of the vertical trench cross-section within 18 inches of finished grade.

D. Pipe Bedding: Material placed below the pipe and in the Pipe Zone.

E. Springline: The center axis of the pipe.

F. Trench Backfill: Material placed from the top of the Pipe Zone to finished grade.

G. Trench Foundation Material: Material placed below the Pipe Bedding.

PART 2 - PRODUCTS

2.1 PIPE BEDDING MATERIAL

A. Pipe bedding shall consist of crushed stone backfill (bedding chips) material per Section 31 00 00 - Earthwork.

2.2 TRENCH BACKFILL MATERIAL

A. Excavated trench material may be used as follows:

1. Excavated trench material shall be free from cinders, ashes, refuse, organic and frozen material, boulders with any dimension exceeding 8 inches, or other unsuitable material per Section 31 00 00 - Earthwork.

2. Material with excessive or deficient moisture content will not be considered as unsuitable if the moisture content can be adjusted to a level that allows obtaining compaction.

3. Imported backfill material shall conform to imported trench backfill (8" Pit Run) per Section 31 00 00 - Earthwork.

2.3 FOUNDATION STABILIZATION

A. Trench foundation material shall consist of foundation stabilization backfill material per Section 31 00 00 - Earthwork.

2.4 IDENTIFICATION TAPE AND LOCATING WIRE

A. Locating wire shall be No. 12 AWG insulated cooper locating wire with 1/64" PVC insulation.

B. Identification tape shall be 3-inches wide, 4 mil polyethylene vinyl. Tape text and color shall meet the following requirements

Pipe Contents	Text	Color
Potable Water	"CAUTION – WATER LINE BURIED BELOW"	Blue
Pressure Sewer	"CAUTION – SEWER LINE BURIED BELOW"	Green
Reclaimed Water	"CAUTION – RECLAIMED WATER LINE BURIED BELOW"	Purple
Pressure Irrigation	"CAUTION – IRRIGATION LINE BURIED BELOW"	Purple
Gas	"CAUTION – GAS LINE BURIED BELOW"	Yellow
Telephone	"CAUTION – PIPE LINE BURIED BELOW"	Yellow
Cable TV	"CAUTION – PIPE LINE BURIED BELOW"	Yellow
Electric	"CAUTION – ELECTRICAL LINE BURIED BELOW"	Red

PART 3 - EXECUTION

3.1 EXISTING UTILITIES:

A. The Contractor shall be fully responsible for any and all damage to existing or constructed utilities, and shall repair damages in accordance with utility owner's requirements at no additional cost to the Owner. It shall be the Contractor's responsibility to coordinate and notify all affected utility owners. Call 811 Dig-Line before commencing construction.

1. Parallel Utility Support: Work associated with parallel utility support and utility crossings shall be incidental to the work unless a specific bid items is provided for parallel utility support.

2. Utility Crossing Support: All utilities that interfere with the construction of the trenching and pipe installation shall be temporarily supported in accordance with the utility owner's requirements. Work associated with utility crossings support shall be incidental to the work unless a specific bid items is provided for utility crossing support.

3. All crossing utilities shown on the plans and marked by Dig-Line shall be vertical and horizontally located, in a non-destructive manner, prior to construction to verify pipe elevation, materials, and diameter. This information shall be provided to the Engineer for evaluation of conflicts prior to construction. All potholes shall be backfilled immediately after obtaining information.

3.2 TRENCH EXCAVATION

A. Trenches shall be excavated to lines and grades shown on the drawings, with a minimum width at the top or crown of the pipe not to exceed the outside diameter of the pipe plus 2'. In the event the Contractor should over excavate in width or depth without the Engineer's approval, he shall provide pipe bedding for the full length of the over excavation. No special payment will be made for work caused by over excavation.

B. Trench shall be kept free from water at all times to facilitate fine grading, proper laying and joining of pipe, and prevention of damage to completed joints.

C. If the trench bottom is disturbed during excavation, compact trench bottom to 95% maximum density of the standard proctor, ASTM D698.

D. The Contractor shall conduct trench operations in such a manner as to provide adequate safety precautions for workmen, adjacent property, or the public at all times by use of adequate sheeting, shoring, or bracing to sustain stability of the trench floor and walls. The Contractor shall furnish, place, and maintain such shoring as may be required to support sides of the trench. Costs of shoring and bracing shall be considered incidental to trench excavation and backfill.

E. The Contractor shall conduct trench operations in such a manner as to provide adequate safety precautions for workmen, adjacent property, or the public at all times by use of adequate sheeting, shoring, or bracing to sustain stability of the trench floor and walls. The Contractor shall furnish, place, and maintain such shoring as may be required to support sides of the trench.

3.3 PIPE BEDDING

A. Place bedding in layers no thicker than 6 inches. Allow for bedding depth around pipe bells. Place bedding at least 4 inches below the pipe and 6 inches above the pipe.

B. Shovel slice and tamp to ensure that the bedding material is firmly placed.

C. Following placement of pipe, place additional bedding material up to the springline of the pipe. Shovel slice and tamp to ensure that the bedding material fills in and supports the pipe haunch area.

D. In 6 inch lifts, place additional bedding layers from the pipe springline to 6 inches above the pipe.

3.4 TRENCH BACKFILL

A. All tunnel related backfill activities may not be completed until the tunnel lid for the tunnel has been cast and the concrete has met 4,000 psi compressive strength per Section 033000 – Cast-In-Place Concrete.

B. All backfill material shall be placed in layers not to exceed 8-inch maximum loose lift thickness for native material and 12-inch maximum loose lift thickness for imported aggregate backfill.

C. The entire trench shall be compacted to 95% maximum density of the standard proctor as determined by ASTM D-698.

D. Trenches under buildings and structures shall be compacted, the entire depth, to 95% maximum density of the modified proctor determined by ASTM D1557.

3.5 IDENTIFICATION TAPE AND LOCATING WIRE PLACEMENT

A. Unless indicated otherwise, attach locating wire to the crown of all buried pipelines using electrical tape, except gravity irrigation, sanitary sewer, or storm sewer mains having visible manholes or clean-out structures at all angle points. Provide 12” of slack wire above ground at each location of valve or wire box.

B. Unless indicated otherwise, identification tape shall be placed above all buried pipelines, 18” - 24” above the crown of the pipe, except gravity irrigation, sanitary sewer, or storm sewer mains having visible manholes or clean-out structures at all angle points.

C. Unless indicated otherwise, identification tape shall be placed above all buried pipelines that are installed with locating wire. Identification tape shall be placed 18” - 24” above the crown of the pipe.

3.6 QUALITY CONTROL

A. Material & Compaction Testing: All soils testing of samples submitted by the Contractor will be done by a testing laboratory mutually agreed upon by Contractor and Owner and at the Owner’s expense. If tests indicate work does not meet specific compaction requirements, remove work, replace, and retest at the Contractor’s expense.

1. Qualifications of testing company

a. Basic requirements of ASTM E 329, “Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials as Used in Construction” and ASTM D 3666, “Standard Specification for Minimum Requirements for Agency Testing and Inspecting Bituminous Paving Materials”, as applicable.

b. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

2. Frequency of Compaction Tests

a. Test section shall be a test at 2-feet above top of pipe and every 1-foot lift thereafter and at the top of the trench backfill.

b. Two (2) test sections, at different locations for every trench less than 300 feet in length, but not less than once per day.

c. One (1) test section per every 300 feet of additional trench and at locations where materials or construction procedures change, but not less than once per day.

