

# LEWIS COUNTY SITE DEVELOPMENT

## LEWIS COUNTY FACILITIES DEPARTMENT

351 NW North Street  
Chehalis, Washington 98532



## Project Manual –Bid Set

Volume 1 - Divisions 00 - 12

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KMB Project No. J2037C



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**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Related Documents: Drawings and general provisions of the Contract, including General and Supplemental Conditions and other Division 01 Specification Sections, apply to this Section.

**1.02 WORK COVERED BY THE CONTRACT DOCUMENTS**

- A. This project may include various trades as well as owner subcontractors. Coordinating of construction activities by the Contractor will be required to ensure that the project will not affect the operation and construction activities of Owner's personnel throughout the entire construction process. At least one adjacent area will remain occupied during construction.
1. Each trade is governed by General and Supplemental Conditions of the Contract and all provisions of Division 01, General Requirements, whether or not specifically referenced for its particular work.
- B. Scope of Work, Base & Alternate Bids
1. Briefly and without force and effect upon the contract documents, the work of the contract can be summarized as follows: This project is a site reconfiguration and parking lot and sidewalk improvement of the following sites.
    - a. At the Rainier block: which is comprised of Chehalis Ave to the east, Center street to north, and north Street to the south and fronting the railroad tracks in the back of the site. A new parking lot and greenspaces will be revised and constructed. Construct minor modifications to the existing stormwater system. The sidewalk that fronts the two buildings along Chehalis Ave will be re-built and regraded.
    - b. At north Street adjacent to the Rainier block street frontage and sidewalk improvements will occur to Chehalis Ave and terminate at the east end of the existing building.
    - c. At the Royal bakery Block: which is comprised of Chehalis Ave to the west, Center Street to the south, Pacific Ave to the east and an existing alley to the north. A new parking lot and greenspaces will be revised and constructed within the block and sidewalk frontage shall be done on the south side. Construct minor modifications to the existing stormwater system. The block will include the reconstruction of Center Street pavement and walks.
    - d. At the Health department Block: which is comprised of Center Street to the north, Pacific Ave to the east, North Street to the south, and Chehalis Ave to the west. A new parking lot and greenspaces will be revised and constructed with the block sidewalk frontage shall be improved and done per the civil and landscape drawings. Construct minor modifications to the existing stormwater system.
    - e. **Alternate Bid #1:** At the Law and Justice block: which is comprised of Main Street to the north, Alfred Street to the south, and Pacific Ave to the west. The parking lot will be reconfigured, restriped and improved per civil and landscape drawings.
    - f. Provide and install water and sanitary sewer connections to the Rainier building from North street frontage.
    - g. Landscape scope includes the following:

New landscape planter beds are proposed at the Rainier Block, Royal Bakery Block and Health Department Block as part of the Base Bid scope of work in conjunction with Civil Engineering improvements. Work shall also include irrigation and hardscape plaza areas. In addition, as part of Bid Alternate #1, landscape, irrigation and hardscape areas are proposed at the Law & Justice Block.
- C. Contractor's Storage/Set-Up Areas

1. The Owner shall instruct the Contractor as to the location to be used by the Contractor for storage and set-up of material and equipment to be used in the work. Cooperate with other on-site contractors for access.
2. Use of the Site: Drawings generally indicate the location to be used by the Contractor for storage and set-up of material and equipment to be used in the work. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project construction. Ultimately contractor access throughout the entire campus shall be only be as permitted by the Owner.
  - a. Keep existing driveways and entrances serving the premises clear and available to the Owner and their employees at all times. Do not use these areas for parking or storage or materials.
  - b. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off-site.

### **1.03 CONTRACTOR USE OF THE PREMISES**

- A. During the construction period the Contractor shall have use of the premises in areas containing project work as indicated in the Contract Documents.
- B. Monitor and secure portions of the buildings and site under Contractor's control to prevent unauthorized access. Inspect premises at end of each work day to ensure all doors are locked and exterior openings are closed and secure that pertain to this project.
- C. Keep existing driveways and entrances serving the premises clear at all times. Do not use these areas for parking or storage of materials, except upon prior written approval of Owner.
- D. Do not unreasonably encumber the sites with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated or otherwise directed by Owner. If additional storage is necessary, obtain and pay for such storage off-site.
- E. Limit construction access to only those areas that require work under this Contract.
- F. Contractor is fully responsible for damage or loss that occurs to existing facilities, occupants and public as a result of the work performed. Take precautions to protect existing facilities, occupants and public. Immediately repair or replace items damaged or lost as a result of work under the Contract.
- G. Assume full responsibility for protection and safekeeping of products stored on-site.

### **1.04 CONTRACTOR'S RESPONSIBILITY**

- A. All work that is described in the Scope of Work, Base and Alternate Bids section 1.02 B. and is described in the Drawings and Project Manual, and which is not specifically indicated as "not in contract" (NIC) or "Owner-furnished, Owner-installed" (OFOI) shall be a part of this contract for construction.
- B. The Contractor will be responsible for all aspects of transport, receiving, and any temporary storage of materials, tools, equipment, and the transport and facilities required by the contractor's personnel to, from, and at the worksite.
- C. It is the Contractor's responsibility to verify all information made available through the project documents, review of the Owner's files and records, or from any other form of communication. Measurements and site conditions are to be field verified by the Contractor. No allowance will be made for any items incorrectly ordered, fabricated, or installed due to failure to perform such verification prior to commencing the work.

### **1.05 MISCELLANEOUS PROVISIONS**

- A. Stored Products

1. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on and off the site.
  2. Move any stored products, under Contractor's control, interfering with operations of the Owner or separate contractors.
  3. Obtain and pay for the use of additional storage or work areas needed for operations.
  4. Refer to Section 01 61 00, Common Product Requirements, for additional requirements relating to storage of products and equipment.
- B. Subcontractor Instructions: Notify subcontractors to become familiar with requirements of Division 00, Division 01 and the work of Sections related to their own work. Instruct them that these conditions and requirements apply to their work in each Section of the technical specifications.
- C. Mechanical/Electrical Requirements Of General Work
1. General: Except as otherwise indicated, comply with applicable requirements of Divisions 22 and 23 sections for plumbing and mechanical provisions within units of general (Division 2-14) Work and with applicable requirements of Division 26 sections for electrical provisions within units of general (Division 2-14) Work.
  2. Service Connections: Refer to Division 22, 23 and 26 sections for the characteristics of the respective mechanical and electrical services to be connected to units of general work. Provide units manufactured or fabricated for proper connection to and utilization of available services, as indicated. Except as otherwise indicated, final connection of mechanical service to general work is defined as being mechanical work, and final connection of electrical service to general and mechanical work is defined as being electrical work.
  3. Electrical Requirements: Except as otherwise indicated, comply with applicable provisions of the National Electrical Code (NEC) and standards by National Electrical Manufacturer's Association (NEMA), for electrical components of General Work. Provide Underwriters Laboratories listed and labeled products where applicable.
- D. Field Verification: It is the Contractor's responsibility to verify all field measurements and site conditions. No allowance will be made for any items incorrectly fabricated or installed due to failure to perform such verification prior to commencing the work.
- E. Coordination Of Utility Service Requirements: Coordinate all utility service requirements with serving utility companies including, but not limited to, power, telephone, water and sanitary sewer service. Observe specification standards, written details, and sketches showing equipment locations and dimensions as indicated by the utility company. Coordinate scheduling of utility company work with all other trades.

#### **1.06 WORK NOT INCLUDED IN CONTRACT**

- A. Work Not Included In Contract
1. Contractor is responsible for scheduling the work, storing such equipment if requested, and coordinating related work in the Contract with installation of NIC and FIO equipment. Contractor shall provide all preparatory work necessary for proper installation including blocking and backing, and finish work including caulking, grouting, furring, and painting adjacent surfaces as required for NIC and FIO equipment.
- B. Owner Furnished Items: FOIC Equipment: Items designated by the abbreviation "FOIC", meaning Furnished by Owner but Installed by Contractor, will be delivered to the jobsite for consignment to the Contractor. Contractor shall assume custody and responsibility for same after inspecting and determining that they are complete and in acceptable condition for installation. Installation of such items includes receiving, unloading, uncrating, storing, and all preparatory work necessary for proper installation including blocking and backing, rough-ins, setting in place, building-in, leveling and attaching to building elements, making all mechanical and electrical connections required, and finish work including caulking, grouting, furring, and

painting adjacent surfaces, leaving same in completely installed and operable condition satisfactory to Consultant. Contractor shall provide all equipment necessary for proper unloading and handling of FOIC items.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Coordinate scheduling, submittals and work identified in the Contract to assure efficient and orderly sequence of installation of construction elements.
- B. Responsibility
  - 1. The Contractor shall be in charge of this Contract and the site, as well as the directing and scheduling of all Work. Contractor shall be on site at all times work of this Contract is in progress. Do not delegate responsibility for coordination to any subcontractor.
  - 2. Anticipate interrelationship of all subcontractors and their relationship with the total Work.
  - 3. Resolve differences or disputes between subcontractors and materials suppliers concerning coordination, interference, or extent of Work between Sections. Contractor's decisions, if consistent with Contract Document requirements, shall be final.
  - 4. Final responsibility for the performance, interface, and completion of the Work and the Project in accordance with the Contract Documents shall be with the Contractor.

**1.02 PROJECT PHASING & MILESTONES**

- A. Prior to any work beginning on the site, the Contractor shall submit, and receive final approval on:
  - 1. Construction schedule;
  - 2. All required plans, such as, but not limited to, safety, demolition, quality control, and waste management;
  - 3. On all materials to be used on the project in accordance with Section 01 33 00.

**1.03 SPECIAL COORDINATION**

- A. There are occupied spaces outside of the limits of construction. These spaces will not be vacated for construction during this contract. Any work in these surrounding areas must be coordinated with the Owner.
- B. Additional special requirements and conditions apply to the work of this contract. Refer to Section 01 50 00 for detailed description of these additional requirements and conditions.

**1.04 CONSTRUCTION ORGANIZATION**

- A. On-Site Lines Of Authority & Communications: Refer to Section 01 31 15.
- B. Intra-Project Communications: Comply with procedures for intra-project communications including:
  - 1. Submittals.
  - 2. Recommendations.
  - 3. Coordination drawings.
  - 4. Schedules.
  - 5. Resolution of conflicts.
- C. Construction Mobilization
  - 1. Cooperate with the Site Representative in allocation of mobilization areas of site; for field offices and sheds, for access, traffic and parking facilities.
  - 2. During construction, coordinate use of site and facilities through Site Representative.
  - 3. Comply with Architect and Site Representative's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
  - 4. Coordinate field engineering and layout work under instructions of Site Representative.

- D. Coordination Of Submittals
  - 1. Schedule and coordinate submittals specified in the Contract Documents.
  - 2. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to and placing equipment in service.
  - 3. Coordinate request for substitutions to assure compatibility of space, operating elements, and effect on work of other Sections.
- E. Coordination & Pre-Installation Meetings: Refer to Section 01 31 19, Project Meetings.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 COOPERATION & COORDINATION OF WORK**

- A. The Contractor is responsible for the coordination of the work of all trades; coordinating the installation of their work and that of all subcontractors to ensure compliance with the Contract Documents and to expedite the progress of the Project. Contractor shall check specifications, addenda, and drawings covering all trades as the work progresses. Contractor shall promptly report to the Architect what they consider omissions, conflicts or points requiring clarification.
- B. Contractor shall prepare and distribute to each entity performing work at project site, a written memorandum of instructions on required coordination activities, including required notices, reports and attendance at meetings.
- C. It is the responsibility of the Contractor to ensure that the work of subcontractors complies with Conditions of the Contract, Division 01 - General Requirements, and the work of other Sections related to their own work. No additional payments or time extensions will be authorized for failure on the part of subcontractors to be familiar with and in compliance with the aforementioned specification divisions and sections.
- D. Inclusion of portions of the work under particular divisions of the specifications or sections of the drawings does not in every case conform to the categories of work customarily subcontracted to particular crafts or trades. In such cases, the Contractor shall be responsible to inform bidders, subcontractors, crafts and trades, that work assigned to them is contained in sections other than the usual. In every case, the General Contractor shall be responsible to provide at its cost, all work required in the Contract Documents.
  - 1. Provide project interface and coordination as required to properly and accurately bring together the several parts, components, systems, and assemblies and as required to complete the Work and the Project, pursuant to General Conditions for Washington State Facility Construction, Part 4 and Part 5.
  - 2. Provide interface and coordination of all trades, crafts, and subcontracts as required to provide correct and accurate connection of abutting, adjoining, overlapping, and related Work, and provide all anchors, fasteners, accessories, appurtenances, and incidental items as required to complete the Work properly, fully, and correctly in accordance with the Contract Documents.
  - 3. Materials, equipment, component parts, accessories, incidental items, connections, and services required to complete the Work which are not provided by subcontractors shall be provided by the Contractor.

**3.02 PROJECT COORDINATION & SCHEDULING CONTROL**

- A. The Contractor shall schedule and coordinate the work of all subcontractors on the project including their use of the site. Responsibility for coordination and close adherence to time schedules rests solely with the Contractor who shall maintain coordination and scheduling control at all times.

- B. Each subcontractor responsible to the Contractor shall cooperate diligently with the Contractor in the execution of their work so as to cause no delay in the completion of the Project. This responsibility includes the completion of all work in a timely manner. All Contractors, Prime Contractor and Subcontractors, shall diligently comply with the following requirements:
1. Cooperate in planning and layout of the work well in advance of operations.
  2. Inform other contractors of requirements at proper time to prevent delay or revisions.
  3. Be informed on the requirements of other contractors and check own work for conflicts with the work of other contractors.
  4. Insure delivery of materials and performance of work on coordinated schedule with other contractors.
  5. Contractor shall ensure subcontractors and equipment suppliers are responsible for compatibility and completeness of the installation and operation of the equipment in their respective Specification Sections including conformance with code requirements.
  6. Contractor shall be represented on the job site by his superintendent at all times when there is construction going on, including the work of his subcontractors, as well as his own.
- C. Changing Subcontractors: The General Contractor shall be responsible for all the additional expenses incurred by changing subcontractors during the course of this project. These additional expenses include, but are not limited to, the engineering expenses for revised submittal, request for information, or any clarification or duplication that might occur due to the fact that the initial documents have been revised.

### **3.03 MECHANICAL AND ELECTRICAL COORDINATION**

- A. All. In turn, this Mechanical Subcontractor shall answer to the General Contractor. This Mechanical Subcontractor shall be responsible for coordination between the trades above to make sure that all the interface between the different mechanical subs are in place, assuring that all the above systems are in proper working condition.
- B. Coordination Of Space
1. Coordinate use of Project space, including structural and architectural elements, and sequence of installation of fire suppression, plumbing, HVAC, communications, security and all other electrical work which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance and for repairs.
- C. Resolve all "tight" or restricted conditions involving work of various sections in advance of installation of mechanical and electrical work.
1. Where conflicts occur, architectural and structural has right-of-way over mechanical and electrical work; concealed mechanical work has right-of-way over concealed electrical work; exposed electrical fixtures have right-of-way over mechanical fixtures.
  2. Submit conflicts which cannot be resolved by right-of-way to the A/E for direction.
  3. Submit reflected ceiling coordination plans showing work by all applicable trades for review and approval by the Architect.
- D. Prior to proceeding with work in these areas, Contractor shall be responsible for preparing supplementary drawings for review showing all Work in "tight" areas, and provide minor adjustments and additional work necessary to overcome "tight" conditions, at no increase in Contract Sum. "Tight" areas shall be identified by the Contractor, however, the Owner reserves the right to require supplementary drawings for any areas affected by the construction activity whether or not identified as "tight" by the Contractor. ("tight" shall be defined here as "a condition so close in structure as to prevent passage; allowing little or no room for free motion or movement.")

- E. Equipment Connections: Refer to Section 01 11 00 and to General Requirements in the various Mechanical and Electrical Divisions. Work includes but is not limited to:
1. Provide motors and equipment for current characteristics as shown on Electrical drawings:
    - a. Electrical Contractor:
      - 1) Electrical Contractor shall furnish and install all wiring except:
        - a) Temperature control wiring.
        - b) Equipment control wiring.
        - c) Interlock wiring.
      - 2) The Electrical Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. After all circuits are completed, Electrical Contractor shall be responsible for all power wiring.
    - b. Mechanical Contractor: Mechanical Contractor shall, regardless of voltage, furnish and install all temperature control wiring, all starters not factory mounted on equipment, and all interlock wiring and equipment control wiring for the equipment that the Mechanical Contractor furnishes.

### 3.04 JOB SITE FIELD MEASUREMENTS AND TEMPLATES

- A. Obtain field measurements required for accurate fabrication and installation of Work included in this Contract. Exact measurements are the Contractor's responsibility.
- B. Contractor shall be responsible for field verifying actual dimensions where "+/-" dimensions are indicated.
- C. Furnish or obtain templates, patterns, and setting instructions as required for installation of all Work. Verify all dimensions in the field.

### 3.05 NOTIFICATION & CORRECTION OF DEFECTIVE WORK

- A. Coordinate the Work of all subcontractors and make certain that, where the work of one trade is dependent upon the work of another trade, the work first installed is properly placed, installed, aligned and finished as specified or required to properly receive subsequent materials applied or attached thereto.
- B. Direct subcontractors to correct defects in substrates they install when subcontracts of subsequent materials have a reasonable and justifiable objection to such surfaces. Promptly notify the Owner's Representative and Architect of any defects or imperfections in preparatory work which will in any way affect satisfactory completion of the work.
- C. Under no condition shall a section of work proceed prior to preparatory work having been completed, cured, dried or otherwise made satisfactory to receive such related work. Do not force subcontractors to apply or install products to improperly finished product.
- D. Correction of defective work shall be the responsibility of the Contractor or subcontractor providing the defective work. Correction of work due to underlying defects shall be the responsibility of the Contractor or subcontractor providing overlying work.