3.7 CLEANUP

A. Surplus excavated material or stripped material not salvaged as topsoil and excavated material not meeting the requirements for backfill shall become waste. All waste material shall be disposed of by the Contractor.

END OF SECTION 31 23 33

SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all labor, equipment and materials as required to provide new pavement, and to repair existing asphalt surfaced, streets, roads, driveways, or other similar improved areas damaged or removed by excavations.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Superpave Hot Mix Asphalt: Submit job mix formula and ITD approval letter of previously approved Mix Design. Prepare a submittal that includes:

1. The original approved mix design that includes the confirmed JMF from the previous project;

2. adjustments made to the JMF that make it the C-JMF;

3. adjustments made to the C-JMF during production;

4. documentation supporting these adjustments.

5. Current Stockpile Quality Control testing that includes the following to confirm the material in stockpile is similar to the material used for the original mix design, including RAP:

a. Sieve analysis on the stockpiles to be used, including crusher control charts;

6. Note: Previously used mix designs that are used during the calendar year of confirmation may omit Step 5 if the stockpiles consist of the crushed material, including RAP, from the original mix design. Previously used mix designs that more than one calendar year has elapsed from the time of confirmation must include Step 5.

7. JMF with a content of more than 30% recycle asphalt pavement (rap) will not be accepted, regardless of prior ITD approval.

C. Material Test Reports: For each paving material.

1.3 QUALITY CONTROL

A. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated.

B. Pre-Paving Conference: Conduct conference at Project Site. Immediately before paving, the Contractor, the asphalt supplier, the Engineer, and the Owner personnel involved in the paving operation will hold a pre-paving conference to discuss the means that will achieve the highest quality surface.

1. Before the pre-paving conference, submit a Superpave HMA paving plan to the Engineer. Tailor the plan to the asphalt to be supplied, the anticipated JMF, and the Contractor's equipment and operation. Include at least the following:

a. Breakdown, intermediate, and finish rollers to be used

b. Static or vibratory rolling for breakdown and intermediate rolling

c. Frequency, amplitude, force/impact, and roller velocity for vibratory rolling

d. Proximity of breakdown roller to paver with respect to horizontal displacement

e. Proximity of intermediate roller to breakdown roller

f. Compaction temperatures for breakdown, intermediate, and finish rolling

g. Adjustments to paving/compaction operation with respect to temperature, amplitude, frequency, lift thickness, gradation, force/impact, and roller velocity

h. Rubber tired rolling with respect to pickup of pavement material

i. Paving equipment and preheating and vibratory settings of the screed

j. Coordination of plant production and paving operations; climate, haul distance

k. Surface and air temperatures anticipated during production

l. Temperature necessary to allow public traffic onto the new pavement surface

m. Anticipated traffic control issues as necessary

n. Additional equipment required

o. Inspection, sampling and testing requirements

p. Other paving issues as necessary

PART 2 - PRODUCTS

2.1 PLANT MIX PAVEMENT

A. General: Superpave hot mix asphalt shall conform to the 2012 Idaho Department of Transportation Standard Specifications for Highway Construction, Section 405.

1. Mixture Type: SP3 (SP2 could be used on small applications if SP3 isn't available – call the local asphalt contractor).

2. Grade of Asphalt: PG 64-28

3. Aggregate Size: 1/2"

4. Anti-Stripping Additive: Provide anti-stripping additive if the immersion compression retained strength (ASTM T165) of the design mix is less than 70 percent of the dry compressive strength. Anti-stripping additive shall be added at the refinery at a rate of 0.5 to 1.0 percent of asphalt cement as determined by laboratory test.

2.2 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, or crushed gravel.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, or combinations thereof.

1. For plant mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.3 AUXILIARY MATERIALS

A. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not place pavement on a wet or frozen surface or when weather or surface conditions will otherwise prevent the proper handling or finishing of the pavement placement.

B. Air and Surface Temperature Limitations:

Compacted Thickness of Individual Courses	Top Course	Leveling and Courses Below the Top Course
Less than 1.5”	60°F	-
1.5” to 3”	50°F	40°F
Greater than 3”	40°F	40°F

C. Asphalt concrete shall not be placed when the surface and atmospheric temperature is below 40 degrees F, if rain is imminent or expected before time required for adequate cure, or if subgrade is wet or excessively damp.

3.2 SURFACE PREPARATION

A. Aggregate base shall be provided where indicated to the thickness indicated. The compacted surface of the finished aggregate shall be hard, uniform, smooth and at any point shall not vary more than 0.02 feet from the indicated grade or cross-section.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed at no cost to the Owner.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Verify that subgrade is dry and in suitable condition to begin paving.

E. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, plant mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying plant mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.3 PATCHING

A. Plant Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches minimum into adjacent sound pavement. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Patching: Fill excavated pavements with plant mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.4 SUPERPAVE HOT MIX ASPHALT PAVING

A. Machine place Hot Mix Asphalt on prepared surface, spread uniformly, and strike off. Place Hot Mix Asphalt by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place Hot Mix Asphalt base course in number of lifts and thicknesses indicated.

2. Place Hot Mix Asphalt surface course in single lift.

3. Spread mix at minimum temperature of 250 deg F (121 deg C).

4. Begin applying Hot Mix Asphalt along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place Hot Mix Asphalt in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with plant mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of Hot Mix Asphalt courses.

1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.

3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method.

5. Compact joints as soon as Hot Mix Asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.6 COMPACTION

A. General: Begin compaction as soon as placed plant mix paving will bear roller weight without excessive displacement. Compact plant mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Do not operate vibratory rollers in the vibratory mode when the internal mix temperature is less than 175 °F or when checking or cracking of the mat occurs at a higher temperature.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while plant mix asphalt is still hot enough to achieve specified density. Continue rolling until plant mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while plant mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, plant mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Surface Course: 1/8 inch.

2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Corrective Actions:

1. Grind the asphalt pavement to within the surface smoothness tolerance, if thickness permits in accordance with the above criteria.

2. All grinding shall be done parallel to centerline. Adjacent grinder passes within any single ground area shall be extended to produce a neat rectangular area having a uniform surface appearance. At transverse boundaries between ground and unground areas, smoothly feathered transitions shall be made.

3. The Contractor shall check the pavement for smoothness after grinding, in accordance with this specification and shall make any additional corrections necessary to the pavement to achieve smoothness.

4. After grinding has been completed, the ground pavement surface shall receive a fog coat at a rate approved by the Engineer.

5. The cost of such grinding or milling, and all related work such as fog coat, disposal of milled material, traffic control, flagging, profiling, surface repair of ground or milled areas, and temporary pavement markings shall be at the Contactor’s expense.

6. If correction of the pavement as listed above will not produce satisfactory results as to smoothness, or will reduce pavement thicknesses and serviceability excessively, the pavement shall be removed and replaced or overlaid to correct the deficiency at no additional cost to the project.

3.8 FIELD QUALITY CONTROL & ACCEPTANCE

A. Thickness: The Contractor shall extract core samples from the in-place compacted plant mix pavement. Thickness will be determined according to ASTM D 3549.

1. Take two samples minimum. Take one core samples for every 3,500 square feet, at least one sample every day.

2. Tolerance: Plus 1/4 inch (6 mm), no minus.

3. If more than 25% of pavement core samples fail to meet thickness requirements with a tolerance of 0-1/4" minus of the project requirements, or if more than 10% fail to meet thickness requirements with a thickness deficit greater than 1/4", corrective actions shall be taken at no additional cost to the Owner.

4. Corrective Actions:

   a. Install 1.5-inch asphalt overlay with same Job Mix Formula and Plant Mix Pavement, if grades allow, or

   b. Remove and replace pavement to specified thickness, grades, and smoothness.

   c. If allowed by the Engineer, adjusts price for asphalt pavement that does not meet thickness requirements in accordance with the following pay factor (PF) reductions:

      1) If thickness is ≥ 100% of Required Thickness, PF = 1.0.

      2) If thickness is 1/4" less than the Require Thickness, PF = 0.80.

      3) If thickness is 1/2" less than the Require Thickness, subject to rejection, if allowed to remain in place, the PF will be 0.75.

5. Core Samples during Pavement Placement: If cores are taken during placement of pavement, fill core sample holes with hot mix asphalt.

6. Core Samples after Pavement Placement: If cores are taken after placement of pavement, fill core sample hole with 4,000 psi concrete. Prevent concrete from staining asphalt pavement by using a plastic sheet around the core hole while filling with concrete. Tap plastic sheet down.

B. The relative density after compaction shall be 92-96 percent of the density obtained by using ASTM D 1188 or D 2726. A properly calibrated nuclear asphalt testing device shall be used for determining the field density of compacted asphalt concrete, or slabs or cores may be laboratory tested in accordance with ASTM D 1188.

3.9 CLEAN-UP

A. After Work of this Section is complete, remove all debris, rocks, gravel, excess asphalt.

END OF SECTION 32 12 16

SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Pavement marking materials and installation.

B. Reflectorized thermoplastic pavement markings.

1.2 SUBMITTALS

A. Submit manufacturer's certification that paint meet or exceed specified requirements.

1.3 STORAGE AND HANDLING

A. Store paint in an area prepared to contain spills and prevent contamination of storm water.

PART 2 - MATERIALS

2.1 PAVEMENT PAINT (WATERBORNE)

A. Paint to be waterborne with volatile organic compound (VOC) less than 150 g/L.

B. Paint to conform to either the current Idaho Waterborne Traffic Line Paint Specifications or to Federal Specification TT-P-1952-D with the following modifications:

1. Viscosity: 80-95 K.U. per ASTM D 562.

2. Total Nonvolatile Solids: 75% minimum per ASTM D 2369.

3. Scrub Resistance: 1,000 cycles minimum per ASTM D 2486.

4. pH: 9.6 S.U. minimum per (ASTM E 70).

C. Paint Colors: Meet the Federal Test Standard 595 with color chip designations:

1. White: 37875.

2. Yellow: 33538.

3. Blue: OSHA Handicap Blue

2.2 SOURCE QUALITY CONTROL

A. Provide test and inspection reports required of the Manufacturer.

B. Inspect material shipping lists to verify type, class, thickness and marking information required by the Standard for paint.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Airless spray-type marking equipment, compatible with waterborne paint, and capable of providing a uniform wet film thickness of 15 ± 2 mils.

3.2 EXAMINATIONS

A. Verify that pavement preparation work is complete prior to painting operations.

B. Verify paint delivered to the site meet the requirements of the Contract Documents.

C. Verify pavement has had cure time exceeding 7 days.

D. Verify size and dimension of pre-formed thermoplastic markings.

3.3 PAINT APPLICATION

A. Pavement surface must be clean and thoroughly dry.

B. Ambient air temperature must be above 50°F.

C. Paint stripes to be uniform and free of erratic waves.

D. Width and location of marking to be as designated in the drawings and be within a tolerance of 5%.

E. Paint stripes must not deviate from the intended alignment by more than 2 inches in 100 feet.

F. Apply paint in accordance with the manufacturer's recommendations.

G. Apply painted pavement markings (school crosswalk text, RR crossings, turn arrows, etc.) using an approved template.

H. Mix paint thoroughly prior to application.

I. Do not thin paint.

J. Apply paint at a rate of not more than 100 square feet/gallon.

K. All pavement markings to conform to the MUTCD.

L. If paint is unagitated for a period greater than 15 minutes, thoroughly agitate until the mixture is homogeneous prior to continuance of application.

END OF SECTION 32 17 23

SECTION 32 17 26 – TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes Specifications for furnishing and installing Cast In Place Replaceable Tactile Warning Surface Tiles (REP) with an in-line truncated dome pattern, embedded in all curb ramps and walking surfaces at the locations and to the dimensions shown on the Drawings, in accordance with the Contract Documents and as directed by the Engineer.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specifications, apply to this Section.

B. Americans with Disabilities Act (ADA) Title 49 CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces. FHA Memo (5-06-02) titled Truncated Domes. Federal Register Volume 71, No. 209, 49 CFR Part 37 (10-30-06), ADA Standards for Transportation Facilities (11-29-06, DOT): Sections 406, 705, and 810. ADA Standards for Accessible Design – 2010 (9/05/11, DOJ), ADAAG: Sections 705 and 810. Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board), PROWAG: Sections R208, R304, R305, R308, and R309.

C. American Society for Testing and Materials (ASTM) Test Methods B117, C501, C1028, D543, D570, D638, D695, D790, G151, G155, and E84.

D. American Association of State Highway and Transportation Officials (AASHTO): Test Method AASHTO-H20.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s literature describing products, installation procedures and maintenance instructions.

B. Shop Drawings: Submit Standard Manufacturer Shop Drawings showing all pertinent characteristics of the composite Cast In Place Replaceable Tactile Warning Surface Tile (REP), including profile, sound on cane contact amplification feature and installation methods.

C. Material Test Reports: Submit current test reports from qualified, accredited independent testing laboratory in accordance with ASTM guidelines and indicating that materials proposed for use are in compliance with specification requirements and meet the properties indicated. All test reports submitted shall be representative of the Cast In Place Replaceable Tactile Warning Surface Tile (REP) delivered to the Project.

D. Maintenance Instructions: Submit copies of manufacturer’s specified maintenance practices for each type of Tactile Warning Surface Tile and accessory.

1.4 QUALITY ASSURANCE

A. Provide composite Cast In Place Replaceable Tactile Warning Surface Tiles (REP) as produced by a single manufacturer with a minimum of five years' experience in manufacturing Cast In Place Replaceable Tactile Warning Surface Tiles (REP).

B. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) shall meet or exceed the following test criteria using the most current test methods:

1. Compressive Strength: 28,900 psi minimum, when tested in accordance with ASTM D695.

2. Flexural Strength: 29,300 psi minimum, when tested in accordance with ASTM D790.

3. Water Absorption: Not to exceed 0.10%, when tested in accordance with ASTMD570.

4. Slip Resistance: 1.05 minimum wet and 1.18 dry static coefficient of friction when tested in accordance with ASTM C1028.

5. Flame Spread: 25 maximum, when tested in accordance with ASTM E84.

6. Salt and Spray Performance of Tactile Warning Surface: No deterioration or other defects after 200 hours of exposure, when tested in accordance with ASTM-B117.

7. Chemical Stain Resistance: No reaction to 1% hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, and antifreeze, when tested in accordance with ASTM D543.

8. Abrasion Resistance: 500 minimum, when tested in accordance with ASTM C501.

9. Accelerated Weathering of Tactile Warning Surface when tested by ASTM-G155 or ASTM G151 shall exhibit the following result: $\Delta E<5.0$ at 2,000 hours minimum exposure.

10. Tensile Strength: 11,000 psi minimum, when tested in accordance with ASTM D638.

11. AASHTO-H20 Load Bearing Test: No Damage at 16,000# loading.

12. Freeze/Thaw/Heat: No deterioration when tested in accordance with ASTM C 1026.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings.