### 3.06 COORDINATION DRAWINGS

- A. Coordination Drawings - General
  1. The purpose of coordination drawings is to resolve potential interdisciplinary dimensional interferences and conflicts prior to shop fabrication or field installation of components and systems. While the A/E has exercised the accepted standard of care in performing overall dimensional coordination in the preparation of the Construction Documents, additional factors influence coordination which the Contractor must address in the coordination drawings. These factors include, but are not limited to, specific means and methods, the sequence of work, the characteristics of the specific equipment to be installed (where the documents allow multiple options), and the bidding assumptions made by each Contractor.

2. Where work by separate entities requires off-site fabrication of products and materials which must be accurately interfaced and closely intermeshed to produce required results, prepare coordination drawings consisting of plans, sections and details to indicate how the work shown by separate shop drawings will be interfaced, intermeshed, and sequenced for installation; comply with submittal requirements of Section 01 33 00.
  3. The Mechanical/Electrical coordination process shall be performed on site at the Mechanical subcontractors field office. The following parties shall be directly involved and participate, under the direction of the General Contractor, on regularly scheduled weekly basis: Contractor, Plumbing subcontractor, HVAC subcontractor, Fire Protection subcontractor, Electrical subcontractor, Automatic Temperature Control System subcontractor, and Low Voltage Electrical Systems subcontractor. Additional subcontractors and vendors shall participate at various times as required: Masonry and Structural Steel subcontractors, Drywall and Ceiling subcontractors, and others as required.
  4. Each trade's superintendent is expected to participate in the development of coordination drawings. All piping and equipment shall be shown, and all piping greater than 4 inches shall be indicated in double line fashion on the coordination drawings.
  5. Coordination meetings shall be held on a minimum of once a week for the duration of the coordination process which shall commence immediately upon Notice to Proceed.
  6. The Owner and General Contractor shall have full time onsite representation during this process, and will participate in the resolution of conflicts that may arise from indicated routings or service requirements.
  7. The Contractor and each applicable subcontractor shall sign drawings to indicate their participation in the coordination process and their agreement that the individual systems and components can be installed as indicated in the drawings and in the conformance with the Contract Documents.
  8. Upon completion of the Project, all coordination drawings shall be turned over to the Owner as a record document submittal.
- B. Coordination Drawings - Drawing Criteria: Prepare coordination drawings per the following guidelines:
1. Sheet size same as Contract Drawings. Drawings at appropriate scale to depict necessary detail; but not less than 1/4" = 1'-0" for plans and elevations, 1/2" = 1'-0" for sections and details.
  2. Drawings to contain elements of construction in their correct dimensional relationship, including but not limited to, floors, walls, ceilings including ceiling heights, roofs, columns, beams, soffits, openings, supports, hangers, equipment, fixtures, and other appurtenances. Develop drawings sequentially through Architectural, Structural, Civil, Fire Suppression, Plumbing, Mechanical, and all various Electrical trades.
  3. Put signatures of Contractor and each subcontractor on each drawing to confirm their participation in coordination process and agreement that individual systems and components can be installed accordingly.

### 3.07 CLOSEOUT DUTIES

- A. General
1. Coordinate completion and cleanup of work by the various trades in preparation for Substantial Completion.
  2. After Owner occupancy of premises, coordinate access to site by the various trades involved for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
  3. Assemble and coordinate closeout submittals.

- B. At Completion Of Work Of Each Subcontract: At completion of work of each subcontract, conduct inspection to assure that:
  - 1. Work is acceptable.
  - 2. Temporary facilities and debris have been removed from site.
- C. At Substantial Completion
  - 1. Conduct inspection and prepare list of work to be completed or corrected.
  - 2. Assist A/E and Owner's Representative in inspection.
  - 3. Supervise correction and completion of Work as established in A/E's inspection reports ("punch lists").
- D. At Final Completion: Assist A/E and Owner's Representative in inspection.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 GENERAL COMMUNICATION**

- A. Telephone communication and correspondence shall be between Contractor's Representative and Architect.
- B. Subcontractors are not to contact members of the design team directly unless explicitly agreed to by Contractor, Architect and Owner. All such contact and discussions are to be documented in writing by the subcontractor and submitted to the Architect and Owner through the Contractor.
- C. The General Contractor shall transmit problems or questions in writing using a Request for Information (RFI).
- D. On-Site Lines Of Authority & Communications: Establish on-site lines of authority and communications including attendance at Pre-Construction Meeting and Progress Meetings as required by the Architect and Owner's Site Representative. All on-site lines of authority and communications shall be established through the Architect.

**1.02 CORRESPONDENCE**

- A. All correspondence to and from Contractor will be routed through Architect with a copy to Owner.
- B. Include project title and project number on all correspondence.

**1.03 CORRESPONDENCE PROCEDURES**

- A. The following shall apply to all forms of correspondence initiated by the contractor:
  - 1. The project name and state project number shall appear prominently.
  - 2. The date of preparation and originator shall be given.
  - 3. Correspondence shall be directed to the Architect. If sent by facsimile, a hard copy shall promptly follow.
  - 4. The Contractor shall submit all required correspondence within the stipulated time.

**1.04 REQUIRED CORRESPONDENCE**

- A. Subcontractors Listing: Two copies of a complete list of all subcontractors and major material suppliers shall be submitted prior to the start of construction.
- B. "Statement of Intent to Pay Prevailing Wages" Forms: For the general contractor, and each subcontractor, submit to the Architect a copy of Washington Department of Labor & Industries form bearing the approval of the Industrial Statistician and indicating payment of fees. This must be submitted prior to application for payment for the subcontractor's work scope.
- C. Construction Schedule: Within seven days of notice to proceed, submit to the Architect three copies of the CPM (Critical Path Method) construction schedule. Consultant may request updated schedules if a significant discrepancy is noted during construction. The schedule shall be reviewed at project meetings. The Contractor shall keep the actual progress updated on the schedule.
- D. Schedule of Values: Within seven days of notice to proceed, submit to the Architect three copies of the Schedule of Values. The breakdown will form the basis of evaluation of the work done and for progress payments.
  - 1. The breakdown shall schedule the value of the work for each category of work or subcontractor and each major material supplier.
  - 2. General Conditions will be itemized into at least the following separate categories: Bonds and insurance, supervision, taxes, temporary services, overhead and profit.

### 1.05 CONTINGENT CORRESPONDENCE

- A. Construction Field Authorization(s): A written order, instruction, or interpretation, making changes in the work, which may or may not involve a change in Contract Sum or Contract Time. When signed by the Architect and Owner the Contractor shall proceed as directed in the Authorization.

### 1.06 REQUEST FOR INFORMATION (RFI)

- A. It is the Contractor's responsibility to review Contract Documents in a timely manner so that the Consultant shall have sufficient time to respond to a Request for Information prior to the start of actual construction of that part of the Work.
- B. When field conditions or Contract Document contents require clarification or verification by the Architect or Architect's sub-consultants, a written RFI is to be submitted as follows:
  - 1. Identify the nature and location of each clarification/verification using a RFI form; provide as a minimum the following information:
    - a. Project name and number;
    - b. Date;
    - c. Date response desired.
    - d. RFI number;
    - e. Subject;
    - f. Initiator of the question;
    - g. Indication of costs, if known;
    - h. Location on site;
    - i. Contract drawing reference;
    - j. Contract specification section and paragraph reference;
    - k. Descriptive text;
    - l. Space for reply on same page as questions; and
    - m. Single subject matter, 1 item each - architectural, civil, structural, mechanical, electrical
  - 2. Number each RFI sequentially beginning with number 001 (RFI-001). Only one question per RFI.
- C. Uses
  - 1. The RFI form shall be used for interpretation or clarification of the Contract Documents only.
  - 2. Do not use the RFI form for the following; the Consultant will not reply and the RFI will be returned without action:
    - a. Product or material substitution.
    - b. Questions relating to construction means, methods, techniques, sequences, procedures, or safety precautions. These are the Contractor's responsibilities exclusively.
    - c. Questions relating to construction schedule, coordination between trades, or division of work among subcontractors. These are Contractor's responsibilities exclusively.
    - d. Questions on contract administration procedural matters, unless they require interpretation or clarifications of the Contract Documents.
    - e. Dimensions or quantities which are shown on the Contract Documents, which can be measured or calculated from the information contained in the Contract Documents where such measurement or calculation is standard construction industry practice.
    - f. Confirmation of interpretations or clarifications previously provided by the Architect.

- g. The Contractor shall not initiate requests for interpretations or clarifications of the Contract Documents which can be reasonably derived from a review of the Contract Documents.
- D. Route: RFI's in same manner as correspondence
- E. Clarifications may be discussed on-site or by telephone with Architect or Architect's sub-consultant with concurrence of the Architect. The essence of these discussions are to be incorporated into a RFI form and submitted for normal RFI processing.
- F. Reply
  - 1. The Consultant will endeavor to reply to all RFI's promptly as his work schedule allows and generally no later than 7 working days from the day received. The Architect will expedite those RFI's indicated by the contractor as being critical to the construction process.
  - 2. When an RFI involves a complex subject, extensive research or governmental agency contact, the Architect will inform the Contractor that additional time is required to prepare a reply. The Contractor shall cooperate and agree to reasonable additional time.
  - 3. The reply shall be a clarification or an interpretation of the Contract Documents; the reply is not an authorization of change in the Contract Sum or Time.

#### **1.07 NON-COMPLIANCE NOTICE (NCN)**

- A. Any work that is identified as not in compliance with the Contract Documents, either by oral discussion with the contractor, or written communication to the contractor, shall be removed and replaced without cost to the Owner, including removal of additional material necessary to confirm non-compliance. At its option, the Owner may accept written alternative solutions by the contractor and recommended by the Architect. The Contractor shall notify the Architect and Owner in writing immediately following oral discussion or receipt of any written communication if the contractor believes they are in compliance with the Contract Documents. The Architect will make a determination based on the Contract Documents. If the Architect finds the work is in non-compliance the Architect will issue a written Non-Compliance Notice (NCN). Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. Upon receipt of the NCN, the Contractor shall take immediate action to correct work. Review corrections at progress meetings for closure.
- B. If the Contractor fails or refuses to comply promptly after the final determination of the appropriate corrective action, the Owner may:
  - 1. issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Owner will not pay for non-complying work or follow on work until the non-complying work is corrected or replaced. If it becomes necessary to stop work due to non-correction or non-complying work, no delay claim, time extension, or compensation will be granted, or
  - 2. the Owner may elect to correct the non-compliant work and back charge the Contractor by a deductive Change Order

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
  - 1. Preconstruction meeting;
  - 2. Progress meetings;
  - 3. Coordination meetings;
  - 4. Pre-installation meetings prior to starting certain work;
  - 5. Commissioning meetings;
  - 6. Project closeout meetings;
  - 7. Owner training meetings.

**1.02 PRECONSTRUCTION MEETING**

- A. The Owner will schedule a preconstruction conference before starting construction, at a time convenient to the Contractor and the Architect, but no later than 15 days after the Notice To Proceed. The conference will be held at the Project Site or another convenient location as selected by Owner.
- B. Attendance is required of the following:
  - 1. Consultant and Consultant's sub-consultants;
  - 2. Owner's Representatives;
  - 3. Project Manager;
  - 4. Contractor's Superintendent and Project Manager; Contractor's QC Representative if different individual than the Project Manager.
  - 5. Major Subcontractors;
- C. Discussion will cover items of significance, including the following:
  - 1. Communication chain and persons authorized to direct changes;
  - 2. The Work;
  - 3. Site Representative's roles;
  - 4. Work hours, sequence, phasing, and occupancy;
  - 5. Special project procedures;
  - 6. Procedures and processing:
    - a. Application for payments;
    - b. Change Order Proposals (COP);
    - c. Field Authorizations (FA);
    - d. Change Orders (CO);
    - e. Requests for Information (RFI);
    - f. Architects Supplemental Instructions (ASI)
    - g. Field decisions;
    - h. Submittals;
    - i. Others as appropriate.
  - 7. Project record documents including review of as-builts on a regular basis during construction;
  - 8. Temporary utilities;
  - 9. Security procedures;
  - 10. Housekeeping procedures;

11. Utility shutdowns / Outage Request Form;
  12. Parking;
  13. Schedule Review;
  14. Hazardous material abatement procedures.
  15. Use of site and premises by Owner and Contractor.
  16. Others, as appropriate.
- D. The Architect will:
1. Conduct the meeting to review contract administration requirements.
  2. Record, produce, and distribute copies of the minutes to the Owner and General Contractor within seven (7) days of the meeting.
- E. The General Contractor shall be responsible to distribute copies to all other Contractor attendees.

### 1.03 PROGRESS MEETINGS

- A. For purposes of coordination and scheduling after start of the work, weekly Progress Meetings will be held to enable an orderly review of the construction progress and to provide for systematic discussion and analysis of concerns that may arise relative to execution of the work.
- B. Contractor, and Subcontractors as required, shall incorporate attendance at these meetings as part of the Base Bid of the project - no overtime payments will be authorized for Contractor or Subcontractors to attend Progress Meetings or other special meetings if required.
- C. Meeting Locations: ADA accessible Contractor's project field office or Owner provided meeting room, unless otherwise agreed.
- D. Attendance: Representatives attending meetings are required to be qualified and authorized to act on behalf of their firms. Attendance shall include:
1. Architect and Architect's sub-consultants, as appropriate;
  2. Owner's Representatives;
  3. Contractor's Superintendent, Project Manager, and QC Representative;
  4. Subcontractors, as appropriate;
  5. Suppliers, as appropriate;
- E. Agenda: The minimum agenda for construction progress meetings shall include:
1. State Project Number
  2. State Project Title
  3. Date of meeting
  4. Attendees
  5. Other project participants to be included on meeting minutes' distribution but not necessarily in attendance
  6. Previous Minutes with action items from last meeting
  7. Risk Issues
  8. Construction Progress Schedule Update
  9. Review pertinent portions of Site Specific Safety Plan. Address what will occur before next progress meeting and if there have been any incidents
  10. Field Authorization/Change Order Proposal/Change Order Log and Status
  11. Material Delivery Status
  12. Requests for Information (RFI's)
  13. Quality Control/Quality Assurance
  14. As-built Updates

15. Construction Waste Management Update
  16. Project Closeout
  17. Commissioning Update
  18. Field Observations
  19. Inspection and Test Reports
  20. Progress Payment, Apprenticeship, and Diverse Business Participation (when applicable)
  21. Discussion
  22. Action Items (by whom and by when)
  23. Next Meeting Date & Time
- F. Architect will:
1. Administer weekly Progress Meetings throughout work progress;
  2. Record, produce, and distribute copies of the minutes to the Owner and General Contractor within seven (7) days of the meeting.
  3. Ascertain that work is prosecuted consistently with contract documents and construction schedules.
- G. Contractor shall be responsible to provide the following at each meeting:
1. Current (and updated if necessary) construction schedule which includes the past week and 2 week 'look ahead'.
  2. One set of record documents (drawings, specifications, COs, COPs, RFIs, FAs, etc.).
  3. Current (and updated if necessary) submittal schedule.
  4. Current (updated) set of "as-built" Project Record Documents.

#### **1.04 COORDINATION MEETINGS**

- A. Contractor shall hold weekly coordination meetings with his subcontractors and suppliers as deemed necessary by the Contractor for coordination of the work. Meetings shall be held on site. The Owner and the Architect will be available to attend such meetings upon request. Refer to Section 01 31 00 for additional information and requirements pertaining to coordination meetings.
- B. The Contractor shall hold weekly coordination meetings with its prime subcontractors beginning the first week after the Notice To Proceed. The superintendent of the Contractor and prime subcontractors shall review the Contractor's schedule for the first three (3) months of work and thoroughly review the work required by the Contract Documents for that period. The Contractor shall submit Design Clarification Requests, Requests For Information, or any other type of information requests the Contractor may use, for the three (3) month work period during the first month after Notice To Proceed to minimize any conflicts that might occur when mobilization begins.
- C. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special preinstallation meetings.
- D. Request representation at each meeting by every trade currently involved in coordination or planning for the construction activities involved.
- E. The Contractor shall continue to hold coordination meetings with its prime subcontractors on a regular weekly basis, and, beginning one month in advance of the next three (3) month work increment, review the Contractor's schedule and contract documents and submit Design Clarification Requests, Requests For Information, or any other type of information requests the Contractor may use. This process shall continue for each three (3) months, or increments of 3 month work segments until the completion of the Project.
- F. Record meeting results and distribute copies to Consultant and Owner and to others affected by decisions or actions resulting from each meeting.