B. Storage Facility

1. Store REP Tiles in an area that is within an acceptable temperature range (40-90 degrees). In particular, protect sealants from freezing.

2. Maintain Storage Facility in a clean dry condition to prevent contamination or damage to REP Tiles and incidentals.

1.6 GUARANTEE

A. REP Tiles shall be guaranteed in writing for a period of five (5) years from date of Contract's final completion. The guarantee includes manufacturing defects, breakage, and deformation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Composition: REP Tiles shall be manufactured using a matte finish exterior grade homogeneous (uniform color throughout thickness of product) glass and carbon reinforced polyester based Sheet Molding Compound (SMC) composite material. Truncated domes must contain fiberglass reinforcement within the truncated dome for superior structural integrity and impact resistance. A matte finish will be required on the Tactile Warning Surface for superior slip resistance performance superior to that offered by a gloss finish. Use of Tactile Warning Surface Products employing coatings or featuring layers of material with differing composition, performance, or color properties is expressly prohibited under this Section.

B. Color: Color shall be homogeneous throughout REP Tile.

1. Federal Yellow (Y) per Federal Standard 595B Table IV, Color No. 33538.

C. Domes: Square grid pattern of raised truncated domes of 0.2" nominal height, base diameter of 0.9" and top diameter of 0.45". The Federal Code of Regulations permits a truncated dome spacing range of 1.6"-2.4." For superior wheelchair, walker and shopping cart mobility, the preferred truncated dome spacing shall have a center-to center (horizontally and vertically) spacing of 2.35", measured between the most adjacent domes on square grid.

D. Configuration: REP Tile sizes shall be as indicated on the Contract Drawings. The REP Tiles shall feature a minimum of eight (8) embedded corrosion resistant 1 ½" corrosion resistant concrete inserts with ½" x 1 ½" heavy duty steel bolts and washers. Bolts must be covered with a structural water tight cap. Bolts must be located BETWEEN the truncated domes (in the field) for maximum protection of the Bolt integrity. Bolts are NOT to be located in the truncated dome.

1. The field area shall consist of a non-slip textured surface with a minimum static coefficient of friction of 0.80, wet and dry.

2. At a minimum, REP Tile thickness shall measure ¼" nominal exclusive of the perimeter minimum 3/8" thick (nominal) by 1" wide flange. The body of the Tactile Warning Surface Tile must consist of a SOLID body for maximum strength and to eliminate the possibility of air entrapment and cracking.

E. Radius REP Tile:

1. Radius REP Tile measures 24"x 33.25" and features reverse score lines on each 24" dimension for a 10', 15', and 20' radius condition. The Radius REP Tile out of the box measures 11' - 6" radius.

2. Truncated domes feature proper dome alignment for a radius application. Radius REP Tile shall be cut to the appropriate configuration using the reverse score lines as a guide.

F. Truncated Dome Surface of REP Tile shall be protected with factory installed plastic sheeting for cleanliness during the installation process. Basic Installation Guidelines shall be printed on the plastic sheeting in both English and Spanish for customer convenience.

G. Dimensions: REP Tiles shall be held within the following dimensions and tolerances:

H. Length and Width: as shown on the drawings

I. Cleaning materials used on site shall have code acceptable low VOC solvent content and low flammability.

J. The Specifications of the concrete, sealants and related materials shall be in accordance with the Contract Documents and the guidelines set by their respective manufacturers.

2.2 MANUFACTURERS

A. Available manufacturers, subject to compliance with these Specifications include, but are not limited to, the following:

1. ADA Solutions Inc. of Chelmsford, MA (Phone: 800-372-0519, Fax: 978-262-9125, Web Site: www.adatile.com, E: info@adatile.com), or approved equal.

2. Requests for Approved Equal Status must be submitted and approved by the Owner during the Bid Phase of the Project.

2.3 EQUIPMENT

A. Contractor shall provide all tools, equipment and services required for satisfactory installation per manufacturer's instruction as Incidental Work. Equipment, which may be required include typical mason's tools, a 2-foot long level with electronic slope readout, (2) 25-pound weights, and a rubber mallet with a piece of wood for tamping down the Tactile Warning Unit(s).

PART 3 - EXECUTION

3.1 PREPARATION

A. During all concrete pouring and REP Tile Installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

B. The physical characteristics of the concrete shall be consistent with the Contract Specifications while maintaining a slump range of 4 - 7 to permit solid placement of the REP Tile. An overly wet mix will cause the REP Tile to float. Under these conditions suitable weights such as 2 concrete blocks or sandbags (25 pounds) shall be placed on each REP Tile.

C. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to REP Tile placement.

3.2 INSTALLATION

A. Contractor will not be allowed to install Tactile Warning Surface Tiles until all submittals have been reviewed and approved by the Engineer.

B. REP Tile shall be installed per manufacturer's instructions.

C. To the maximum extent possible, the REP Tiles shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple REP Tiles regardless of size are used, the truncated domes shall be aligned between the tactile warning surface tiles and throughout the entire tactile warning surface installation.

D. In accordance with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board): Sections 304 + 305), Tactile Warning Surface Tile shall be located relative to the curb line as shown within Sections 304+305 of the Guidelines.

E. The REP Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the Tactile Warning Surface Tile is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

F. On Continuous Runs: The Installer shall leave a 1/8" nominal gap between successive Tactile Warning Surface Tiles. As part of the concrete finishing operation, the Installer shall apply ¼" edge treatment around the perimeter of the Tactile Warning Surface Tiles such as Sikaflex 1a or BASF NP1 shall be applied to the edge treatment for a watertight Tactile Warning Surface Tile installation.

3.3 CLEANING AND PROTECTING

A. Protect REP Tiles against damage during construction period to comply with REP Tiles manufacturer's Specifications.

B. During and after the REP Tile installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the REP Tile to rock the REP Tile, causing a void between the underside of the REP Tile and the concrete substrate.

C. Remove Protective Plastic Sheeting from REP Tile within 24 hours of installation of the REP Tile. Particularly under hot weather conditions (80 degrees or higher), plastic sheeting will adhere strongly (resulting in difficult removal of same) to Tactile Warning Surface Tile when not removed quickly.

D. If requested by the Project Manager, clean REP Tiles not more than four (4) days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean REP Tile by method specified by Tactile Warning Surface Products manufacturer.

END OF SECTION 32 17 26

SECTION 33 05 07.13 – UTILITY DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish all labor, materials, tools and equipment as necessary to install casing or conduits by the horizontal directional drilling method. Furnish all labor, equipment, materials and supplies and perform all work necessary to provide a complete, finished casing or conduit. The finished work includes proper installation, testing, restoration of underground utilities, and environmental protection and restoration.

1.2 REFERENCE STANDARDS

A. ASTM F1962, current revision, "Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings."

B. Plastics Pipe Institute, Technical Report TR-46, Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe

1.3 SUBMITTALS

A. General: All submittals shall be submitted in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Work Plan: Prior to beginning work, the Contractor must submit to the Engineer a general work plan outlining the procedure and schedule to be used to execute the project. Plan should document the thoughtful planning required to successfully complete the project. This shall include, but not be limited to, entry and exit pits; settlement pit; size, capacity and arrangement of drilling and pulling equipment; layout of carrier pipe; details and spacing of pipe rollers; type of current head; method of monitoring and controlling line and grade; method of detection of surface movement; and layout of any proposed construction staging areas.