**1.05 PRE-INSTALLATION MEETINGS**

- A. General: Prior to commencement of work listed below or as otherwise determined by the Consultant or Owner, the General Contractor or his general superintendent, the responsible foremen for the subcontractors performing said work, plus all associated sub-subcontractors, suppliers, fabricators, vendors, and others as appropriate, shall attend a meeting for the purpose of establishing a full understanding of the procedures and requirements for the orderly progress of the designated work.
- B. Require attendance of entities directly affecting, or affected by, work of the Section including Architect, Owner's Representatives, Contractor's Project Manager and Superintendent with Lead man performing the work, and/or the appropriate Subcontractors/Suppliers/Fabricators.
- C. Contractor shall notify the Architect of the Contractor's scheduled pre-installation meeting not less than seven (7) days prior to the scheduled start of any of the work listed below so that the Architect may schedule their appropriate staff. All applicable submittals as well as the Subcontractor's safety plan and insurance certificates shall have been submitted to and reviewed by the Architect prior to scheduling this meeting. Work requiring pre-installation meetings shall include, but not necessarily be limited to, the following.
  - 1. Landscaping
  - 2. Cast-in-place concrete.
  - 3. Masonry cleaning/restoration
  - 4. Structural steel.
  - 5. Waterproofing / water repellent treatment (each respective type).
  - 6. Painting.
  - 7. HVAC sheetmetal.
  - 8. Plumbing
  - 9. Fire alarm.
  - 10. Balancing controls.
- D. Work Plan: Develop a written work plan for each definable segment of work. Complete the work plan prior to the pre-installation meeting, and this shall serve as the basis for discussion and contract compliance. Include a review of contract requirements to assure that materials and equipment delivered and assembled for construction conform to contract requirements and that control testing, including procedures, are finalized. Examine work areas, upon which new work is to be placed, to verify the substrate for the new phase of work.
- E. Agenda
  - 1. Review technical contract requirements with any options. Contractor to submit any options and resolve with Owner any conflicts, interference, or compatibility problems.
  - 2. Insurance and certifications.
  - 3. Schedule. Include the work on the three (3) week Short Interval Schedule.
  - 4. Review requirements as relates to:
    - a. Schedule.
    - b. Submittals and mock-ups - status of approval; review contract requirements. Note: All submittals pertaining to a pre-installation meeting shall have been reviewed by Architect/Engineer and returned to Contractor.
    - c. Tolerances.
    - d. Manufacturer's requirements.
    - e. Weather limitations.
  - 5. Materials - available and ready for use.
  - 6. Persons responsible for work.
  - 7. Quality control methods:

- a. Testing/Inspection requirements - required inspections and tests, who samples and how often? Criteria for performance of work.
- b. Acceptability of substrates - criteria for approving substrate.
- c. Required performance results.
- d. Recording requirements.
- 8. Applicable governing rules and regulations.
- 9. Temporary facilities and controls:
  - a. Safety, environmental controls, security, noise.
  - b. Space and access limitations.
- 10. Protection of work, curing periods and related subjects.
- 11. Other business

#### **1.06 COMMISSIONING MEETINGS**

- A. Refer to respective sections of the various general, mechanical and electrical Divisions of the Project Manual for associated commissioning meeting requirements.

#### **1.07 PROJECT CLOSEOUT MEETINGS**

- A. When the Architect determines that the construction is approximately 75% complete, a meeting dedicated to construction closeout issues shall be held at the site, at a time as established by the Architect.
- B. For the purpose of attaining project closeout, commencing immediately following established date of Substantial Completion, Contractor's project manager and superintendent and all subcontractors who have outstanding punch list items associated with their work, or as otherwise requested and including all subcontractors involved in the building systems commissioning process, shall attend closeout meetings which shall be held at the jobsite.
- C. Such meetings shall be held to review and discuss the resolution of all punch list items in order to attain Final Completion. Closeout meetings shall continue until all punch list items have been resolved and Final Completion is attained.

#### **1.08 TRAINING MEETINGS FOR OPERATING INSTRUCTIONS OF OWNER'S PERSONNEL**

- A. Refer to Section 01 79 00 for training requirements related to operating instructions of Owner's personnel.

#### **1.09 ADDITIONAL MEETINGS**

- A. As the construction progresses, additional meetings may be required. These may be called at the direction of or by the Architect.

**END OF SECTION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:
  - 1. Shop Drawings.
  - 2. Product Data.
  - 3. Samples.
- B. The individual submittal requirements of certain submittals are specified in applicable sections for each unit of work.
- C. Shop drawings, product data, samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate, for those portions of the Work for which submittals are required, how Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

**1.02 DEFINITIONS**

- A. Shop Drawings: Shop drawings include specially prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to several projects. Reproduction of Contract Document drawings are not considered to be shop drawings unless approved by the Architect.
- B. Product Data: Product data includes standard printed information on materials, products and systems, not specially prepared for this project, other than the designation of selections from among available choices printed therein.
- C. Samples: Samples include both fabricated and unfabricated physical examples of materials, products, and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.
- D. Coordination Drawings: Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

**1.03 SUBMITTAL PROCEDURES**

- A. Provide a submittal on every product and material used in the Project. Before submittal of shop drawings, brochures, and lists, Contractor shall carefully review same for proper identification, completeness, correctness, dimensions, and technical applicability to the Contract Document requirements and note all corrections, items needing clarification, additional comments, and the like. Upon thorough review and subsequent acceptance by the Contractor, if so accepted, Contractor is to note its approval together with said notes or amendments thereto for compliance with the Contract Documents by suitable stamp, date and the signature of the Contractor or its authorized representative. Submittals will be returned to the Contractor without action by the Architect if the items submitted are not stamped, signed, and identified as approved or approved as noted or other similar language indicating approval by the Contractor, or if the submittal is obviously not thoroughly reviewed.
- B. Submission of shop drawings and samples shall be accompanied by one original and one copy of a transmittal letter containing Project name, Contractor's name, number of drawings and samples, titles and other pertinent data.
- C. Many products are specified by one or more named products/manufacturers. In those circumstances where Contractor submits an unnamed, non-prior approved product/manufacturer during this 'shop drawing' phase, said submittal shall be submitted in conformance with product substitution requirements of Section 01 61 00, Article 2.03.

SECTION 01 33 00  
SUBMITTAL PROCEDURES

- D. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
- E. Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block. Consecutively number each submittal beginning with the number 001.
  - 1. Provide adequate space for the Contractor's stamp and approval, plus a space approximately 4 by 5 inches each on the label or beside the title block on Shop Drawings to record the Architect's review and approval markings and the action taken.
  - 2. Include the following information on the label or title block for processing and recording action taken.
    - a. Project name and job number.
    - b. Date.
    - c. Name and address of the Architect.
    - d. Name and address of the Contractor, subcontractor, supplier and manufacturer as appropriate.
    - e. Number and title of appropriate Specification Section.
    - f. Drawing number and detail references, as appropriate.
- F. Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned through the Contractor without action.
  - 1. Address no more than one topic or related topics on a single transmittal (i.e. mechanical items shall not be submitted under same transmittal with electrical items).
  - 2. Record relevant information, deviations, and requests for data, including minor variations and limitations from the Contract Documents.
  - 3. Shop drawings, product data, samples, and mock-up as required for submissions by the technical specification sections are to be submitted for Architect's review/approval. For printed submittals, the number of submittals required is noted in the parenthesis.
    - a. Shop Drawings: (4) sets.
    - b. Product Data: (4) copies.
    - c. Samples: (2) samples
    - d. Mock-ups: As required by any technical specification section.
    - e. Reference applicable electrical technical specifications' sections for additional submittal requirements.
  - 4. Material and Color Submittal: Submit samples of actual colors of materials.
  - 5. Number submittals as follows: Numerical Order, Spec Section, Revision Letter.
  - 6. In the event of the need to "revise and resubmit" a submittal, resubmit same in acceptable form/content, clearly identifying deviations from previous submittal content.
- G. Electronic Submittals: Should the Contractor want to use an electronic submittal process in lieu of printed submittals, the design team supports and encourages this approach. The submittal requirements for electronic submittals shall be one PDF electronic copy. Identify and incorporate information in each electronic submittal file 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.
    - a. File name shall use project number and Specification Section number followed by a decimal point and then a sequential number (e.g., J2037C-092900.01). Resubmittals

shall include an alphabetic suffix after another decimal point (e.g., J2037C-092900.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect or their Sub-Consultant.
4. Transmittal Form for Electronic Submittals: Use form acceptable to Owner and Architect, containing the following information:
  - a. Project number and name.
  - b. Date.
  - c. Name and address of Architect.
  - d. Name of Contractor.
  - e. Name of firm or entity that prepared submittal.
  - f. Names of subcontractor, manufacturer, and supplier.
  - g. Category and type of submittal.
  - h. Submittal purpose and description.
  - i. Specification Section number and title.
  - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - k. Drawing number and detail references, as appropriate.
  - l. Location(s) where product is to be installed, as appropriate.
  - m. Related physical samples submitted directly.
  - n. Indication of full or partial submittal.
  - o. Transmittal number, numbered consecutively.
  - p. Submittal and transmittal distribution record.
  - q. Other necessary identification.
  - r. Remarks.
5. Transmittal: Transmit each submittal package via e-mail to appropriate parties. When submittals are directed to parties other than Architect or Owner's Representative, Architect and Owner's Representative shall be copied on such email.

#### 1.04 SHOP DRAWINGS

- A. Submit drawings drawn to accurate scale. Do not reproduce Contract documents or copy standard information for use as Shop Drawings. Standard information prepared without specific references to the project is not a Shop Drawing.
- B. Include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
  1. Dimensions;
  2. Identification of products and materials included;
  3. Compliance with specified standards;
  4. Notation of coordination requirements;
  5. Notation of dimensions established by field measurements; and
  6. Any deviation from contract drawings or specifications;
  7. Date when review has to be finalized to meet schedule.
- C. Except for templates, patterns and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2" x 11", but no larger than 24" x 36".
- D. Shop drawings shall clearly indicate the correct configurations and relative sizes, materials, metal gauges, etc. of the various components and the proposed methods of fabrication, required clearances, supports and any other pertinent data.

- E. All items shown on shop drawings that do not conform to plans and specifications shall be specifically noted as such (flagged) and brought to the Architect's attention. In any case, the Architect's stamp of review shall not include approval of unauthorized changes in the Contract Documents, except where specific written approval is given.
- F. Contractor is responsible for obtaining and distributing required prints of shop drawings to its subcontractors and material suppliers after as well as before final review by the Consultant. Prints of reviewed shop drawings shall be made from returned transparencies which carry the Contractor's and Consultant's appropriate stamps. Architect / Owner and applicable sub-consultants and governing agencies will retain copies of each shop drawing submittal. Reproducible transparency and all remaining prints not otherwise retained will be returned to Contractor.
- G. At Architect's discretion, the prints distributed by the Consultant including the one print returned to the Contractor (in addition to the original transparency) may consist of copies made from the marked-up and stamped transparencies.

#### **1.05 PRODUCT DATA**

- A. Product data includes Safety Data Sheets (SDS), manufacturer's printed installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves.
  - 1. Where product data must be specifically prepared because standard printed data is not suitable, submit as Shop Drawings.
- B. Mark each copy to show applicable choices and options, and indicate the applicable information on selected products. Include the following information:
  - 1. Manufacturer's printed recommendations.
  - 2. Compliance with recognized trade association standards;
  - 3. Compliance with recognized testing agency standards;
  - 4. Application of testing agency labels and seals;
  - 5. Notation of dimensions verified by field measurement;
  - 6. Notation of coordination requirements; and
  - 7. Any deviation from Contract Drawings or Specifications;
  - 8. Date when review has to be finalized to meet schedule.
- C. The Contractor is responsible for providing certification that all construction materials used on the Project are 100% free of asbestos and lead.

#### **1.06 SAMPLES AND MOCK-UPS**

- A. Submit samples and mock-ups that are identical with the material or product proposed. Samples include partial sections of components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
  - 1. Package samples to facilitate review. Prepare samples to match the Architect's sample. Include the following:
    - a. Generic description of the sample;
    - b. Sample source;
    - c. Product name or name of manufacturer;
    - d. Compliance with recognized standards;
    - e. Availability and delivery time; and
    - f. Specification section.
- B. Submit samples and mock-ups for review of kind, color, pattern, and texture, for a comparison of these characteristics before the actual component installation and after final submittal.

1. Where variation in color, pattern, texture or other characteristics are inherent in the material, submit not less than four (4) units to show approximate limits of the variations.
- C. Where samples are for selection of appearance characteristics from a range of standard choices, submit a full set of choices for the material or products.

**1.07 ARCHITECT'S ACTION**

- A. Except for submittals for record, information or similar purposes, Architect will review each submittal, mark to indicate action taken, and return promptly.
- B. Architect review of submittals does not release Contractor from a proper installation, compliance with applicable codes, or coordination of the Work.
- C. The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be marked to indicate the action taken.
- D. The Architect will distribute, as a minimum, the reviewed submittals as follows:
  1. (1) copy to Architect file; along with (1) sample.
  2. (1) copy to Architect subconsultants. For those submittals requiring review by Architect subconsultant.
  3. (1) copy to Owner; along with (1) sample.
  4. Remainder of copies submitted by the Contractor.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 GENERAL REQUIREMENTS**

- A. This project is subject to the payment of prevailing wages to all workers. It is the Contractor's responsibility to determine and use the most recent set of rates for the appropriate area of the state, as published by the Washington State Department of Labor and Industries. These rates are available on the web at <http://www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/>.
- 1. Contractor must include these provisions in all subcontracts for work performed under this Contract.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

A. Description Of Requirements

1. Definition:
  - a. This Section specifies procedural and administrative requirements for the compliance with governing regulations and imposed codes and standards, including the obtaining of permits, licenses, inspections, releases and similar documentation, and including payments, statements and similar requirements associated with regulations, codes and standards.
  - b. "Regulations" is defined to include those rules, conventions and agreements within the construction industry which effectively control the performance of the work, regardless of whether lawfully imposed by governing authority.
2. Governing Regulation: Refer to the General and other Conditions for requirements related to the compliance with governing regulations.
3. Industry Standards: Refer to individual specification sections and other contract documents for names and abbreviations and for compliance with applicable industry standards.

**1.02 INDUSTRY STANDARDS**

A. General Applicability of Standards

1. Applicable standards of construction industry have same force and effect (and are made a part of Contract Documents by reference) as if copied directly into contract documents, or as if published copies were bound herewith.
  - a. Referenced Standards: Referenced standards (referenced directly in contract documents or by governing regulations) have precedence over non-referenced standards which are recognized in industry for applicability to work.
  - b. Non-Referenced Standards: Non-referenced standards recognized in the construction industry are hereby defined, except as otherwise limited in contract documents, to have direct applicability to the work, and will be so enforced for performance of the work.

B. Publication Dates

1. Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

C. Copies of Standards

1. In connection with the general requirement (elsewhere in the contract documents) that each entity performing the actual work be expert in the portion of the work being performed, each such entity is hereby also required to be familiar with recognized industry standards applicable to that portion of work.
2. In general, copies of applicable standards have not been bound with the contract documents. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source. Although certain copies of standards needed for enforcement of the requirements may be specified as required submittals, the Architect reserves the right to reasonable require the Contractor to submit copies of additional applicable standards as needed for enforcement of the requirements.
3. The General Conditions, or Division 01 - General Requirements of the Project Manual shall void any of the general, but not technical, provisions of any of the referenced Standard Specifications in conflict therewith.

D. Abbreviations & Names

1. Standard data of the following organizations may be referenced in the Project Manual with the organization names abbreviated as noted; copies of standard specifications and data may be obtained from the organizations.
- 2.

### **1.03 GOVERNING REGULATION/AUTHORITIES**

#### **A. General**

1. The procedure followed by the Architect has been to contact governing authorities where necessary to obtain information needed for the purpose of preparing the contract documents, recognizing that such information may or may not be of significance in relation to the Contractor's responsibilities for performing the work.
2. Contact- governing authorities directly for necessary information and decisions having a bearing on the performance of the work.
3. Notwithstanding reference in these Specifications to any rule or regulation, the Architect does not assume any duty to provide supervision of construction methods or processes.

#### **B. Trade Jurisdictions**

1. It is a procedural requirement that the Contractor maintain, and require the prime Contractors to maintain, complete current information on jurisdictional matters, regulations, actions and pending actions, as applicable to the performance of the work, and that these be discussed at appropriate project meetings at the earliest feasible dates, and that information of particular relevance be recorded along with actions agreed upon.
2. The manner in which the contract documents have been organized and subdivided is not intended to be an indication of jurisdictional or trade agreements.
3. Assign and subcontract the work, and employ tradesmen and labor, in a manner which will not unduly risk jurisdictional disputes of the kind which could result in conflicts, delays, claims and losses in the performance of the work.

### **1.04 SUBMITTALS**

#### **A. Permits, Licenses & Certificates**

1. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

### **PART 2 - PRODUCTS - NOT USED**

### **PART 3 - EXECUTION - NOT USED**

**END OF SECTION**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. See other sections of the specifications for additional definitions.

**1.02 DEFINITIONS**

- A. Definitions: The following definitions, of terms or words used in this Project Manual, are in addition to those in the General Conditions.
  - 1. Product: The term "product" as used in the Project Manual includes materials, systems and equipment provided by the Contractor for use in the Work.
  - 2. Project Manual: The term "Project Manual" is the volume which includes the Bidding Requirements, Conditions of the Contract, and the Specifications, Divisions 1 to 49 inclusive, as applicable, and as listed in the Table of Contents bound therein, hereinafter referred to as "Project Manual".
  - 3. Architect or Consultant: The term "Architect" or "Consultant" as used herein, shall mean "KMB Architects, 906 Columbia St. SW, Suite 400, Olympia, Washington 98501".
  - 4. Owner: The term "Owner": means Lewis County, acting through the Lewis County Facilities Department".
  - 5. General Requirements: The provisions or requirements of Division 01 Sections. General Requirements apply to entire work of Contract and, where so indicated, to other elements of work which are included in the Project.
  - 6. Indicated: The term "indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in the contract documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated", it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.
  - 7. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed", "requested", "authorized", "selected", "approved", "required", "accepted", and "permitted" mean "directed by Architect", "requested by Architect", etc. However, no such implied meaning will be interpreted to extend Architect's responsibility into Contractor's area of construction supervision.
  - 8. Approved: Where used in conjunction with Architect's response to submittals, requests, applications, inquires, reports, and claims by Contractor, the meaning of the term "approved" will be held to limitations of Architect's responsibilities and duties as specified in General Conditions. Where the terms "or approved" or "as approved" or "for approval" are used, the Architect is the sole judge of the quality and suitability of the proposed substitutions. In no case will "approval" by Architect be interpreted as a release of Contractor from responsibilities to fulfill requirements of the Contract Documents. Whenever a material, article or piece of equipment is identified on the Drawings or in the Project Manual by reference to manufacturer's or vendor's names, trade names, catalog numbers, or the like, and followed by the wording "or approved" or "equivalent, as approved", it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equivalent substance, appearance or function and has been approved by the Architect in writing prior to bid opening in conformance with the provision of the Instructions to Bidders. It shall not be purchased or installed by the Contractor without Architect's and Owner's prior written approval.

9. Furnish: Except as otherwise defined in greater detail, the term "furnish" as used herein shall mean supply and deliver to project site, ready for unloading, unpacking, assembly, installation or erection, etc., as applicable in each instance.
10. Install: Except as otherwise defined in greater detail, the term "install" is used herein to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations, as applicable in each instance.
11. Provide: Except as otherwise defined in greater detail, the term "provide" means furnish, coordinate and install, complete and ready for intended use, as applicable in each instance.
12. Coordinate: The term "coordinate" means satisfactorily combine the work of all trades for a complete and operating installation.
13. Selected: The term "selected" means "selected by the Architect and Owner" and is not necessarily limited to a manufacturer's standard line of colors, finishes or details.
14. Satisfactory: The term "satisfactory" means "satisfactory to the Architect and Owner"; the Architect shall be the sole judge of the acceptability of a product or an installation.
15. Trades: Except as otherwise indicated, the use of titles such as "carpentry" in specification text, implies neither that the work must be performed by an accredited or unionized tradesman of the corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradesmen of that corresponding generic name.

### **1.03 SPECIFICATION AND DRAWING FORMAT AND CONTENT EXPLANATION**

- A. The General Conditions, Supplemental Conditions, and Division 01 of these Specifications shall be a part of technical Divisions and Sections the same as if they were specifically called for in each section.
- B. Wording of these Specifications: These Specifications are of the abbreviated or streamlined type and may include incomplete sentences. Words such as "shall," "the Contractor shall," "shall be," and similar mandatory phrases, are included by inference.
- C. Tense, Gender, Singular, Plural: Present tense words include future tense. Words in masculine gender include feminine and neuter genders. Words in the singular include plural. Plural words include singular.
- D. All, Entire, and the Like: For brevity throughout the documents, these words may be omitted. Read their implications into all work, as the following parenthetical insertion exemplifies: "Balance and adjust (all) dampers."
- E. Specification by Reference: Any material specified by reference or number, symbol or title of a specified standard, such as commercial standard, ANSI and ASTM documents, Federal Specifications, trade association standard, or the like, shall comply with the following:
  1. The latest revision requirements thereof;
  2. Any amendment or supplement thereto in effect on date of the Project Manual, except as modified;
  3. When building code requirements refer to a different issue of standards specifications, such issue governs.
- F. Drawings are in part diagrammatic and do not necessarily show complete details of construction, work or materials, performance or installation. They do not necessarily show how construction details, other items or work, fixtures, and equipment may affect any particular installation. The Contractor is required to ascertain and correlate the work to bring the parts together into a satisfactory and completed whole.
  1. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other portions of the work.

2. Wherever a detail is referenced and developed for a specific condition, same or similar detail shall apply to identical or similar conditions elsewhere on project even though not specifically referenced.

#### **1.04 DRAWING SYMBOLS**

- A. General: Except as otherwise indicated, graphic symbols used on Drawings are those symbols recognized in the construction industry for purposes indicated.

#### **1.05 DRAWINGS, DIMENSIONS & MEASUREMENTS**

- A. General
  1. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other portions of the work.
  2. Wherever a detail is referenced and developed for a specific condition, same or similar detail shall apply to identical or similar conditions elsewhere on project even though not specifically referenced.
  3. Where the word "similar" occurs on the Drawings, it shall be interpreted in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection with other parts of the work.
  4. The figured dimensions on the Drawings or notes indicating dimensions shall be used instead of measurements of the Drawing by scale, and shall be strictly complied with.
  5. No scale measurements shall be used as a dimension to work with except on "full size" drawings not dimensioned.

**END OF SECTION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Testing and Inspection Service: The Owner may select and employ one or more Independent Testing Agencies, Engineering Services or Special Inspectors, hereinafter called Owner's Testing Representative (OTR), to conduct tests and inspections as specified, requested by the Owner, or required by Authorities Having Jurisdiction (AHJ). The OTR will provide inspector(s) approved by the AHJ. For the purpose of this specification section, all references made herein to OTR shall be those tests or inspections which will be conducted by an inspector provided by the Owner.
- B. Tests and inspections not explicitly assigned to Owner under this Section as well as tests and inspections which are normally associated with obtaining permit approval by AHJ shall be provided and paid for by the Contractor.
- C. In general, materials, quantities and extent of tests are identified in the respective specification sections.

**1.02 QUALITY ASSURANCE - INDEPENDENT TESTING AGENCY**

- A. Qualifications:
  - 1. Agency employed by Owner shall be a testing laboratory qualified by the United States Bureau of Standards, to provide inspection and material testing services for the general construction quality control, and which will meet basic requirements of ASTM E329 "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".
  - 2. Meet "Recommended Requirements for Independent Laboratory Qualification" published by American Council of Independent Laboratories.
  - 3. Authorized to operate in the State of Washington.
- B. Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to either:
  - 1. National Bureau of Standards.
  - 2. Accepted values of natural physical constants.
- C. Certification: The OTR will submit to Architect and Local Building Department certification of meeting the above qualifications. Inspector(s) performing welding inspection shall be AWS certified.

**1.03 DUTIES OF OWNER'S TESTING AGENCY**

- A. The OTR will be available during Contractor's normal working hours and identified overtime, second shift and out of area activity as scheduled by the Contract Documents.
- B. The OTR shall conduct testing and inspection services, interpret them, and evaluate the results for compliance with the Specifications. Testing and inspection services which are performed shall be in accordance with applicable standard methods of ASTM or other procedures specified.
- C. Continuous and special inspections shall be performed by the OTR as required by Contract Documents and governing authorities.
- D. The Inspectors are not authorized to do the following:
  - 1. Release, revoke, alter or enlarge on requirements of Contract Documents.
  - 2. Approve or accept any portion of the work, unless otherwise specifically noted.
  - 3. Perform any duties of the Contractor.
  - 4. Stop Work.

#### 1.04 CONTRACTOR'S RESPONSIBILITIES

- A. It is the Contractor's responsibility to initiate and coordinate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract. Contractor shall be responsible for coordinating the testing requirement with the OTR and provide the OTR no less than two (2) working days advance notification to schedule tests.
- B. For the purpose of inspection, the OTR shall at all times have free access to all parts of the work and to the shops where the work is in preparation, and the Contractor shall at all times provide and maintain proper facilities and safe access for such inspection. The Contractor shall cooperate with OTR personnel, and furnish access, tools, samples, certifications, test reports, design mixes, equipment, storage, and assistance as requested by the OTR. The Contractor shall:
  - 1. Make available to the OTR safe access and working environment, and adequate quantities of samples of materials proposed to be used which require testing.
  - 2. Furnish copies of product test reports performed by Contractor as required by Contract Documents.
  - 3. Furnish incidental facilities necessary for the following:
    - a. To obtain and handle samples at the project site or at the source of the product to be tested.
    - b. To facilitate inspections, geotechnical monitoring, and tests.
    - c. For storage and curing of the test samples.
    - d. Electrical power and water required for testing procedures.
  - 4. Provide incidental labor, when requested, to facilitate testing and inspections.
- C. Where defective work requires redesign of portions of construction, such redesign costs shall be back charged to the Contractor by a deductive Change Order.
- D. All costs associated with Contractor scheduled testing outside its normal working hours which is not identified in the Contract Documents, insufficient advance notice to the OTR of cancellation of a test or inspection to allow rescheduling of the OTR's work load, and for re-testing of non-conforming material, will be back charged to the Contractor by a deductive Change Order.

#### 1.05 TEST AND INSPECTION REPORTS

- A. Copies of tests, special sampling operations and inspection reports shall be distributed by the OTR at weekly intervals, except as noted under NOTIFICATION OF NON-COMPLIANCE. All reports will be signed by a Registered Engineer. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported.
- B. The OTR will:
  - 1. Obtain and handle samples at project site or at source of product to be tested.
  - 2. Furnish laboratory test reports of materials and construction as required; include:
    - a. Date issued.
    - b. Project title and number.
    - c. Testing laboratory or engineering firm name, address, and telephone number.
    - d. Name and signature of representative.
    - e. Description of method of test.
    - f. Identification of sample and portion of the work tested.
    - g. Description of location in the work of the sample.
    - h. Time and date of obtaining sample.
    - i. Time and date of test of sample.

- j. Weather and climatic conditions.
  - k. Results of tests and compliance with Contract Documents.
  - l. Evaluation of results tests, including recommendations for action, when requested by Architect or Structural Engineer.
- C. The OTR will furnish "Inspection at Site" reports for each site visit documenting activities, observations, and inspections of work being inspected include:
- 1. Date issued.
  - 2. Project title and number.
  - 3. Testing Laboratory or engineering firm name, address, and telephone number.
  - 4. Name and signature of representative.
  - 5. Observations on weather and climatic conditions.
  - 6. Time and date.
  - 7. Conditions and/or status of the work being inspected.
  - 8. Actions taken.
  - 9. Recommendations or evaluation of the work.
- D. The OTR will distribute test and inspection reports as follows:
- 1. Architect: 2 copies.
  - 2. Structural Engineer: 2 copies.
  - 3. Soil Consultant: 1 copy;
  - 4. Owner: 2 copies;
  - 5. Contractor: 1 copy;
  - 6. Building Department: 2 copies.

#### **1.06 NON-COMPLIANCE OF WORK**

- A. See Section 01 31 15 Communication.

#### **1.07 NOTIFICATION OF NON-COMPLIANCE**

- A. If a laboratory test result indicates material on-site did not conform to the Contract Documents, the OTR shall immediately contact the Contractor, Architect, and/or Owner's Representative.
- B. Anything found by the OTR or Site Representative that is believed to be in non-compliance when they are on-site shall be immediately reported. The OTR shall notify the Contractor, Architect, and/or Owner's Representative. If the Architect believes there is a non-compliance the Architect will notify the Contractor and OTR.

### **PART 2 - PRODUCTS**

#### **2.01 NOT USED**

### **PART 3 - EXECUTION**

#### **3.01 DETAILED SITEWORK INSPECTION & TESTING REQUIREMENTS**

- A. Special Inspection & Structural Observation Requirements - General
- 1. Special inspection and structural observation requirements and programs shall be in accordance with the following provisions of the IBC, as adopted and amended by the State of Washington and AHJ:
    - a. Section 110 - Inspections.
    - b. Chapter 17 - Structural Tests and Special Inspections.

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TESTING LABORATORY SERVICES PROVIDED BY OWNER

2. Structural Notes may also have additional provisions pertaining to special inspection and are incorporated as if specified herein.
- B. Structural Cast-In-Place Concrete: Conform to "Required Special Inspections and Tests of Concrete Construction" as set forth on Structural Drawings.
- C. Welding: Conform to "Welding Inspection Tasks" as set forth on Structural Drawings.
- D. Bolting: Conform to "Bolting Inspection Tasks" as set forth on Structural Drawings.
- E. Metal Decking: Conform to "Metal Decking Inspection or Execution Tasks" as set forth on Structural Drawings.
- F. Steel Elements of Composite Construction: Conform to "Steel Elements of Composite Construction Prior to Concrete Placement" as set forth on Structural Drawings.
- G. Cold-Formed Steel Framing: Conform to "Cold-Formed Steel Structural Steel Material Verification Tasks and Inspection or Execution Tasks" as set forth on Structural Drawings.
- H. Roofing & Waterproof Membranes
  1. OTR to inspect and approve substrates for application of waterproofing and roofing materials, inspect all joints and flashings.
  2. Furnish continuous (full time) inspection during application of waterproofing and roofing materials, including roofing related sheet metal flashings and counterflashings.
- I. Water Repellent
  1. Inspect and approve substrates for application of water repellent materials.
  2. Furnish continuous (full time) inspection during application of water repellent.
- J. Building Envelope Air Leakage Rate Test: The completed building shall be tested for air leakage rate of the building envelope. The air leakage rate shall not exceed 0.40 cfm/ft<sup>2</sup> at a pressure differential of 0.3 inches water gauge (2.0 L/s x m<sup>2</sup> at 75 Pa) at the upper 95 percent confidence interval in accordance with ASTM E779 or an equivalent method approved by the local code official. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the Owner and the local code official. If the tested rate exceeds that defined here, a visual inspection of the air barrier shall be conducted and any leaks noted shall be sealed to the extent practicable. An additional report identifying the corrective actions taken to seal air leaks shall be submitted to the Owner and code official and any further requirement to meet the leakage air rate will be waived.
  1. Test shall be accomplished using either (1) both pressurization and depressurization or (2) pressurization alone, but not depressurization alone. The test results shall be plotted against the correct P for pressurization in accordance with Section 9.4 of ASTM E779.
  2. The test pressure range shall be from 25 Pa to 80 Pa per Section 8.10 of ASTM E779, but the upper limit shall not be less than 50 Pa, and the difference between the upper and lower limit shall not be less than 25 Pa.
  3. If the pressure exponent n is less than 0.45 or greater than 0.85 per Section 9.6.4 of ASTM E779, the test shall be rerun with additional readings over a longer time interval.
- K. Miscellaneous
  1. General: Provide other special inspections required by IBC as adopted by AHJ for structural or other work, or as requested by Owner.
  2. Additional Testing Services: Additional testing which may be performed by the Owner's OTR, if any, are specified elsewhere in Contract Documents.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, security and protection. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this Section will be recognized as an indication that such temporary activity is not required for successful completion of the work and compliance with the requirements of the Contract Documents.
- B. Unless otherwise noted, the temporary utilities described herein shall be provided by the Contractor. Work and requirements include, but are not necessarily limited to, the following:
  - 1. Provide temporary devices, equipment, power and other utilities as needed for use, convenience and safety of personnel engaged in the work of the Contract. Installations of temporary utilities is to be safe, non-hazardous and sanitary; they are to be protective of persons and property, and be free of deleterious effects.
  - 2. Locate temporary utilities where required or as directed or approved by Owner and A/E.
  - 3. Make all service connections to existing services in approved manner, in accordance with code requirements, and with prior approval of Owner.
  - 4. Install extensions and branches, as required.
  - 5. Maintain and protect temporary utilities.
  - 6. Remove from site upon completion of the Project or when directed.

**1.02 QUALITY ASSURANCE**

- A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction.
- B. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.
- C. Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

**1.03 EXISTING WORK**

- A. Existing construction and equipment not scheduled to be removed shall be kept in its original condition. If damaged, replace at no additional cost to the Owner.
- B. Repair damaged surfaces to match adjacent finish.

**1.04 PROTECTION OF EXISTING UTILITIES**

- A. Known utilities of record are shown on the Contract Drawings but are not to be considered as As-Built. The Contractor shall consider that the actual As-Built location may be within a tolerance of five (5) feet vertically or five (5) feet either side horizontally of that indicated in the documents. The Contractor shall take the following steps:
  - 1. Notify Owner in writing, on each occasion, of the intent to work near existing utility services or structures or when a new excavation or sawcutting operation is about to begin. Submit procedure for approval to assure safe and continuous operation of the services.
  - 2. Proceed with sufficient caution within the As-Built tolerance area to preclude damaging any known utilities. In the event unidentified utilities are encountered, notify Owner's Representative immediately.

3. In the event unknown utilities are damaged during construction, temporary services and/or repairs shall be made immediately by the Contractor to maintain continuity of services. Costs for temporary and/or permanent repairs will be accounted for through a Change Order.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Use qualified personnel for installation of temporary work. Locate temporary installations where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify as required.
- B. Provide each temporary installation ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until they are no longer needed or are replaced by authorized use of completed permanent installations.

### **3.02 TEMPORARY UTILITIES**

- A. If the Contractor decides to use any of the equipment or materials installed under this contract for heating, power, lighting, or any other project need while the Project is still under construction, warranty on those materials shall not begin until Substantial Completion.
- B. Telephone Service: Superintendent shall carry a cellular phone capable of receiving signal at the jobsite location to allow voice communication at all times.
- C. Engage the appropriate local utility company to install temporary service as needed or connect to existing service when it is on a public right-of-way, or the Owner when it will be connected to systems within the Owner's property lines. Where the utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
  1. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
  2. The Contractor may use existing Owner power, heat and water, and Owner will pay all consumption costs. However, Contractor's power shall be obtained through the use of a temporary construction power center installed by Contractor's electrician with connection made to an existing electrical panel with sufficient capacity for Contractor's power usage.
- D. Temporary Water. The Contractor may use existing Owner water. Supplement as required. Provide additional piping, hoses, etc. as required. The contractor is to confirm the source of any existing water to be used with the Owner prior to either connecting to, or opening, any source. Failure to confirm with the Owner the proper source could cause false alarms.
- E. Temporary Electric Power. The Contractor may use existing Owner power, if it is appropriate. However, Contractor's power shall be obtained through the use of a temporary construction power center installed by Contractor's electrician with connection made to an existing electrical panel with sufficient capacity for Contractor's power usage.
- F. Temporary Lighting. The Contractor may use existing Owner lighting. Where lighting is inadequate, supplement as follows:
  1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
  2. Provide a minimum of 5 foot-candles, higher if required by codes or regulations, of illumination in all building work areas where construction work is being accomplished; increase illumination to a minimum of 50 foot-candles for painting and other interior fine finish work. Provide additional illumination as directed for proper installation and

inspection of interior finish work. Permanent lighting equipment may be used after it is installed provided that any damaged components are replaced, and that all components are cleaned prior to acceptance of the project.