C. Schedule: Time schedule for completing the Directional Bore, including any delays due to anticipated soil conditions.

D. Equipment: Contractor will submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project.

E. Materials: Specifications on material to be used shall be submitted to Engineer. Material shall include the pipe, fittings and any other item which is to be an installed component of the project.

1.4 QUALITY ASSURANCE

A. The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification.

B. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

C. Adhere to the Specifications; any changes must be expressly approved by the Engineer. Approval of any aspect of any Directional Bore operation covered by this Specification shall in no way relieve the Contractor of its ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

D. All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.

E. HDD equipment operators shall be trained to operate the specific Horizontal Directional Drilling equipment with at least 3 years experience in directional drilling obtained within the last five years.

F. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The Contractor’s supervisor shall have supervised directional drilling of a minimum of 5,000 linear feet of pipe of a similar or greater diameter, of similar material, over similar lengths, and with similar subsurface conditions.

1.5 PROFILES

A. Contours, topography and profiles of the ground as may be shown on the Drawings are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation. It is the Contractor's responsibility to verify all elevations required to successfully complete the installation.

PART 2 - PRODUCTS

2.1 PIPE

A. Polyethylene Pipe: Unless otherwise specified in the Contract Documents, pipe installed by horizontal directional drilling shall either be high density polyethylene pipe (HDPE) specifically designed for directional drilling.

1. High Density Polyethylene (HDPE) Pipe, AWWA C906 compliant, NSF 61 Standard Listed, and furnished in fifty (50) foot lengths.

2. Polyethylene pipe shall be furnished with an outside diameter conforming to ductile iron pipe sizes. Minimum thickness of HDPE pipe shall be determined by the Contractor's calculations, but shall not be considering in-service loading shall not be less than DR 11 when measured in accordance with ASTM D2122.

3. All polyethylene pipe and fittings shall be made of a high-density polyethylene pipe compound with extra high molecular weight that meets the requirements for Type III, Grade P34 Polyethylene material as defined in ASTM D1248.

4. Pipes shall be jointed to one another and to polyethylene fittings by thermal butt-fusion or by socket fusion in accordance with ASTM D3261.

5. Joining of pipe sections shall be performed in accordance with the procedures recommended by the pipe manufacturer. Joints between pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 3/16-inch.

6. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe. A specimen of pipe cut across the butt-fusion joint shall be tested in accordance with ASTM D638.

7. Polyethylene pipe shall be joined to ductile iron pipe by the use of flange adapters and back-up rings. Flange adapters shall be butt fused to the polyethylene carrier pipe. The face of the flange adapter shall have a serrated sealing face to assist in holding the flange gasket in place. Flange gaskets shall be full-faced neoprene. Back-up rings shall be Class "D" steel ring flanges in accordance with AWWA C207. Flange bolts must span the entire width of the flange joint, and provide sufficient thread length to fully engage the nut.

2.2 EQUIPMENT:

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing & delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2.3 DRILLING SYSTEM

A. Drilling Rig: The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.

B. Drill Head: The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

C. Mud Motors: Mud motors (if required) shall be of adequate power to turn the required drilling tools.

D. Drill Pipe: Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

2.4 GUIDANCE SYSTEM

A. The Guidance System shall be of a proven type and shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

2.5 DRILLING FLUID (MUD) SYSTEM

A. Mixing System: A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. Drilling Fluids: Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 – 10 and/or as per mixing requirements of the Manufacturer. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. Delivery System: The mud pumping system shall have a minimum capacity to supply mud in accordance with the drilling equipment pull-back rating at a constant required pressure. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum of 12" high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage facilities.

2.6 OTHER EQUIPMENT

A. Pipe Rollers: Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall be used to prevent excess sagging of pipe.

B. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by the Engineer prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

PART 3 - EXECUTION

3.1 GENERAL

A. The Engineer must be notified 48 hours in advance of starting work. The Directional Bore shall not begin until the Engineer is present at the job site and agrees that proper preparations for the operation have been made. The Engineer approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract. It shall be the responsibility of Engineer to provide inspection personnel at such times as appropriate without causing undue hardship by reason of delay to the Contractor.

3.2 PERSONNEL REQUIREMENTS

A. All personnel shall be fully trained in their respective duties as part of the directional drilling crew and in safety.

3.3 DRILLING PROCEDURE

A. Site Preparation

1. Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy of which shall be given to Engineer and one copy to remain with contractor for a period of one year following the completion of the project.

2. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. Drill Path Survey: Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path will be surveyed for any surface geo- magnetic variations or anomalies.

C. Environmental Protection: Contractor shall place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel or oil may not be stored in bulk containers within 200' of any water-body or wetland.

D. Safety: Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.

E. Pipe: Pipe shall be welded/fused together in one length, if space permits. Steel pipe welds will be X-rayed prior to being placed in bore hole. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

F. Pilot Hole

1. Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', Contractor will notify Engineer and Engineer may require Contractor to pull-back and re-drill from the location along bore path before the deviation.

2. In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, contractor will cease operations and notify Engineer. Engineer and contractor will discuss additional options and work will then proceed accordingly.

G. Reaming: Upon successful completion of pilot hole, contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

H. Pull-Back

1. After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor will not apply more than the maximum safe pipe pull pressure at any time.

2. In the event that pipe becomes stuck, contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, contractor will notify Engineer. Engineer and contractor will discuss options and then work will proceed accordingly.

3.4 BORING FAILURE

A. If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer. Immediately fill the product left in place with excavatable flowable fill. Submit a new installation procedure and revised plans to the Engineer for approval before resuming work at another location. If, during construction, damage is observed to the facilities, cease all work until resolution to minimize further damage and a plan of action for restoration is obtained and approved by the Engineer.

3.5 SITE RESTORATION

A. Following drilling operations, contractor will de-mobilize equipment and restore the work-site to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original. All mud shall be disposed of by the Contractor.

3.6 RECORD KEEPING

A. As-Builts: Contractor shall maintain a daily project log of drilling operations and a guidance system log with a copy given to Engineer at completion of project. The Contractor shall furnish “as-built” plan and profile drawings, on the same horizontal and vertical control datum shown on the Drawings, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation. As-built drawings shall be certified as to accuracy by the Engineer.

END OF SECTION 33 05 07.13

SECTION 336305 - SELECTIVE DEMOLITION FOR STEAM & CONDENSATE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, apply to work of this section.

B. General Conditions of the Contract, Division 1 and other General Requirements of the Contract apply to the work of this section.

1.2 DESCRIPTION OF WORK:

A. The extent of steam and condensate lines and piping support demolition work is shown on drawings and includes incidental work needed for completion of the project.

B. A portion of the existing steam and condensate piping is run in existing tunnels resting on rollers on top of concrete pads of various heights. In some areas, piping has slipped off of the pad and the rollers are missing. These are indicated on the drawings, and are to be re-established in this work.

C. The steam system will be shut off for only a scheduled period of time. Contractor to work within that time frame to complete their work.

1.3 TYPES OF SELECTIVE DEMOLITION WORK: Demolition requires the selective removal and subsequent offsite disposal of the following. The assignment of the work to the various trades working on the project is at the discretion of the Contractor.

1.4 JOB CONDITIONS:

A. Occupancy: Owner will be continuously utilizing areas of the campus immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities which will severely impact Owner's normal operations.

B. Partial Demolition and Removal: Items indicated to be removed are to be taken from the site as work progresses. This is an active and public part of the campus and should be maintained in orderly condition.