3. Remove temporary lighting and power equipment and accessories and their connections at completion of the work or sooner if approved or directed.

G. Temporary Heat & Ventilation

1. Furnish by methods approved by Architect, temporary heat and ventilation including fuel and power and attendance as required for the work when no other heat or ventilation is available.
2. Provide facilities and temporary units as required to comply with requirements. Provide temporary heat and ventilation required to:
  - a. Maintain adequate environmental conditions to facilitate progress of the work.
  - b. Meet specified minimum conditions for installation of materials.
  - c. Protect materials and finishes from damage due to temperature or humidity.
3. Provide adequate forced ventilation of enclosed areas to:
  - a. Cure installed materials.
  - b. Disperse humidity.
  - c. Prevent hazardous accumulations of dust, fumes, vapors, or gases.
4. Portable heaters: Use standard approved units complete with controls; the use of "salamanders" will not be permitted, except in exceptional cases when prior approval of Architect is obtained and proper ventilation in conjunction with said use is provided, as approved.
5. Non-availability of temporary heat when required for said work is cause for stoppage of affected work.
6. Include all costs for temporary heat in bid items.
7. See technical divisions for temperatures required for work of the various trades.
8. Indoor Air Quality and Dust Control: Refer to Section 01 81 19, Indoor Air Quality.

H. Temporary Ventilation.

1. Ventilate enclosed areas to exterior to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases. Where/when toxic or volatile materials are used, Contractor shall provide containment within specific work zones and 100% ventilation in an effort to maintain indoor air quality.
2. Pay all costs until final acceptance. Should Owner occupy part of facilities during construction, the cost of contractor provided utilities will be apportioned upon agreed unit costs.
3. All heating system equipment warranties shall commence at Substantial Completion, regardless of when put into operation.

- I. Temporary Toilets. Contractor shall provide temporary sanitary facilities, including temporary toilets, wash facilities, and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install adjacent to field office facilities where facilities will best serve the Project's needs.

**3.03 TEMPORARY SUPPORT FACILITIES**

- A. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Office. The Contractor shall provide a prefabricated or mobile unit to accommodate:
  1. With the capability to accommodate ADA access if needed.
  2. An office for the Contractor.

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3. A separate area of adequate size for weekly Progress Meetings of sufficient size to accommodate table(s) and chairs for up to (12) attendees and a lay-out table of adequate size to accommodate the construction documents. Space shall be wheelchair accessible.
  4. Locate field office and other temporary construction and support facilities in location as directed by Owner.
- C. Temporary Enclosures. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. The Contractor shall be responsible for the determination and maintenance of proper security measures for the job site temporary facilities for the duration of the construction Project including, but not limited to:
    - a. Locks on all construction equipment boxes, temporary storage and office facilities, and construction equipment (vehicles, cranes, dozers, forklifts, etc.).
    - b. Temporary construction cores for all exterior and storage room doors, locksets or cylinders.
    - c. Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism. Contractor is responsible for any theft or vandalism of its materials and equipment.
    - d. The Contractor shall hold the Owner harmless from all damage, vandalism, stolen equipment or supplies on the Project Site for whatever reason, or from injury to or death of unauthorized persons trespassing on Project Site because of inadequate security measures until the Owner releases the Contractor from security responsibilities in writing or at Final Completion, whichever occurs first.
  2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq.ft. or less with plywood or similar materials.
- D. Construction Aids
1. Provide construction aids and equipment required by personnel to facilitate the execution and inspection of the work.
    - a. Include scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, protective enclosures, and other such facilities and equipment.
    - b. Refer to respective Sections for particular requirements for each trade.
  2. Maintain all facilities and equipment in a first-class condition.
  3. Comply with all applicable requirements specified in Project Manual. Install in accordance with "Quality Assurance" provisions, Specifications and Manufacturer's instructions. Where these may be in conflict, the more stringent requirements govern.
  4. Relocate construction aids as required by:
    - a. Construction progress.
    - b. Storage requirements.
    - c. Accommodation of Owner's legitimate requirements.
    - d. Accommodation of any other Contractor employed at site.
  5. Completely remove temporary materials, equipment and services when construction needs can be met by use of permanent construction, or at Project completion.
  6. Clean and repair damage caused by installations or by use of temporary facilities and clean site areas affected by temporary installations. Restore damaged vegetation.
  7. Restore existing permanent facilities used for temporary purposes to specified or to original conditions.
- E. Cleaning: Refer to Section 01 74 00 Cleaning, for cleaning during construction and final cleaning.

**3.04 OPERATION, TERMINATION, AND REMOVAL**

- A. Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
  - 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.
  - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Unless the A/E requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. At Substantial Completion, clean and restore permanent facilities used during the construction period to its original condition.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 DEFINITIONS**

- A. Definitions used in this Section are not intended to change the meaning of other terms used in the Contract Documents.
  - 1. Product: "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from the Contractor's previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 2. "Named Products" are items identified by the manufacturer's product name, including such items as a make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
  - 3. "Materials" are products that must be shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
  - 4. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

### **1.02 SUBMITTALS**

- A. See Section 01 33 00 for submittal requirements.
- B. Proposed Product List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- C. Long-Lead-Time Items
  - 1. Provide copies of purchase orders for long-lead-time items to the Consultant within twenty (20) days after receipt of Notice to Proceed.
  - 2. Forward copies of acknowledgment, production and shipping schedules to Architect as they are received for all required items.

### **1.03 QUALITY ASSURANCE**

- A. To the fullest extent possible, provide products of the same kind from a single source.
- B. When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options. Compatibility is a basic general requirement of product/material selections.
- C. Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior. Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

### **1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
  - 1. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing to prevent damage, deterioration, loss or theft. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage. Where appropriate, submit SDS for all delivered products.
  - 2. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

3. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
  - a. Store with lids sealed, outside of building, all glues, adhesives, sealers, caulking, mastics, cleaners, paints, thinners and related flammable and hazardous materials.
4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that quantities are correct and that products are undamaged and properly protected. Reject damaged and defective items.
5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units. Store and protect in accordance with manufacturers' instructions, with seals and labels intact and legible.
6. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
7. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
8. Prevent contact with material that may cause corrosion, discoloration, or staining.
9. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

## **PART 2 PRODUCTS**

### **2.01 GENERAL PRODUCT REQUIREMENTS**

- A. Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
  1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
  2. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar application.
  3. Color and Appearance Consistency of Finish Materials: All finish materials of their respective kinds, in regards to construction phasing, shall be consistent in color and appearance throughout the total Project and shall be purchased out of one dye lot, production run, batch, etc., as applicable, for the total Project for each respective material.
- B. Additional Requirements: Material and equipment incorporated in to the work:
  1. Shall conform to applicable specifications and standards.
  2. Shall comply with size, make, type and quality specified or as specifically approved in writing by Architect.
  3. Shall be free of ASBESTOS, FORMALDEHYDE and LEAD.
  4. Manufactured and Fabricated Products:
    - a. Design, fabricate, and assemble in accordance with first-class "Workmanship" as defined in these Contract Documents.
    - b. Manufacture like parts of duplicate units to standard sizes and gauges; parts to be interchangeable.
    - c. Two or more items of the same kind to be identical and by same manufacturer (whether furnished under one Section or more).
    - d. Products shall be suitable for service conditions.
    - e. Adhere to indicated equipment capacities, sizes, and dimensions unless variations are specifically approved in writing.

- f. Except where field finishing is specified or otherwise required, products and fabricated items shall be pre-finished off-site.
- 5. Do not use materials and equipment for other than designed or specified purposes and uses.
- C. Nameplates: Except as otherwise indicated for required approval labels, and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on exterior of the work.
  - 1. Labels: Locate required labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.
  - 2. Equipment Nameplates: Provide permanent nameplate on each item of service-connected or power-operated equipment. Indicate manufacturer, product name, model number, serial number, capacity, speed, ratings and similar essential operating data. Locate nameplates on an easily accessed surface which, in occupied spaces, is not conspicuous.

## 2.02 PRODUCT SELECTION

- A. The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
  - 1. Proprietary Specification Requirements. Where only a single product or manufacturer is named, or indicates "no equals", "no substitutions", or "no exceptions", provide the product indicated. Notify Consultant if it is discovered that the named product does not comply with the contract documents, or is not appropriate for the function intended.
  - 2. Semi proprietary Specification Requirements. Where two or more products or manufacturers are named, or indicates "no equals", "no substitutions", or "no exceptions", provide one of the products indicated. Notify Consultant if it is discovered that none of the named products complies with the contract documents, or is not appropriate for the function intended.
  - 3. Nonproprietary Specification Requirements. Where the Specifications list products or manufacturers, or indicates "or approved equal" or "other acceptable", comply with Contract Document provisions concerning PRODUCT SUBSTITUTION to obtain approval for use of another product.
  - 4. Descriptive Specification Requirements. Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  - 5. Performance Specification Requirements. Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated. Submit manufacturer's recommendations contained in published product literature or by the manufacturer's certification of performance for approval by Consultant.
  - 6. Visual Matching. Where matching an established sample is required, the Consultant's decision will be final on whether a proposed product matches satisfactorily.
    - a. Where there is no product available within the specified category which matches satisfactorily and also complies with other specified requirements, comply with the provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
  - 7. Visual Selection. Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures ..." or similar phrases, select a product and manufacturer that complies with other specified requirements. The Consultant will select the color, pattern, and texture from the product line selected.

## 2.03 PRODUCT SUBSTITUTION

### A. General Provisions

1. The requirements for substitutions do not apply to specified Subcontractor options on products and construction methods. Revisions to Contract Documents, where requested by Owner or Consultant, are "changes" not "substitutions".
  2. Subcontractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, the Subcontractor's requests for changes in products, materials and methods of construction required by contract documents are considered requests for "substitution", and are subject to requirements hereof.
  3. If a bidder or Contractor desires approval of some material or product other than that specified, it shall submit a written request for approval of the substitute item in accordance with the following requirements:
    - a. All such requests must be made on the SUBSTITUTION REQUEST FORM at end of this Section. Where specifications specify a product color and/or pattern, Contractor shall include a sample of proposed product/item at a size appropriate to make an evaluation with the specified product.
    - b. No request for approval will be considered unless submitted in accordance with this Section.
    - c. Final decision as to whether an item is an equal or satisfactory substitution rests with Owner.
  4. Every substitution request must state whether the item offered is equal or equivalent to the specified product. The substitute material or product must be accompanied by its reference in the Contract Documents and complete catalog, technical and other information. If applicable, include samples showing comparison of physical and other pertinent characteristics as required to establish equivalence of acceptability for the proposed application. Where specific test results are required by the Contract Documents, the comparison data for the proposed item shall be based upon the same test methods as those specified, or they shall be correlated to clearly demonstrate comparability. The same guarantee described for the specified product is required for the substitution.
- B. Substitution requests for approval of substitute materials or products for all items not followed by restrictive language will be considered if the Contractor submits information and documentation as required above. The proposed product or material shall be equal or equivalent to the specified item and shall be subject to the same redesign and coordination as all substituted items.
- C. In making request for approval of substitute materials, the Bidder/Contractor shall represent that it has investigated the proposed product and, in its opinion, it is equal or superior in equivalence in all respects to that specified. Also, Contractor shall coordinate all trades including changes thereto as may be required, that it waives all claims for additional costs which subsequently become apparent as a consequence of the substitution, and that it will bear all costs related hereto, including costs of Consultant's services for redesign, if deemed necessary.
- D. Substitutions will not be considered if they are indicated or implied on Shop Drawings or other project data submittals, without proper notice shown on the SUBSTITUTION REQUEST FORM at the end of this Section. Submissions received that include products or manufacturers not listed in the specifications or approved on the form during the bid period will be returned and marked "Revise and Resubmit".

## 2.04 SUBMITTAL REQUIREMENTS

### A. Requests For Substitutions

1. Submit requests for substitutions in the manner of the form provided immediately following this Section, fully identified for product or method being replaced by substitution, including

related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions.

- a. When making requests for substitutions, submit three (3) copies of requests directly to Consultant, and one (1) copy directly to Owner, for concurrent review.
  2. Include product data/drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitution will result in overall work equal-to or-better-than work originally indicated.
- B. Action By Consultant
1. During Bidding Period: If the Consultant approves any proposed substitution, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.
  2. After Start of Work:
    - a. Within one week of receipt of Contractor's request for substitution, the Consultant will request whatever additional information or documentation may be needed for their evaluation of the request.
    - b. Within two weeks of receipt of request, or within one week of receipt of requested additional information or documentation (whichever is later), the Consultant will notify the Contractor of either their acceptance or rejection of the proposed substitution.
      - 1) Rejection will be the endorsement on the form provided by the Contractor and will include statement of the reasons for rejection (non-compliance with the requirements for requested substitutions, or other reasons as detailed).
      - 2) Acceptance will be the endorsement on the form provided the Contractor.

### **PART 3 EXECUTION**

#### **3.01 GENERAL INSTALLATION PROVISIONS**

- A. Manufacturer's Instructions: Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
1. When Contract Documents require installation of work to comply with Manufacturer's printed instructions, obtain and distribute instructions to concerned parties, including Consultant, before starting that particular work.
  2. Handle, install, connect, clean, condition and adjust products in accordance with Manufacturer's recommendations, directions and specified requirements.
    - a. Should job conditions or specified requirements conflict with Manufacturer's instructions, consult with Consultant for further instructions.
    - b. Do not proceed with work without clear instructions.
  3. Perform work in accordance with Manufacturer's instructions. Do not omit any preparatory step or installation procedure unless it is:
    - a. Verified with and accepted by Consultant in writing.
    - b. Specifically modified or exempted by Contract Documents.
    - c. Perform additional requirements that are specified which are greater than the manufacturer's requirements and do not have a deleterious effect on the product being installed.
- B. Attachment & Connection Devices & Methods
1. Provide attachment and connection devices and methods necessary for anchoring work securely and properly in place as it is installed; install true to line and level, accurately

located and aligned with other Work, and within recognized industry tolerances if not otherwise indicated.

2. Allow for expansions and building movements.
3. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Consultant for final decision.

C. In-Place Protection

1. General
  - a. During handling and installation of work at project site, clean and protect work in progress and adjoining work on a basis of perpetual maintenance.
  - b. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of Substantial Completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period.
  - c. Adjust and lubricate moving components to ensure operability without damaging effects. Contractor is responsible for function, condition and unblemished appearance of all work on Project, and any item or work judged defective by A/E shall be subject to replacement at no additional cost to Owner.
2. To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period.

- D. Replacement Components with damage affecting appearance, function or structural characteristics will not be accepted; repair and/or replace all such items on the Project as directed at no additional expense to Owner.

**END OF SECTION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. General Contractor is responsible for all cutting, fitting, and patching, required to complete the Work and to:
  - 1. Make its several parts fit together properly;
  - 2. Join new work to existing work;
  - 3. Uncover portions of the Work to provide for installation of any ill-timed work;
  - 4. Remove and replace defective work;
  - 5. Remove and replace work not conforming to requirements of Contract Documents;
  - 6. Remove samples of installed work as specified for testing;
  - 7. Provide routine penetrations of non-structural surfaces for installation of piping, duct work, and electrical conduit.
- B. For additional requirements for cutting and patching see respective Specification Sections.

**1.02 DEFINITIONS**

- A. "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other work and subsequent fitting and patching required to restore surfaces to their original condition.
  - 1. "Cutting and patching" is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.
  - 2. Cutting and patching performed during the manufacture of products, or during the initial fabrication, erection or installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".
  - 3. "Selective Demolition" is recognized as related-but-separate categories of work, which may or may not require cutting and patching as defined in this Section.
  - 4. See respective Specification Sections for additional definitions and requirements pertaining to Cutting and Patching.

**1.03 SUBMITTALS**

- A. Submit written request to Owner and Architect a minimum of 48 hours in advance of executing any cutting and alteration affecting:
  - 1. The work of the Owner or any separate Contractor;
  - 2. Structural value or integrity of any element of Project;
  - 3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems;
  - 4. Efficiency, operational life, maintenance, or safety of existing operational elements;
  - 5. Visual quality of sight-exposed elements.
  - 6. Exterior weather protective finish.
- B. Include with Request:
  - 1. Project identification;
  - 2. Description of affected work and products to be used;
  - 3. Necessity for cutting;
  - 4. Effect on work of Owner or any separate Contractor;
  - 5. If structural modifications is a contractor alternative to work shown in the Contract Documents, the Contractor shall retain and submit calculations of a Washington State

- registered structural engineer that the proposed work will not change the load-carrying capacity or load-deflection ratio of the structural element;
6. Weatherproof integrity of Project;
  7. Description of proposed work designating extent of cutting, patching or alteration. Include the following:
    - a. name trades to be executing the Work;
    - b. products proposed to be used;
    - c. extent of refinishing to be done;
    - d. alternatives to cutting and patching;
    - e. where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
    - f. cost proposal (when applicable);
    - g. written permission of any separate Contractor whose work will be affected;
    - h. list of utilities that will be disturbed or otherwise affected by Work. Indicate duration of disruption.
- C. Submit written notice to Architect designating date and time work will be uncovered.
- D. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.

#### **1.04 QUALITY ASSURANCE**

- A. Requirements For Structural Work: Do not cut-and-patch structural work in a manner resulting in reduction of load-carrying capacity or load/deflection ratio; submit proposed cutting and patching of structural elements to Architect for structural approval before proceeding.
- B. Operational & Safety Limitations: Do not cut-and-patch operational elements and safety-related components in a manner resulting in reduction of capacities to perform in manner intended, including energy performance, or resulting in decreased operational life, increased maintenance, or decreased safety.
- C. Visual Requirements: Do not cut-and-patch work which is exposed on exterior or exposed in occupied spaces of buildings, in a manner resulting in reduction of visual qualities or resulting in substantial evidence of cut-and-patch work, both as judged solely by Architect. Remove and replace work judged by Architect to be cut-and-patched in a visually unsatisfactory manner.

#### **1.05 WARRANTY**

- A. Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. General: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.
- B. Salvaged Materials: Salvage sufficient quantities of cut or removed material to replace damaged work of existing construction, when material is not readily obtainable on current market.
  1. Store salvaged items in a dry, secure place on site, or deliver to Owner as noted.
  2. Items not required for use in repair of existing work shall remain the property of Owner at the Owner's option; otherwise they shall become Contractor's salvage.

3. Salvaged items to be re-used shall be cleaned, refinished, etc., as appropriate before reinstallation.
4. Do not incorporate salvaged or used material in new construction except where specifically indicated or with written permission of Architect.
5. Refer to other sections for salvage requirements that may be more stringent.

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
  1. Before proceeding, meet at the 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.
- B. Prior to cutting into existing concrete or masonry, the Contractor shall conduct X-ray inspections to verify location of existing internal conditions (conduit, structural steel, etc.) to ensure that they will not be damaged during cutting and demolition work.
- C. After uncovering work, inspect condition affecting product installations and work performance. Advise A/E in writing if there are conditions which will change the Contract Document requirements.

### **3.02 PREPARATION**

- A. Provide adequate temporary support of work to be cut to assure structural integrity of affected work and safety for Contractor and Owner personnel.
- B. Protect existing and adjoining construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

### **3.03 PERFORMANCE**

- A. Employ skilled workmen to perform cutting and patching. Skilled shall mean workmen trained in the installation and repair of the specific material(s) impacted.
- B. Execute cutting and removals by methods preventing damage to other work. Use core drilling equipment and diamond saws for cutting required openings in concrete and masonry. Provide proper surfaces to receive installation of repairs.
- C. Work shall be performed by or under the direct supervision of the General Contractor and only by specialists or workers skilled in the necessary trades for materials requiring cutting and patching. Employ qualified installer or fabricator to perform cutting and patching for sight-exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide finished installations complying with specified products, functions, tolerances, and finishes.
- E. Restore cut or removed work. Install new products as required to complete work in accordance with Contract Documents. Quality of patched or extended work shall be not less than that specified for new work.

- F. Fit work air-tight to pipes, sleeves, ducts, conduit, and other surface penetrations. Maintain required clearance around pipe in accordance with National Fire Protection Association NFPA-13. Provide required firestopping in conjunction with patching.
- G. Refinish entire surfaces as necessary to provide even finish matching adjacent finishes:
  - 1. For continuous surfaces, refinish to nearest intersection.
  - 2. For an assembly, refinish the entire unit.

### 3.04 CUTTING

- A. Only sawcutting or core drilling of concrete and masonry are permitted; no jack hammering, unless an exception is requested by the Contractor and approved by the Owner., hammering, or chopping. Limited use of rotohammers is acceptable. Use of these pieces of equipment shall occur when the building occupancy is at its lowest in the space adjoining the work. See Specification Section 01 50 00 for requirements related to cutting equipment.
- B. Cut existing construction using methods least likely to damage elements retained or adjoining construction.
  - 1. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit flush with remaining wall, floor, or ceiling to prevent entrance of moisture or other foreign matter after by-passing and cutting.
  - 4. Monitor cutting to detect any movement of surrounding work after cutting has occurred.
  - 5. Cutting of any surface identified as historical shall be observed by the A/E and not begun prior to A/E approval.

### 3.05 PATCHING

- A. Except as specified otherwise, all patching is the responsibility of the applicable trade and performed under the direction of the Contractor. All patching shall conform to the requirements set forth herein and to the standards set forth in these Contract Documents for applicable like work and materials.
- B. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  - 2. Patching shall match existing or adjacent surfaces, and shall match existing materials and assemblies so as to retain all existing fire ratings. Existing walls, floors, ceilings, beams and other building surfaces shall be neatly finished by patching, filling or otherwise as directed by the Architect.
  - 3. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - 4. Where removing walls or partitions extending from one finished area into another, patch and repair floor and wall surfaces at the removed area to obtain a uniform transition between any adjoining spaces. Provide an even surface of uniform color and appearance. If necessary to achieve uniform color and appearance, remove existing floor, wall and ceiling coverings and replace with new materials.
  - 5. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 6. Fit work air-tight to pipes, sleeves, ducts, conduit, and other surface penetrations.

7. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material allowed in these specifications to full thickness of the penetrated element.
  8. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface as approved by Architect.
- C. Refinish entire surfaces from corner to corner or to change in material as necessary to provide an even finish matching adjacent finishes.
1. For continuous surfaces, refinish to nearest intersection.
  2. For an assembly, refinish the entire unit.

### **3.06 CLEANING**

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
1. Clean common areas on a daily basis that may be used by occupants.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 DESCRIPTION**

- A. This Section includes administrative and procedural requirements for cleaning and protection during construction and final cleaning at Substantial Completion.
- B. Related Requirements: Coordinate related requirements specified in other parts of the Project Manual; special cleaning requirements for specific construction elements are included in appropriate Sections of Divisions 02 through 33, as applicable.

### **1.02 RELATED REQUIREMENTS**

- A. Section 01 74 19 - Construction Waste Management And Disposal.

### **1.03 QUALITY ASSURANCE**

- A. General Cleaning Requirements: Conduct cleaning and waste disposal operations in compliance with governing laws, codes, and ordinances. Comply fully with Federal and Local environmental and anti-pollution regulations.
  - 1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
  - 2. Burning or burying of debris, rubbish, or other waste material on premises is not permitted.
- B. Conform to State safety regulations (WISHA requirements).
- C. Documentation of waste management, spill response, procedures and contingency plans to be made available to Owner's Representative upon request.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Cleaning Agents (for non-historic materials and spaces)
  - 1. Use only cleaning agents and methods recommended by Manufacturer of surface material to be cleaned.
  - 2. Use cleaning materials only on surfaces recommended by cleaning material Manufacturer; Do not use cleaning materials damaging to surfaces.
  - 3. Do not use cleaning materials creating hazards to health or property.

## **PART 3 EXECUTION**

### **3.01 CLEANING & PROTECTION DURING CONSTRUCTION**

- A. General:
  - 1. Contractor and each subcontractor at all times shall keep the premises free from accumulation of waste materials, debris and rubbish caused by their operations.
  - 2. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
  - 3. Execute periodic cleaning. Keep work area free from accumulation of construction waste materials and rubbish.
  - 4. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
  - 5. Provide on-site containers for collection of waste materials, debris, and rubbish.

6. Allow no debris, broken or open cartons, or other refuse to collect in the project or around it; allow no inflammable or hazardous materials to be stored on the site without approved fire protection precautions and procedures.
- B. Non-Compliance: If the Contractor fails to enforce clean-up procedures, the Owner may do the cleanup and the cost thereof shall be charged to the Contractor and/or subcontractors, as applicable, as provided in Paragraph 3.4 of the General Conditions.

### 3.02 CLEANING DURING CONSTRUCTION - GENERAL REQUIREMENTS

- A. Execute periodic cleaning. Keep work, site, and adjacent properties free from accumulation of construction waste materials, rubbish, and windblown debris.
  1. Protect new materials from damage by construction debris.
  2. Dispose daily all flammable, hazardous, and toxic waste materials. Storage of these materials will not be permitted on the interior of the building.
    - a. Disposal and storage shall be in accordance with 40 CFR; WAC 173-303; 49CFR; State and Local fire codes and regulations.
- B. Store volatile wastes in covered metal containers and remove from premises daily. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.
- C. Debris Control: In accordance with Section 01 74 19, Construction Waste Management and Disposal, and the following:
  1. Maintain all areas free of extraneous debris.
  2. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, and along access roads and haul routes.
    - a. Provide containers for deposit of debris as specified.
    - b. Prohibit overloading of trucks to prevent spillages on access and haul routes.
      - 1) Provide periodic inspection of traffic areas to enforce requirements.
  3. Schedule periodic collection and disposal of debris as specified. Provide additional collection and disposal of debris whenever the periodic schedule is inadequate to prevent accumulation.
  4. Keep storm sewers free of debris or extraneous materials.

### 3.03 FINAL CLEANING

- A. Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected in a normal commercial building cleaning and maintenance program, complying with manufacturer's instructions.
- B. Cleaning to include all exposed surfaces and materials within the limits of construction, whether installed by the Contractor, installed by the Owner, or existing prior to the beginning of this project.
  1. The extent of cleaning existing facilities (remodel and/or addition projects) shall apply only to those areas of new work, or existing areas impacted by the construction activities, even if simply due to workmen passing through the space.
- C. Complete the following cleaning operations before requesting review for certification of Substantial Completion for the entire Project or a portion of the Project. Cleaning shall include adjacent existing surfaces, such as, but not limited to, walls, floors, ceilings and glazing, that have been affected by the construction activity.
  1. Clean the Project Site, yard and grounds, in areas disturbed or impacted by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.

2. Remove tools, construction equipment, machinery, and surplus material from the site.
  3. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  4. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  5. Broom and mop clean concrete floors and floors finished with sheet vinyl, and similar surfaces.
  6. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo, if required.
  7. Clean transparent materials, including mirrors and glass (both sides) in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  8. Remove labels that are not permanent labels.
  9. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  10. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  11. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  12. Clean ducts, blowers, and coils if units were operated without filters during construction.
  13. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
  14. Leave the Project clean and ready for occupancy.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection and administration of the work during construction. Restore landscaping and other repair as necessary or required.
- E. Compliances: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner. Do not use Owner's containers for trash generated by cleaning or construction.
1. Where extra materials of value remaining after completion or associated work have become Owner's property, arrange for disposition of these materials as directed.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Closeout is hereby defined to include general requirements near end of Contract Time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Time of closeout is directly related to "Substantial Completion".
- B. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
  - 1. Maintenance Materials submission.
  - 2. Substantial Completion.
  - 3. Final Acceptance.

**1.02 SEQUENCE OF CLOSE-OUT**

- A. The Contractor's superintendent shall perform a review of all installed work (general, electrical, security electronics) and note any corrections, touch-up, or otherwise restore marred, exposed surfaces necessary to comply with the Contract Document requirements before requesting the Consultant to review the Work. The Contractor shall develop a written correction list (pre-punch list) and track the completion of the items by initialing and dating each item, signifying that it has been reviewed and properly completed.
- B. Upon receipt of the Contractor's written notice of completion with its incidental correction list (pre-punch list), the Consultant team will schedule and conduct a punch list inspection with the Contractor, and the Owner PM. The Consultant will prepare a supplemental punch list to include incidental corrective work not addressed in the Contractor's punch list as well as any review comments and punch list items generated by the Owner PM and incorporate into a single supplemental punch list. The Consultant will issue the supplemental punch list to the Contractor and monitor the Contractor's performance to ensure the work on both lists are completed
- C. Provide operation and maintenance instruction on installed equipment to Owner designated staff.
- D. The Contractor shall correct any outstanding punch list items and submit all other close-out documentation to the Consultant as indicated under Article FINAL ACCEPTANCE below. When punch lists have been verified by the Consultant as being complete and all documentation is satisfactory and accepted by the Consultant, the Consultant will issue its notification of Final Acceptance.

**1.03 PROJECT RECORD DOCUMENT SUBMITTAL**

- A. Refer to Section 01 78 00, Closeout Submittals.

**1.04 OPERATION AND MAINTENANCE MANUALS**

- A. Refer to Section 01 78 00, Closeout Submittals.

**1.05 FINAL CLEANING**

- A. Refer to Section 01 74 00, Cleaning.

**1.06 WARRANTIES, BONDS & EXTRA STOCK**

- A. Refer to Section 01 78 00, Closeout Submittals.

**1.07 OPERATING INSTRUCTION OF OWNER'S PERSONNEL**

- A. The Contractor shall provide for operating and maintenance instruction of Owner's personnel for items installed under this contract. Contractor shall provide for this instruction at a mutually agreeable time and place, which may be outside of Contractor's normal working hours.

1. Prior to any training, the Contractor is to complete all system start-up and functionality testing. The Contractor/Sub-contractor will then assist the Consultant to review and confirm the systems are performing in accordance with the Contract Documents. If the documents identify that systems will be commissioned, the Owner may elect to have the commissioning agent also perform the functionality review with the Contractor. If commissioning is required, this will be completed prior to the Contractor and major subcontractors providing qualified personnel for conducting full on-site operation and maintenance training and instruction to Owner's designated user personnel and maintenance crews. Instruction shall include the proper operation, adjustment and maintenance of all general, detention, mechanical and electrical operating systems and equipment.
  2. Contractor shall schedule this period in advance with the Owner and appropriate subcontractor or vendor's representative. This shall be scheduled two (2) weeks after submittal of the final Operating and Maintenance Manuals so that such information will be available for Owner staff familiarization prior to the time of this instructional period. Provide a minimum of (8) hours of such training and instructions on site, unless otherwise directed, conducted to Owner's satisfaction. Such instruction shall be given in time blocks not exceeding (4) hours in any one-day and shall be exclusive of off-site factory training for such items as the energy management system.
  3. At each training session, provide a sign-in sheet for signature of all Owner staff that attend. Identify the sign-in sheet with the training being provided and the date of the training. Submit the sign-in sheet(s) with FINAL ACCEPTANCE procedure.
  4. Except as otherwise specified, arrange for each installer of work requiring continuing maintenance or operation to meet with Owner's personnel at project site to provide basic instructions needed for proper operation and maintenance of entire work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures.
  5. Use operation and maintenance manuals as the basis for instruction. Review contents of manual with personnel in full detail to explain all aspect of operations and maintenance; include as a minimum record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and renewal of finishes, and similar procedures and facilities.
  6. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations. Review maintenance and operations in relation with applicable warranties, agreements to maintain bonds, and similar containing commitments.
  7. All equipment operation and maintenance instructions and training shall be video taped in a professional manner, at the expense of the Contractor, and the edited film delivered with documents for FINAL ACCEPTANCE.
  8. In addition, provide (4) hours training for the energy management system.
  9. Provide a minimum of (4) hours additional follow-up training sessions to be conducted four (4) months following initial training. Systems/equipment to be covered under these training sessions shall be as determined by the Owner.
  10. In addition to or in conjunction with these training sessions, provide for (4) seasonal adjustment training sessions of the energy management system.
- B. The Contractor shall submit a training synopsis for each system required under the Contract Documents to review operations and maintenance instruction and training. Submit training synopsis with each respective preliminary Operation and Maintenance Manual submittal. Each synopsis shall be reviewed by the Architect and approved or returned with comments if necessary. Written approval by the Architect of each synopsis is required prior to beginning such training.
- C. For additional requirements for operating instructions, see respective Specification Sections.

### 1.08 MAINTENANCE MATERIALS

- A. Provide maintenance materials (tools, spare parts, extra stock, etc) indicated in other sections of the specifications.
  - 1. Submit a receipt to the Owner identifying the product and quantity that is being provided.
  - 2. Obtain Owner's signature on the receipt.
  - 3. Send original receipt to Owner's Project Manager and include a copy of the receipt in the Warranties, Bonds, Extra Stock, and Permits manual.

### 1.09 SUBSTANTIAL COMPLETION

- A. Substantial Completion is defined in the General Conditions. Before requesting Consultant's review for certification of Substantial Completion, complete the following, and provide a letter of request for Substantial Completion. List exceptions in the request.
  - 1. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Advise the Owner of pending insurance changeover requirements.
  - 3. Make final changeover of permanent locks and transmit keys, and a list identifying each key to the Owner. The list is a receipt to be signed by the Owner with a copy delivered to Owner's Representative and a copy placed in the Operation and Maintenance Manual hardware section. Advise the Owner's personnel of changeover in security provisions.
  - 4. Complete startup testing and commissioning of systems; submit Balancing Logs.
  - 5. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
  - 6. Complete final clean-up requirements.

### 1.10 CLOSEOUT PROCEDURES

- A. Record Drawings: Refer to Section 01 78 00, Closeout Submittals.
- B. Punch List:
  - 1. Consultant throughout the course of construction will identify items of work observed to be in non-conformance with the contract documents. It will be incumbent upon the contractor to take appropriate action to satisfy such deficiencies as they are brought to his attention. Do not wait for such items to be re-listed as citations in a formal punch list issued at the time of substantial completion.
  - 2. When the project is substantially completed or when a portion or portions of the building(s) or project is complete that the owner wishes to accept, the Consultant will assist the contractor in preparation of a punch list. This punch list will be a tabulated list of items that are not complete, defective items and materials, and items that do not conform to the contract documents.
  - 3. The punch list will not be made prior to all finishes being installed, all systems operating, and all cleaning work completed. Contractor shall give the Consultant written notice of completion and readiness for the punch list inspection.
  - 4. Upon written notification of completion of the punch list items by the contractor, the project will be re-inspected by the Consultant and involved interested parties. One re-inspection only is anticipated. Should repeated re-inspections be required due to failure of the Contractor to properly complete the punch list items, the Contractor shall pay for the Consultant's services for the re-inspections through a deductive change order as issued by the Owner as specified below, Article 1.11, billed at his normal hourly rates.
- C. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Consultant's review.

- D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- E. Notify Consultant when work is considered finally complete.
- F. Complete items of work determined by Consultant's final inspection.