1. Storage of removed items on site will not be permitted.

C. Protections: Provide temporary barricades and other forms of protection as required to protect Owner's staff, student body and general public from injury due to demolition work, replacement work and utility piping replacement and repair.

1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure, steam/condensate line or element to be demolished, and adjacent facilities or work to remain.

2. Protect existing work that is to remain in place and becomes exposed during demolition operations.

3. Provide protection for workers and public from exposed hot steam and condensate piping.

4. Remove protections at completion of work.

E. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

F. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block or otherwise obstruct walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways as required by governing regulations. Recognize and respect fire lanes, emergency vehicle access, maintenance access, student and staff foot and vehicle traffic patterns, etc.

G. Explosives: Use of explosives is not permitted for this work.

H. Utility Services: Maintain existing utilities indicated to remain, keep in service, repair or replace, and protect against damage during operations.

1. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

I. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

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

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 INSPECTION:

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

3.2 PREPARATION:

A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

1. Cease operations and notify the Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

B. Cover and protect equipment and fixtures to remain from soiling or damage when demolition work is performed in areas from which such items have not been removed.

C. Locate, identify, stub off and disconnect utility services that are not indicated to remain.

3.3 DEMOLITION:

A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

3.4 DISPOSAL OF DEMOLISHED MATERIALS:

A. Remove piping, debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose of materials off site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on project site.

3.5 CLEAN-UP AND REPAIR:

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave areas clean.

B. Repair demolition performed in excess of that required. Return structures and surfaces to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 336305

SECTION 336310 - STEAM AND CONDENSATE SYSTEM EXTENSIONS AND REVISIONS

PART I - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. See Section 336305, "Selective Demolition for Steam Condensate", for other requirements.

B. Extent of steam and condensate piping valves, specialties, insulation work as indicated on drawings and by requirements of this section. Includes runs of new piping, new valves and fittings to a complete end.

1.3 QUALITY ASSURANCE:

A. MANUFACTURER'S QUALIFICATIONS: Firms regularly engaged in manufacture of steam and condensate piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years and are located in the U.S.A.

B. INSTALLER'S QUALIFICATIONS: Firm with at least 5 years in business, and 10 or more complex projects of successful installation experience with steam and condensate piping, valves and insulating work similar to that required for this project. Mechanical project foreman/superintendent to be an experienced master/journeyman with specific experience with steam/condensate systems and pipefitting.

C. INSULATOR'S QUALIFICATIONS: Use experienced insulation subcontract firms for pipe insulation and jacketing, and only firms recommended by Owner at that. Do not suppose that insulation work is of little concern. Do not use any firm, or anyone unskilled in the work for this assignment.

D. CODES AND STANDARDS:

1. ASME Compliance: Fabricate and install steam and condensate piping in accordance with ASME B31.9 "Building Service Piping".

2. IMC Compliance: Fabricate and install steam and condensate piping in accordance with the IMC "International Mechanical Code" and ASME Standards pertaining to Pipe Welding.

3. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9 or ANSI and ASTM, as applicable, for shop and project site welding of piping work.

4. Idaho State Plumbing Code

5. International Building Code

6. Industry Standards:

   a. American National Standards Institute (ANSI B31.1 piping)
   b. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
   c. American Society of Mechanical Engineers (ASME)
   d. American Society of Testing Materials (ASTM)
   e. ETL Testing Laboratories (ETL)
   f. Hydronics Institute (HI)
   g. Idaho Safety Standard (OSHA), Idaho State Industrial Council
   h. Hydraulic Institute (HI)
   i. Thermal Insulation Manufacturers Association (TIMA)

E. MANUFACTURERS SUPERVISION: Manufacturers involvement is required regarding the installation of the direct bury dry powder insulation system (Gilsulate 500XR).

1. Install the insulation material with the styrofoam blueboard forms as a system according to manufacturer's instructions, and after a project specific training session for all workers, training to be conducted by an authorized Gilsulate manufacturer's representative.

2. Prior to installation, the manufacturer's representative shall inspect the installed pipe and support system for compliance with the recommendations and procedures.

3. Backfilling operations shall be witnessed by an Owner's representative.

1.4 SUBMITTALS:

A. PRODUCT DATA:

1. Submit manufacturer's data sheets for materials and components used in the work. See list below. Includes most components of the work.

B. WELDING CERTIFICATIONS: Applies to all welders employed on this project.

1. Each welder shall have passed a qualification test within the past six months.

2. The test shall be conducted by an authorized agency and conducted in accordance with the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications", ASME Section VIII, and ANSI 313.

3. The test report shall certify that the welder is qualified to weld the material to be used at the job site.

4. The Contractor shall submit three copies of each welder's qualification test report to the Project Manager for approval prior to commencing the work. No welder shall be employed on the project until so certified.

C. SHOP DRAWINGS: For all steam system components.

1. Pipe and pipe fittings
2. Valves
3. Strainers
4. Steam traps and specialties
5. Gaskets
6. Field fabrications, anchors, guides, insulation techniques
7. Pipe insulations and jacketing

D. RECORD DRAWINGS: Use a protected copy of the contract documents and maintain and protect a complete red-line record of changes to the work and actual final conditions including dimensions and coordinates.

E. MAINTENANCE INFORMATION: Provide for all manufactured items, with parts lists, instructions, sources of parts, etc.

F. INSULATION GUARANTEE: In addition to the comprehensive Contractor’s warranty for materials and installation involved in this work, provide a written guarantee for the material and installation of the new and revised construction, including the dry insulating powder system (Gilsulate), in force for a period of one (1) year from date of acceptance by the Owner, against deterioration of insulating value, compaction, or water leakage under normal operating conditions. (Vendor will provide written guarantee for material to Contractor to allow a comprehensive single source).

G. SAFETY: Note that medium pressure steam at 350°F and 80-125 psig is inherently hazardous, and that steam tunnel are by definition enclosed spaces. Establish a plan, conduct training and maintain records to confirm that workers are competent, knowledgeable and trained in working with steam systems such as this. Provide required supervision, gear and installation to assure a safe working environment. Let no worker work alone or untended in an enclosed vault environment. Provide ventilation for all work in an active vault or enclosed space work environment.

1.5 TESTS AND CERTIFICATIONS:

Make all tests required by code or specification in the presence of a representative of the Owner, recorded and certified by the Contractor and Representative. Involve local authorities where required.

1.6 PERMITS, FEES, LICENSES:

Pay for all permits, fees and licenses required for the conduct of the specified work and be responsible for all criteria associated with the same. Comply with requirements for inspection, certifications, etc.

1.7 MECHANICAL COORDINATION DRAWINGS:

A. Prepare and submit drawings for steam vault construction including reinforcing steel placement, grating assembly, sleeving and anchorage.

B. Use a marked up construction print to indicate intended location of piping supports, guides, anchors and expansion loops. Present for review in an early weekly construction meeting. Work from reviewed drawings.

1.8 SCHEDULING/METHODS OF PROCEDURE:

Where interruptions of service are needed to effect work of this contract, outline the work, coordinate with other trades, determine the Owners acceptable downtime and prepare a time based schedule to accomplish the work. Give notice of a necessary utility interruption (or shutdown) to any existing system to the Campus Construction Coordinator not less than 7 days prior to the proposed shutdown. This will then be coordinated with the Campus Utility Services Department and the campus areas involved for approval to go ahead with the shutdown or re-schedule. Set up for evening, nighttime or weekend hours as necessary to accomplish the work with minimum disruption. See Supplemental General Conditions for more details. Steam system shutdowns may require more than a 7 day lead time.