#### **1.11 FINAL ACCEPTANCE**

- A. Before requesting certification of Final Acceptance and final payment, complete the following: (Submit all of the following items together - no partial submittals will be accepted.)
  - 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
  - 2. Submit an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work for which the Owner of property might in any way be responsible, have been paid or otherwise satisfied. (AIA Document G706).
  - 3. Submit Contractor's Affidavit of Release of Liens (AIA Document G706A) and Subcontractor/ Supplier "Conditional Waiver Of Lien" (see attached form) from each Subcontractor and Supplier. If any liens are filed and cause the Owner to employ the services of any attorneys, the cost of the services will be deducted from the retainage.
  - 4. Submit a letter from the Contractor's Bonding Company addressed to Owner and submitted to Architect approving release of final payment and waiving submittal of final receipts as well as a statement confirming the extension of the Bond for the one-year warranty period. Final receipts from all subcontractors and material and equipment suppliers shall be furnished to the Architect by the Contractor if the Surety does not waive this requirement.
  - 5. Submit a copy of the Architect's final review list ("punch list") of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, identifying the name and company of the individual who confirmed completion of each item, and date when confirmation inspection was performed.
  - 6. Submit consent of surety to final payment on AIA Form G707.
  - 7. Submit final As-Built Documents.
  - 8. Submit final Operation and Maintenance Manuals.
  - 9. Submit final Warranties, Bonds, and Permit Manual.
  - 10. Submit a list of all paints used, manufacturer, and formulation for each.
  - 11. Submit evidence of completion of Owner's training for all designated systems and videotape(s).
  - 12. Submit evidence of compliance with requirements of governing Authorities.
    - a. Certificate of Occupancy, if not submitted at time of Substantial Completion.
    - b. (Note: Certificate of Occupancy is required to be submitted with Substantial Completion Request unless otherwise exempted by Owner in writing.)
    - c. Certificates of Inspection
      - 1) Mechanical Work.
      - 2) Plumbing Work.
      - 3) Fire Suppression Work.
      - 4) Electrical Work.
    - d. Others as required by Regulatory Agencies.
- B. Submit all other required close-out documents.

**END OF SECTION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Project Record Document submittal.
- B. Operation and Maintenance manuals.
- C. Warranties, Bonds, Extra Stock, and Permits manuals.

**1.02 SUBMITTALS**

- A. Project Record Documents: Submit documents to Consultant with claim for final Application for Payment. The following submittal procedure shall occur prior to Final Acceptance.
  - 1. Submit original copy of as-builts (drawings & specifications) to Consultant for review.
  - 2. Compile and organize any drawings or schedules in the Project Manual onto sheets of the same size as the Contract Drawings and submit with other record documents.
  - 3. Contractor will be notified within 15 work days if the submitted documents are acceptable.
  - 4. Should the submittal be unacceptable for any reason, the Contractor shall make requested modifications and resubmit to the Consultant. Continue to resubmit as necessary until the submittal is acceptable.
- B. Operation and Maintenance Data:
  - 1. Submit two (2) copies of preliminary Operating and Maintenance Manuals for operational and non-operational equipment for review by Architect. Submit for each system upon attaining 75% system completion, together with respective training synopsis; refer to Section 01 77 00. Upon review, Architect will return one copy with comments.
  - 2. Submit 1 copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 3. Within 10 days following receipt of the Architect approval and comments, and prior to Owner training, Contractor shall prepare and transmit to the Architect three (3) final copies of each of the above manuals.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS**

**2.01 PROJECT RECORD DOCUMENTS**

- A. Project Record Documents include the following:
  - 1. Marked-up copies of Contract Drawings.
  - 2. Marked-up copies of Project Manual.
  - 3. Addenda.
  - 4. Reviewed and marked-up copies of shop drawings and product data.
  - 5. Newly prepared drawings.
  - 6. Change Orders, RFIs and other modifications to the Contract issued in printed form during construction.

7. Consultant's Clarifications and Proposal Request with all supporting documentation.
8. Construction Change Directives.
9. Record Samples.
10. Field records for variable and concealed conditions.
11. Record information on Work that is recorded only schematically.
12. Manufacturer's instruction for assembly, installation, and adjusting.
13. Other miscellaneous record documents as listed below and applicable.
  - a. Certifications received in lieu of labels on bulk products.
  - b. Documented qualification of installation firms and/or personnel.
  - c. Load and performance testing.
  - d. Inspections and certifications by governing authorities.
  - e. Final inspection and correction procedures.

### **PART 3 EXECUTION**

#### **3.01 PROJECT RECORD DOCUMENTS**

- A. Maintenance of Documents and Samples:
  1. Store and maintain in field office apart from the Contract Documents used for construction, one complete set of record documents and samples which are used to record as-built conditions.
  2. Do not use Project Record Documents for construction purposes; protect from deterioration and loss in a secure fire-resistant location. Maintain record documents in good order and in a clean, dry, legible condition.
  3. Make record documents and samples available at all times for review by Architect and Owner's Representatives.
  4. Record actual revisions to the Work concurrent with construction progress.
  5. Ensure entries are complete and accurate, enabling future reference by Owner.
    - a. As specified in Section 01 31 19, following each monthly progress schedule meeting, Contractor shall meet with all major subcontractors whose work is in progress at the site, including but not limited to mechanical, plumbing, electrical, security, fire protection, civil, and as otherwise designated, to review all "as-built" revisions on the day-by-day working set of "Project Record Copy" and verify installed record information from the previous month is properly recorded on the day-by-day "Project Record Copy", with all revisions and pertinent information clearly indicated.
- B. Record Drawings and Shop Drawings: A clean, undamaged set of Contract Drawings including coordination drawings and shop drawings shall be kept at the job site as as-built record documents. Record "as-built" drawings shall be comprised of all sheets contained in the Contract Drawings, as well as all special equipment or systems drawings.
  1. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawings that show conditions fully and accurately. Where shop drawings, RFI's or other communication record are used to identify a change, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items required to be marked include, but are not limited to, the following:
    - a. Indicate field changes of dimension and detail.
    - b. RFIs.
    - c. Depths of foundations below the first floor.
    - d. Horizontal and vertical measurements of underground services and utilities, referenced to the building or other permanent construction.

- e. Note changes of directions and locations, by dimensions and elevations, as utilities are actually installed.
  - f. Show measured locations of construction-concealed internal utilities and appurtenances referenced to visible and accessible features of the structure.
  - g. Revisions to electrical circuitry.
  - h. Indicate details not on original Contract drawings.
  - i. "X-out" conditions not constructed and appropriately annotate "not constructed" to convey the actual "as constructed" condition.
- 2. Mark record sets in a clear, legible manner, using red ink (no pencils); use other colors to distinguish between variations in separate categories of the work. Use 'whiteout' to erase errors.
  - 3. Mark new information that is important to Owner, but which was not shown on Contract Documents or Shop Drawings.
  - 4. Show addenda items, change orders, RFI, or other means of communication used in the construction process.
  - 5. Show and date revisions to drawings with a "cloud" drawn around the revision.
  - 6. Organize record drawing sheets in manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set. Where shop drawings, RFI's or other communication record are used as a reference, include a copy of them as part of the record drawings.
- C. Shop Drawings
- 1. Maintain as record documents; legibly annotate to record changes made after review.
  - 2. Include subcontractor reproducible shop drawings for all special equipment including as a minimum where applicable to the project, ductwork layout, fire sprinkler system layout, temperature control system, fire alarm system, intrusion alarm system, communications systems, data systems, detention security systems and others as deemed appropriate. Record Drawing shop drawings shall be easily reproducible; i.e., on mylar or of standard copy machine size, as appropriate and approved.
- D. Project Manual: During the construction period, maintain one complete copy of the Project Manual, including Specifications, addenda, and one copy of other written construction documents, such as Change Orders and RFI's issued in printed form during construction.
- 1. Legibly mark these documents in red ink to show substantial variations in actual work performed in comparison with the text of the specification and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and product data. Record at each product section description of actual products installed, including the following:
    - a. Manufacturer's name and product model and number.
    - b. Product substitutions or alternates utilized.
    - c. Changes made by Addenda and modifications.
  - 2. Each prime contractor (Subcontractor) is responsible for marking up Sections that contain its own Work.
    - a. General Contractor shall be responsible for collecting marked-up record Sections from each of the other prime contractors. General Contractor shall also be responsible for collating these Sections in proper numeric order with its own Sections to form a complete set of record Specifications.
    - b. General Contractor shall be responsible for submitting the complete set of record Specifications as specified.
- E. Record Product Data

1. Maintain one copy of each product data submittal, and mark-up variations in actual work in comparison with submitted information. Include both variations in product as delivered to site, and variations from manufacturer's instructions and recommendations for installation.
  2. Give particular attention to concealed products and portions of the work which cannot otherwise be readily discerned at a later date by direct observation. Note related change orders and mark-up of record drawings and project manuals.
  3. Note related Change Orders and mark-up of record Drawings, where applicable.
  4. Upon completion of mark-up, submit complete set to Architect for Owner's records.
  5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data.
  6. Each prime contractor (Subcontractor) shall be responsible for marking up and submitting record Product Data for its own Work.
  7. Insofar as possible, insert record product data in individual sub-sections of O&M Manuals. Refer to 3.05 below.
- F. Record Sample Submittal: Immediately prior to date(s) of substantial completion, Architect (and including Owner's personnel where desired) will meet with Contractor at site, and will determine which (if any) of submitted samples maintained by Contractor during progress of the work are to be transmitted to Owner for record purposes. Comply with Architect's instructions for packaging, identification marking, and delivery to Owner's sample storage place.
- G. Miscellaneous Record Submittals: Refer to Paragraph 2.01A.13 above for listing of miscellaneous record documents and to other Sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to date of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to Architect for Owner's records.

### **3.02 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
1. Drawings.
  2. Specifications.
  3. Addenda.
  4. Change Orders and other modifications to the Contract.
  5. Reviewed shop drawings, product data, and samples.
  6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
  2. Details not on original Contract drawings.

### **3.03 OPERATION AND MAINTENANCE DATA - GENERAL**

- A. General: For all operational equipment installed, Contractor shall submit operation and maintenance documents in manuals as specified herein.

- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- D. Provide servicing and lubrication schedule, and list of lubricants required.
- E. Include manufacturer's printed operation and maintenance instructions.
- F. Include sequence of operation by controls manufacturer.
- G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- H. Additional Requirements: As specified in individual product specification sections.

### **3.05 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. Content for Operational Equipment.
  - 1. Product Data.
    - a. Compile product data and related information for Owner's maintenance and operation. All manufacturer literature shall be original printed matter; photocopies, printouts from websites or other non-original reproductions are not acceptable.
    - b. Product data shall contain detailed information relative to the following:
      - 1) Description of unit or system, and component parts.
      - 2) Equipment functions, normal operating characteristics, and limiting conditions.
      - 3) Assembly, installation, alignment, adjustment and checking instructions.
      - 4) Operating instructions and sequences for start-up, break-in, routine and normal operation, regulation and control, shutdown, and emergency conditions. Include control diagrams and sequence of operation by controls manufacturer.
      - 5) Routine procedures and guide for preventative maintenance and trouble shooting, including a schedule of recommended checks; disassembly, repair, and reassembly instructions.
      - 6) Detailed servicing and lubrication schedule. Include list of lubricants required.
      - 7) Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

- 8) Complete nomenclature and model number of replaceable parts. Include with list manufacturer's current prices and recommended quantities to be maintained in storage.
- 9) Safety precautions and safety features.
- 10) Outline, cross-section and assembly drawings, engineering data, and color coded wiring diagrams as installed.
- 11) Test data and performance curves.
- 12) Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- 13) Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- 14) Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- 15) Test and balancing reports.
- c. Include only sheet pertinent to specific product.
- d. Annotate each sheet to:
  - 1) Clearly identify specific product or part installed.
  - 2) Clearly identify data applicable to installation.
- e. Delete references to inapplicable information.
2. Drawings.
  - a. Supplement product data with drawings as necessary to clearly illustrate relations of component parts of equipment and systems.
  - b. Coordinate drawings with information in Project Record Documents to ensure correct illustration of completed installation.
  - c. Do not use Project Record Documents as maintenance drawings.
3. Supplement product/installation data with written text.
  - a. Organize in consistent format under separate headings for different procedures.
  - b. Provide logical sequence of installations for each procedure.
4. Special Mechanical Subcontractor Requirements: Comply with Divisions 21 through 25 requirements.
5. Special Electrical Subcontractor Requirements: Comply with Divisions 26 through 28 requirements.

### **3.06 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For all architectural non-operational products, applied materials and finish items installed, Contractor shall submit maintenance information as specified herein. Provide detailed information relative to the following:
  1. Manufacturer's data, giving full information on products.
    - a. Catalog number, size, and composition.
    - b. Color and texture designations.
    - c. Information required for re-ordering special manufactured products.
  2. Instructions for care and maintenance.
    - a. Manufacturer's recommendation for types of cleaning agents and methods.
    - b. Cautions against cleaning agents and methods, which are detrimental to the product.
    - c. Recommended schedule for cleaning and maintenance.
    - d. Instructions and recommendations for repair of finish.
  3. Moisture protection and weather-exposed products.
    - a. Include product data listing applicable reference standards, chemical composition, and details of installation.

- b. Provide recommendations for inspections, maintenance, and repair.
- B. For additional requirements for maintenance data, see respective Specification Sections.
- C. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

### 3.07 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products. Prepare data in the form of an instructional manual.
- B. Format of Operation and Maintenance Manuals
  - 1. Binders
    - a. Commercial quality, stiff cover, metal-hinged 8-1/2 x 11 inch three D side ring binders with durable and cleanable plastic covers. Binders shall be Wilson Jones #344 Series or equivalent as approved by the Architect.
    - b. Provide suitable ring size for content with a 1-inch minimum, up to 3-inch maximum, range.
    - c. When multiple binders are used, correlate data into related consistent groupings.
  - 2. Cover and Spine: Identify the cover and spine of each volume with typed or printed title of the project, project number, and the words OPERATION AND MAINTENANCE INSTRUCTIONS.
  - 3. For Contractor produced pages, paper shall be 8-1/2" x 11", white, 20 pound minimum.
  - 4. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
  - 5. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
  - 6. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
  - 7. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
  - 8. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
    - a. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Architect Consultants, Contractor, Subcontractors, and major equipment suppliers.
    - b. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      - 1) Significant design criteria.
      - 2) List of equipment.
      - 3) Parts list for each component.
      - 4) Operating instructions.
      - 5) Maintenance instructions for equipment and systems.
      - 6) Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
    - c. Part 3: Project documents and certificates, including the following:
      - 1) Shop drawings and manufacturer's printed product data.
      - 2) Air and water balance reports.
      - 3) Certificates.
      - 4) Photocopies of warranties and bonds.
      - 5) Materials Safety Data Sheets (MSDS) for each product used on the Project.

9. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
10. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

**3.08 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SUMMARY**

- A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Electrical systems and equipment.
  - 4. Conveying systems.
  - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
  - 2. Fixtures and fittings.
  - 3. Items specified in individual product Sections.

### **1.02 RELATED REQUIREMENTS**

- A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

### **1.03 INSTRUCTOR QUALIFICATIONS**

- A. The Contractor shall provide competent technicians who shall give full instruction to the Owner's designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements of the equipment and systems specified, with emphasis on:
  - 1. How to use and find information in documentation
  - 2. System operational procedures for all modes of operation including: warm-up, cool-down, emergency, seasonal change-over, occupied, unoccupied, etc
  - 3. Acceptable tolerances for system adjustment in all operating modes
  - 4. Procedures for dealing with abnormal conditions and emergency situations for which there is a specified system response
  - 5. Troubleshooting procedures to deal with equipment malfunction or failure
- B. Arrange and pay for services of Manufacturers' representatives required for instruction on specialized portions of the installation, maintenance and/or operation.
- C. Contractor shall permit the Owner to videotape the training sessions for the Owner's internal use such as training new employees.

### **1.04 TRAINING PLAN**

- A. Submit the training plan for approval by the Consultant thirty (30) days prior to the first scheduled training session. The plan shall cover:
  - 1. Proposed curriculum and teaching methods
  - 2. Required entering skills (e.g., familiarity with Windows™ controls theory). It shall be the responsibility of the Owner to ensure that the trainees have the required entering skills prior to taking the Contractor's course.
- B. The duration of the training period shall not be less than 10 hours of general instruction, and not less than ten (10) hours of site specific instruction for the Work, and not limited to a consecutive period. All training shall take place during normal working hours and shall not exceed seven hours per day. Travel time to sites or place of training shall not be counted as training time.

- C. Co-ordinate all sessions with the Owner and/or his representatives. The Owner and/or the Contractor shall provide written notification at least three working days prior to cancellation or postponement of the training session.
- D. Documentation specified in Section 01 78 00 shall be used as source information for the training sessions.
  - 1. Provide a training manual for each trainee, covering in detail the data included in each training program, before training shall commence.
  - 2. If the Contractor wishes to use visual aids such as video tape, slides, overhead, etc. as a part of the training course fulfillment, these visual aids or copies of them shall be made a part of the documentation package for future reference, refresher or retraining.
  - 3. Provide training source material for a minimum of four of the Owner's operations personnel at least four weeks prior to start of training session.
- E. Training courses shall be presented in the form of four sessions or approved by owner. Each session shall be of equal length.
- F. The first session shall occur prior to the start of the system test for Substantial Completion. This course shall include but not be limited to the following:
  - 1. System architecture
  - 2. Equipment operation
  - 3. Introduction to programming
  - 4. System communication protocol
  - 5. BACnet overview
  - 6. System names
  - 7. Color graphics creation and operation
  - 8. Report generation
  - 9. Maintenance management
  - 10. Energy management
  - 11. Changing setpoints
  - 12. Changing schedules
  - 13. Alarm management
- G. The second session shall start immediately after the start of Substantial Completion and shall include but not be limited to the following:
  - 1. Preventive maintenance of all system components
  - 2. Calibration of all sensors and controls
  - 3. Programming of system equipment (DDC system and Front End)
  - 4. Additional system features
  - 5. Troubleshooting
  - 6. Abnormal and emergency condition procedures
- H. The remaining two sessions will occur at two months and four months after the second session. These sessions shall be designed to address the Owner's requirements. Co-ordinate course curriculum with Owner. Material may cover any or all of the following subjects:
  - 1. OCL programming: editing, saving, reloading, composition and implementation
  - 2. Color Graphic Generation: creation, file management and installation
  - 3. Operational Skills: setpoint modification, graphic interrogation, menu manipulation, file interrogation, alarm management, and controller communications
  - 4. Front End system: Level 0 hardware and Operator software language functions
  - 5. Calibration and preventive maintenance of field equipment

- 6. Troubleshooting
- I. All training shall be clearly documented on a daily basis, detailing number of hours of instruction, material covered, trainees' names and instructor(s)' name. At the end of each training day, this information shall be authorized by the Owner's designated representative and by the Contractor.
- J. Training for Owner's custodians/security personnel:
  - 1. These persons shall be given an orientation to the DDC system including the location and operation of each DDC system component in their buildings, introduction to problem diagnosis, operation of the alarm printer and interpretation of its output.
  - 2. The minimum length of this course is three hours per site. The course shall be delivered to the respective custodian(s) and other Owner's personnel in each building covered the Work.
- K. Upon completion of each session of training, the Contractor shall provide the Owner with a written statement, signed by the Owner, indicating that the training outlined by this Specification has been fulfilled to the satisfaction of the Owner.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.
- C. Demonstration may be combined with Owner personnel training if applicable.
- D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks following date of Substantial Completion.