1.9 DELIVERY, STORAGE AND HANDLING:

A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

D. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.

E. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART II - PRODUCTS

2.1. MATERIALS AND PRODUCTS:

A. GENERAL: Provide piping materials and factory-fabricated piping products, valves and fittings, steam and condensate specialties, insulation materials, etc., which have been manufactured in the U.S.A., of sizes, types, ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on steam and condensate system maximum design pressures. Provide sizes and types matching piping

and equipment connections; provide fittings and materials which match pipe materials used in steam and condensate piping systems. Where more than one type of material or product is indicated, selection is at Installer's option. Provide piping materials and factory-fabricated, piping products, valves and fittings

2.2. BASIC PIPES AND PIPE FITTINGS:

A. GENERAL: Provide pipes and pipe fittings complying with and in accordance with the following listing:

B. HIGH PRESSURE STEAM (15 TO 125 PSI):

1. Use ASTM A53 Grade B, seamless, Schedule 40, black steel, pipe. For 2" and smaller, use pipe Schedule 80.

2. Fittings shall be seamless forged black steel ASTM A-234, ASA B16.9, ASA B-10 of grade and schedule of pipe to which connected. Provide flanged fittings with Flexitallic type CGI gaskets for piping 2-1/2" and larger. Provide threaded fittings for piping 2" or less. All fittings shall be rated for minimum 150 psig. Other than demountable joints, the system shall be an all welded assembly.

3. Use pipe and fittings manufactured in the United States of America.

C. LOW PRESSURE STEAM (15 PSI OR LESS): Not applicable.

D. STEAM/CONDENSATE:

1. Use ASTM A53, Grade B, “Schedule 80” seamless, black steel pipe.

2. For 2" and smaller use 300 pound screwed malleable iron fittings.

3. For 2-1/2" and larger use ASTM A234, ASA B16.9, ASA B10, Grade B, Schedule 80 forged black steel butt weld fittings.

2.3. MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

A. WELDING MATERIALS: Except as otherwise indicated, provide welding materials as determined by Installer to comply with installation requirements.

Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. GASKETS FOR FLANGED JOINTS: ANSI B16.21; full-faced metal gaskets for cast-iron flanges; raised-face for steel flanges, based on Flexitallic Products, Gasket Style CGI.

C. STRAINERS

1. Strainers 2" and smaller for medium pressure steam service shall be Watts No. 77S or equivalent by Armstrong, 250 lb. iron body, threaded, Y-pattern, 20-mesh

stainless steel screen or equal, with a full size drain connection and gate valve (specified above).

2.4. BASIC SUPPORTS AND ANCHORS:

A. GENERAL: Provide supports and anchors in accordance with the following listing and details in drawings:

1. Two-bolt riser clamps, for vertical-piping clamps.

2. Steel turnbuckles, for hanger-rod attachments.

3. Protection saddles for saddles and shields.

2.5. STEAM/CONDENSATE VALVES: (All valves are subject to shop drawing review. Do not offer any valves or fittings of Chinese origin or fabrication. Propose valves to be furnished during the bidding period for consideration, buy only valves from a pre-approved list.):

A. High Pressure Steam and Condensate (Greater than 15 Psig to 125 Psi):

1. Butterfly Valves 3” and larger High Performance, Tripple Offset Butterfly Valves for steam and condensate service 3” and larger. Valves shall be equivalent or better than ANSI Class 150 and suitable for handling saturated steam at 150 psig with seat material rated for up to 175 psig at 450 deg F. Triple offset design, double tapped lug or double flanged stainless steel body, laminated graphite/AISI 316 metal seats, ASTM A351/A744 (316 SS) – CF8 disc, valve trim to suit. Extended neck stem option to accommodate insulation. Provide valves that can function with flow in either direction. Provide valves with indicating gear operators and hand wheels in sizes 4” and larger. 3” valves may have locking lever or gear operator handles.

a. Manufacturer: Subject to compliance with requirements, provide Tri-Axis butterfly valves of one of the following:
1) ARI-Armaturen

2. Globe Valves 2" and smaller for high pressure steam service, bronze, threaded, 200# plug type with stainless steel removable seat and disc. Manufacturer: ARI-Armaturen, Crane or prior approved equal.

3. Check Valves 2" and smaller for high pressure steam service, bronze, threaded, 200# steam swing check valve. Manufacturer: Crane or prior approved equal.

4. Check Valves 2-1/2" and larger for high pressure steam service, iron body, flanged, 250#, with bronze trim. Manufacturer: Crane or prior approved equal.

5. Strainers 2" and smaller for high pressure steam service shall be Watts No. 77S or equal by Armstrong, 250 lb. iron body, threaded, Y-pattern, 20-mesh stainless steel screen, with a full size drain connection and gate valve (specified above).

6. Strainers 2-1/2" and larger for high pressure steam service shall be Watts No. 77F-250 or equal by Armstrong, 250 lb. iron body, flanged, Y-pattern, stainless steel screen, with a full size drain connection and gate valve (specified above).

7. Unions 2" and smaller for high pressure steam service shall be 300 lb. ground joint malleable iron, hexagonal, threaded.

8. Unions 2-1/2" and larger for high pressure steam service shall be flanged (raised face), and bolted with gaskets to suit the specified service.

B. Condensate / High Pressure Drip Valves:
Butterfly Valves 3” and larger High Performance, Tripple Offset Butterfly Valves for steam and condensate service 3” and larger. Valves shall be equivalent or better than ANSI Class 150 and suitable for handling saturated steam at 150 psig with seat material rated for up to 175 psig at 450 deg F. Triple offset design, double tapped lug or double flanged stainless steel body, laminated graphite/AISI 316 metal seats, ASTM A351/A744 (316 SS) – CF8 disc, valve trim to suit. Extended neck stem option to accommodate insulation. Provide valves that can function with flow in either direction. Provide valves with indicating gear operators and hand wheels in sizes 4” and larger. 3” valves may have locking lever or gear operator handles.

a. Manufacturer: Subject to compliance with requirements, provide Tri-Axis butterfly valves of one of the following:
1) ARI-Armaturen

2. Gate Valves 2-1/2" and smaller for high pressure steam service, bronze, threaded, 200#, with Exelloy seats and rising stem. If clearances will not allow a rising stem valve, use a non-rising stem valve. Use flanged valves for valves located in steam main lines. Manufacturer: Crane or prior approved equal.

3. Check Valves 2" and smaller for high pressure drip service shall be Crane No. 37, bronze, threaded, Y-pattern, 150lb steam swing check valve or equal.

4. Unions 2" and smaller for condensate service shall be 300 lb. ground joint malleable iron, hexagonal, threaded.

5. Dielectric Unions for steam and condensate service shall be rated for 175 PSIG WSP at 250^{o}F, and equal to Walter Valley Company V-Line Insulating Coupling or equal.

2.6 BASIC EXPANSION COMPENSATION:

A. General: Provide expansion compensation through expansion loops and expansion joints as indicated on drawings. Create fixed reference points for piping expansion and contraction with anchors at structures or with anchor points in the runs of piping.

2.7 INVERTED BUCKET TRAPS:

A. General: Provide inverted bucket traps as indicated, and where psi is 30 or greater or where condensate must be lifted with body and cover constructed of cast-iron or semi-steel, pressure rated for 250 psi, designed so internal parts are accessible without disturbing piping. Construct bucket of brass or stainless steel, and lever mechanism of heat treated stainless steel, operating on knife edges for friction-free performance. Construct removable seats and plungers of heat treated stainless steel.

1. Strainer: Provide integral inlet strainer built into trap body.

2. Check Valve: Provide integral check valve installed in trap inlet.

3. Air Vent: Provide integral bi-metal auxiliary air vent in top of inverted bucket.

B. Size traps based on inlet pressure in accordance with FCI 65-3.

C. Manufacturer: Subject to compliance with requirements, provide inverted bucket traps of one of the following:

1. Armstrong Machine Works.
2. Spirax Sarco.

2.8 STEAM VENTS:

A. General: Provide steam vents where indicated, for venting of air and non-condensable gases from steam piping system.

1. Quick Vents: Cast-brass body and bottom, with thermostatic bellows, and removable vent port with vacuum check.

2. Float Vents: Cast-iron body, cast-brass bottom, seamless-brass float, thermostatic bellows, removable stainless steel seat, monel metal plunger, and vacuum check discs.

B. Manufacturer: Subject to compliance with requirements, provide steam vents of one of the following:

1. Armstrong.
2. Eaton Corp.
3. Hoffman Specialty ITT.
4. Spirax Sarco.

2.9 PIPING GUIDES: See details on drawings.

A. Provide a complete guide support system for all steam and condensate system installation. Accommodate expansion, contraction, line offsets, etc.

2.10 INSULATION FOR STEAM AND CONDENSATE PIPING, VALVES, FITTINGS AND SPECIALTIES:

A Insulate all new piping as noted on drawings and in accordance with this section.

B. Applied Piping Insulation Materials for Piping Inside Tunnels:

1. Fiberglass Piping Insulation: ASTM C 547, Class 1, pre-formed fiberglass with all-service self sealing jacket, mitered for fittings unless otherwise indicated.

2. Manufacturer: Subject to compliance with requirements, provide mechanical insulation materials of one of the following:

a. Armstrong World Industries, Inc.
b. Babcock and Wilcox Co., Insulating Products Div.
c. CertainTeed Corp.
d. Knauf Fiber Glass GmbH.
e. Manville Products Corp.
f. Owens-Corning Fiberglass Corp.
g. Pittsburgh Corning Corp.
h. Rubatex Corp.

C. Insulating Blankets for Valves in Tunnels:

1. Provide removable reusable valve jacketing for all valves and specialties, requiring action or maintenance, to be insulated, consisting of 17 oz. silicone coated fiberglass cloth fabric rated for minimum 500°F, complete with 1" x 1" type 304 stainless steel rectangular ring buckles, minimum 14 gauge 1.5" or 2.5" stainless steel quilting pins and heavy duty, nylon woven, 1" Velcro hook and loop.

2. Provide valve jacketing as manufactured by Thermal Energy Products, Inc., or engineer approved equal.

D. Piping Insulation Materials for Piping in Trench:

1. Granular Insulation:

Contractor shall furnish (purchase and install) the direct bury granular insulation for this contract. Include all costs of purchasing and placing the material and guarantying the work in this contract. Install material in accordance with the drawings, manufacturer’s recommendations, and these specifications. Material to be equivalent to Gilsulate 500 XR. Order 5% more material than calculated and turn excess over to the Owner at the completion of the insulation work.

2. Board Insulation:

As detailed on the drawings use 2" thick, Dow “Blue Board”, foamed (not beaded) construction grade for sideforms and top cover of steam and condensate piping in the trench. Maintain a full 6" or more thickness of granular insulation between the pipe and the board.

PART III - EXECUTION

3.1. INSPECTION:

A. General: Examine areas and conditions under which steam and condensate piping materials and products are to be installed. Correct, or see that unsatisfactory conditions are corrected, before proceeding with the work.

3.2. INSTALLATION OF BASIC IDENTIFICATION:

A. General: After piping installation, insulation, and jacketing is complete, label steam and condensate piping with two inch high lettering indicating service, pressure and temperature. Use a black high temperature paint system. Prepare the substrate properly with cleaner and primer.

3.3. PIPING SYSTEM JOINTS:

A. General: Provide joints of type indicated in each piping system.

B. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

C. Welded:

1. Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.

2. Weld pipe joints in accordance with recognized industry practice and as follows:

Weld pipe joints only when ambient temperature is above $0^{o}F$ ($-18^{o}C$) where possible, with minimum pipe preheat to $50^{o}F$.
Bevel pipe ends at a 37.5^{o} angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".

Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks,

oxidation, blow-holes and non-metallic inclusions.

Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

At Installer's option, install forged branch-connection fittings wherever branch pipe is indicated; or install regular "T" fitting.

D. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.4. INSTALLATION OF STEAM AND RETURN CONDENSATE PIPING:

A. Where new piping follows same path as removed piping, match existing piping elevations, spacing, etc., except where indicated and in accordance with applicable codes and regulations.

B. Provide pipe guides as indicated on the plans.

C. Condensate piping:

1. Install condensate piping to return steam condensate collection as indicated.

D. Fabrication and installation of steam and condensate piping components:

1. General: Fabricate and install piping components in accordance with applicable requirements of ASME B31.9, and, where not otherwise indicated, comply with recognized industry practices to ensure that components serve intended function.

2. Drip-Legs: Provide new drip-legs as indicated on the drawings.

3.5. CLEANING, FLUSHING, INSPECTING:

A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Inspect each run of each system for completion of joints, supports and accessory items.

B. All new piping systems for steam shall be thoroughly flushed and cleaned before being placed into service.

3.6. PIPING TESTS:

A. Prior notification of at least 10 days will be required for an intent to perform hydrostatic testing. The Contractor's notice shall be reviewed and approved by the Project Manager prior to commencement of the required testing.

B. Complete piping tests prior to painting, insulating, or covering the pipe.

C. Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.

1. Required test period is 4 hours.

2. Observe each test section for leakage at end of test period. Test fails if leakage is observed.

3. Test medium, low pressure steam and condensate lines at 175 psig (hydraulic) and in accordance with ANSI B31.

D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

E. Drain test water from piping systems after testing and repair work has been completed.

F. X-Ray Testing: Test a minimum of 5% of all welds. If a weld is found to be bad then additional welds shall be tested until a satisfactory number has been found to be free of defects. In addition to the 5% minimum, x-ray testing of 100% of joints not capable of being pressure tested shall be performed; furnish copy of test results from an approved test laboratory for Engineer/Owner's review. Test to be in accordance with ASME requirements. Cost of all x-ray testing is borne by the Contractor.

G. Startup testing: Since the steam and condensate piping will move on warmup and during operation, some initial leakage at flanged joints may be encountered. Tighten any joints found to be leaking. Verify that forces imposed on gaskets are guided straight and do not impose a moment force on the connection.

3.7. STEAM/CONDENSATE, SYSTEM INSULATION: (For Steam and Condensate Piping Located Inside Tunnel.)

A. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

1. Fiberglass:

a. Medium/High Pressure Steam (15 psi to 125 psi per IECC 2018): 3" thick insulation for pipe sizes less than 1"; 4" thick insulation for pipe sizes from 1" to 1-1/4"; 4.5" thick insulation for pipe 1-1/2" and larger.

b. Steam Condensate: 2-1/2" thick insulation for pipe sizes up to 3"; 3" thick insulation for pipe sizes from 4" and larger.

B. Repair or replace damaged sections of existing mechanical insulation both previously damaged or damaged during this construction period, including units with vapor barrier

damage and moisture saturated units. Use insulation of thickness as indicated above, install new jacket and sealed over existing.

C. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 336310