### **3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.
- D. Provide training in minimum two hour segments.
- E. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- F. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- G. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.

SECTION 01 79 00  
DEMONSTRATION AND TRAINING

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  4. Provide hands-on training on all operational modes possible and preventive maintenance.
  5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  6. Discuss common troubleshooting problems and solutions.
  7. Discuss any peculiarities of equipment installation or operation.
  8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
- H. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. All selective building remodel demolition as indicated on the Drawings, as specified herein, and as needed for complete and proper installation of new work indicated.
- B. Abandonment and removal of existing utilities where indicated or otherwise encountered at removed construction.
- C. Carefully remove, disassemble or dismantle and store on the site those items to be removed and re-used in the completed work or retained by Owner, all as indicated on the Drawings and/or specified.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- B. Section 01 73 29 - Cutting and Patching.
- C. Section 01 74 19 - Construction Waste Management & Disposal.

**1.03 SUBMITTALS**

- A. Submit to Owner demolition plan addressing the following, as applicable:
  - 1. Description of method(s) for protecting existing and installed work.
  - 2. Schedule of required utility and building system shutdowns, if any.
  - 3. Identify demolition work (saw cutting, drilling, removal) that will involve or affect any structural element or part of the building structure.
- B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

**1.04 FIELD CONDITIONS**

- A. Condition Of Building Prior To Selective Demolition: Accept premises on as "as-is" condition. Owner assumes no responsibility for building condition now, at time of bidding nor thereafter. Damage or loss resulting from any cause to building, persons and/or property shall not relieve contractor from his obligation to complete all work under the Contract.
- B. Protection
  - 1. Before beginning selective demolition activities, erect barriers, fences, overhead protection, shoring, and the like, to protect personnel and construction.
  - 2. Keep free of damage those portions of existing building which are to remain. Contractor shall provide total protection for all existing portions of building against damage caused by construction means and any or all weather elements.
  - 3. Any damage occurred shall be immediately corrected by the Contractor as directed by the Architect or Owner, at Contractor's expense.
  - 4. Remove temporary protection and cover when no longer needed.

**PART 2 PRODUCTS -- NOT USED**

**PART 3 EXECUTION**

**3.01 INSPECTION**

- A. Building Examination
  - 1. Prior to Starting Demolition: Contractor and Owner to make a complete inspection of condition of the existing building within the project limits of construction, including visible

defects. Make careful notes on condition of the existing work. Inspection report to be accepted and signed by both parties to the survey.

2. At Completion of Demolition - Each Area: Contractor and Owner to make examination for possible damage to the building facilities caused by demolition work. Examination report to be accepted and signed by both parties to the inspection where no damage is apparent.

### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  1. Obtain required permits.
  2. Provide, erect, and maintain temporary barriers and security devices.
  3. Use physical barriers to prevent access to areas that could be hazardous to workers, occupants or the public.
  4. Conduct operations to minimize effects on and interference with adjacent structures.
- B. Do not begin removal until built elements to be salvaged or relocated have been removed.
- C. Perform demolition in a manner that maximizes salvage and recycling of materials.
  1. Dismantle existing construction and separate materials.
  2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

### **3.03 EXISTING UTILITIES**

- A. Protect existing utilities to remain from damage.
- B. Do not disrupt public utilities without permit from authority having jurisdiction.
- C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 5 days prior written notification to Owner.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

### **3.04 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Separate areas in which demolition is being conducted from other areas that are still occupied.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- C. Remove existing work as indicated and as required to accomplish new work.
- D. Selective Building Demolition - General
  1. Do all demolition, drilling and/or removal work, as applicable, required for the completion of new work shown on Drawings or specified. Refer to Drawings and details for specific items of construction to be removed and other demolition requirements for the new work.
  2. The extent of demolition required for the entire project shall be verified by the Contractor at the jobsite and performed to the fullest extent required due to actual job conditions and requirements of new work indicated.
  3. Where demolition occurs next to existing work to remain, remove carefully only those items required for placing new work. Conduct demolition to minimize interference with adjacent structures to remain.
  4. Remove all loose material caused by or remaining from demolition work. Cut openings and/or pockets neatly ready for installation of new work. Use carborundum saws or approved means or devices where cuts will remain exposed in the completed work.
  5. Coordinate demolition work with work in other Sections.

- E. Materials & Equipment To Be Removed For Re-Use Or Turned Over To Owner
  - 1. Carefully remove, disassemble or dismantle and store on the site those items to be removed and re-used in the completed work or retained by Owner, all as indicated on the Drawings and/or specified.
  - 2. If wall mounted equipment items are encountered in areas where demolition of associated wall is required for new work, they shall be salvaged for reuse/reinstallation or, if not reused, shall be turned over to Owner.
  - 3. All other debris and non-selected removed materials and equipment shall become the property of the Contractor and removed from site.

**3.05 SALVAGE**

- A. To Owner
  - 1. Owner to retain title of items to be removed for re-use in the new Work and as otherwise indicated or selected by the Owner to be retained as specified above.
  - 2. Deliver salvage materials and equipment and store in approved locations on site, as directed.
- B. To Contractor: Remove from site all other equipment and materials removed for new work and not otherwise specified and/or selected by Owner to be retained or re-used in the new work; let no removed said material accumulate at site.
- C. Leave site in clean condition, ready for subsequent work.

**3.06 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.

**END OF SECTION**

**SECTION 02 41 13  
SELECTIVE SITE DEMOLITION**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.02 SECTION INCLUDES**

- A. Demolition and removal of selected portions of building, structure, or structural remnants (footings, concrete slabs, etc.)
- B. Demolition and removal of selected site elements.
- C. Salvage of existing items to be reused or recycled.

**1.03 RELATED REQUIREMENTS**

- A. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
- B. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.

**1.04 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

**1.05 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.
  - 2. This includes salvaging historic D-rings and anchors in existing curbing.

**1.06 PREINSTALLATION MEETINGS**

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

**1.07 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for dust control.
- C. Schedule of Selective Demolition Activities: Indicate the following:
  1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
  2. Interruption of utility services. Indicate how long utility services will be interrupted.
  3. Coordination for shutoff, capping, and continuation of utility services.
  4. Use of elevator and stairs.
  5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
  6. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Predemolition Photographs or Video: Submit before work begins.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

**1.08 CLOSEOUT SUBMITTALS**

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

**1.09 FIELD CONDITIONS**

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- E. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- F. Storage or sale of removed items or materials on-site is not permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

- H. Maintain fire-protection facilities in service during selective demolition operations.

**PART 2 EXECUTION**

**2.01 PRODUCTS**

**2.02 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

**PART 3 PRODUCTS**

**3.01 EXAMINATION**

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, preconstruction videotapes and templates.
  - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."

**3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Building manager will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

**3.03** preparation

- A. Site access and temporary controls: conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in section 015000 "temporary facilities and controls."
- B. Temporary facilities: provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- C. Temporary shoring: provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

**3.04** Selective demolition, general

- A. General: demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the work within limitations of governing regulations and as follows:
- B. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
- C. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- D. Do not use cutting torches until work area is cleared of flammable materials.
- E. Maintain adequate ventilation when using cutting torches.
- F. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- G. Dispose of demolished items and materials promptly.
- H. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  - 3. Protect items from damage during transport and storage.
  - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- I. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

**3.05** SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

**3.06 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Except for items or materials indicated to be[ recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site[ and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

**3.07 CLEANING**

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

**END OF SECTION**

**SECTION 03 30 53**  
**MISCELLANEOUS CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

**1.02 REFERENCE STANDARDS**

- A. Standard Specification for Road, Bridge, and Municipal Construction as amended by City of Chehalis Standards. Hence forth referred to as Standard Specifications.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.

**1.04 QUALITY ASSURANCE**

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Comply with ACI 301 (ACI 301M).
- C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

**PART 2 PRODUCTS**

**201 FORMWORK**

- A. Furnish formwork and formwork accessories according to ACI 301.

**202 CONCRETE MATERIALS**

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project.
- B. Portland Cement: Shall meet the WSDOT Standard Specification for Commercial Concrete 6-02.

**203 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M [ and ASTM C 1116/C 1116],and furnish batch ticket information.
  - 1. When air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

**PART 3 EXECUTION**

**3.01 FORMWORK**

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

**3.02 EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

**3.03 STEEL REINFORCEMENT**

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

**3.04 JOINTS**

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane [grooved] [sawed] contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least [one-fourth] of concrete thickness.
- C. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- D. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

**3.05 CONCRETE PLACEMENT**

- A. Comply with ACI 301 for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment.

**3.06 FINISHING FORMED SURFACES**

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch (13 mm).
- B. Apply to concrete surfaces [not exposed to public view].
- C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm).
- D. Apply to concrete surfaces.
- E. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301 (ACI 301M), to smooth-formed finished as-cast concrete where indicated:
  - 1. Smooth-rubbed finish.
  - 2. Grout-cleaned finish.

3. Cork-floated finish.

**3.07 FINISHING UNFORMED SURFACES**

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
  - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes, unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

**3.08 CONCRETE PROTECTING AND CURING**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
- E. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
  - 1. Water.
  - 2. Continuous water-fog spray.
  - 3. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
- F. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- G. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- H. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

**3.09 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

**3.10 TESTS: PERFORM ACCORDING TO ACI 301 (ACI 301M).**

- A. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m) but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
- B. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

**3.11 REPAIRS**

- A. Remove and replace concrete that does not comply with requirements in this Section.

**END OF SECTION**

SECTION 12 93 00 – SITE FURNISHINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Benches
- B. Trash Receptacles
- C. Ash Snuffer
- C.D. Planters
- D.E. Picnic Tables
- F. Flag Poles
- G. Bollards
- E.H. Seat Pods

1.2 RELATED SECTIONS

- A. Section 33000- Cast in Place Concrete: Base for site furnishings

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's installation instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect from exposure to weather. Keep dry.
- B. Store in secure location until ready to install on site.
- B.

PART 2 PRODUCTS

2.1 FURNISHINGS

- A. Bench #1es: Wausau Tile, Inc. 6'-0" Concrete / Metal Bench, Model No. TF5023, acid-wash "A-38 Night" with "S-48 Cobalt Blue" powdercoat finish. [www.wausautile.com](http://www.wausautile.com)  
Bench #2: Wausau Tile, Inc. 6'-8" Extra large Concrete Bench, Model No. ZB-CI-6000, acid-wash finish with "S-48 Cobalt Blue" powdercoat finish.  
Bench #3 at Law and Justice Bid Alternate No. 1, Wausau Tile, Inc. Model No. 2045 & 2046 for 4-seat capacity with anchor kit. Color shall be S43 "Fireweed" (Bench) and S72 "Aluminum" for legs.
- B. Trash/Recycle Receptacles: Wausau Tile, Inc, Model No. MF3203 with rain hood. "S-48 Cobalt Blue" powdercoat finish. [www.wausautile.com](http://www.wausautile.com). Law and Justice Bid Alternate No. 1, use Model MF3002 with funnel top and rain hood. Color shall be S43 "Fireweed".

- C. Ash Snuffer: Wausau Tile, Inc. Model No. MF4001 "Classic Ash Urn" with black metal lid and rim, perforated steel with "S-48 Cobalt Blue" (S43 – Fireweed at Law and Justice Bid Alternate No. 1 scope of work) powder-coat finish of canister body screen with polyethylene liner, black metal base, security cable and 10 lb. bag of sand. [www.wausautile.com](http://www.wausautile.com)
- D. Precast Concrete Planters: Wausau Tile Co. [www.wausatile.com](http://www.wausatile.com) Model No. "TF-4007" round concrete planter, Acid-wash "A-38 Night". [www.wausautile.com](http://www.wausautile.com)
- E. Picnic Tables: Wausau Tile, Inc. Model No. 6'-0" steel picnic table with seats, "MF-1059", S-38 Cobalt Blue. Provide one ADA space or equivalent. Add anchor kit for mounting. Add (1) perforated steel panel (4' long x 18" high) to be welded to underside of table top to provide below-table privacy screen. Manufacturer to provide shop drawing for review and may adjust dimensions as required.
- F. Flagpole: Aluminum pole and base kit.
  - 1. Spun aluminum pole, .125" min. thickness suitable for 110 mph wind speed on pole.
  - 2. Pole height: 18'-0" exposed height above grade.
  - 3. Halyard: Internal nylon rope. hal
  - 4. Finial ball: Anodized globe style.
  - 5. Ground sleeve: Galvanized steel with min. 2'-0" pole set depth.
  - 5. Base plate: 24" dia. sSpun aluminum to match color of pole.
  - 6.
  - 7. Acceptable manufacturers:
    - a. American Flagpole, Model ESS15B31-02. [www.americanflagpole.com](http://www.americanflagpole.com) 800 368-7171
    - b. US Flag and Flagpole Supply, LP [www.usflag.com](http://www.usflag.com) 800-710-9892
- G. Bollard shall be per Wausau Tile, Inc. Model No. "TF6016" - Weatherstone with #24 brick red color. Install with anchor style "B" for barricade strength.
- H. Seat Pod: Seat Pods shall be per Wasusau Tile, Inc. Model No. "TF5118" – Weatherstone with #24 brick red color with polished/ground top.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this section may properly commence. Notify the Landscape Architect in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

### 3.2 INSTALLATION

- A. Benches:
  - 1. Provide equipment fastener size in accordance with the manufacturer's recommendations for the model indicated.
  - 2. Use galvanized or stainless steel expansion anchor bolts, drilled into site concrete pavers.
- B. Trash Receptacles:

SECTION 12 93 00  
SITE FURNISHINGS

1. Install furnishing in accordance with the manufacturer's recommendations in the locations as indicated on Drawings.
- C. Ash Snuffer: Anchor bolt per manufacturer's recommendations.
- D. Planters: Anchor bolt per manufacturer's recommendations.
- E. Picnic Tables: Anchor bolt per manufacturer's recommendations.
- F. Flag Poles:
1. Install furnishings in accordance with the manufacturer's recommendations in the locations as indicated on Drawings.
  2. Erect poles plumb and to same height. Position halyards to face the same way.
  3. Set aluminum base covers level with paving, leaving no gaps under. Slope pavement away from each flagpole evenly.
  - 3.4. Coordinate top-of-pole light installation with Electrical Contractor.

END OF SECTION

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description: Work includes materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of electrical work. This section applies to all Divisions 26, 27, and 28 sections.
- B. General Requirements: General Conditions, Supplementary Conditions and Division 01 sections apply to Work in this section.

**1.02 CODES AND STANDARDS**

- A. Perform work in accordance with requirements of the state in which the work is performed.
- B. Conform to applicable industry standards, UL standards, NEMA standards, and other standards as noted.
  - 1. Notify the A/E of deviations in Contract Documents to applicable codes and ordinances prior to installation of the Work. Perform changes in the Work after initial installation due to requirements of code enforcing agencies at no additional cost to the Owner.
  - 2. If conflict occurs between legally adopted codes and the Contract Documents, the codes prevail. Contractor to comply with requirements of the Contract Documents which may exceed code requirements and not contrary to same.
- C. Operating Conditions:
  - 1. Temperature: Minus 20 deg C to plus 40 deg C.
  - 2. Altitude: Up to 3,300 feet (1,000 meters).

**1.03 PERMIT INFORMATION**

- A. Permit Application: Arrange for and pay for all required permits, fees, and inspections required for work included in Division 26, 27, and 28.
- B. Permit Submittal Plan Review: Submit the following to the AHJ as required to support the permit application:
  - 1. Electrical Permit: Submit bid documents
  - 2. Fire Alarm Permit: Submit Shop drawings
- C. Approved Permit Plans Printing: Print and have available for the inspector a full size color set of the approved plan review drawings. A digital set of approved drawings will be provided electronically and will be the same size and sheet count as the Bid Documents.

**1.04 SUBMITTALS**

- A. Comply with requirements in Division 01 and with additional requirements indicated in this article.
- B. Electronic Product Data:
  - 1. Comply with requirements in Section 013300 and additional requirements indicated in this article.
  - 2. Submit each specification section complete at one time with a dedicated submittal number for each section. For example, submit products for Section 260519 under one submittal number and products for Section 260533 under a different submittal number. Submitting multiple sections at one time acceptable as long as each section has a dedicated submittal number. Include submittal number and date submitted in file name.
  - 3. Submit one hard copy of product data.

4. Submit signed letter indicating 3D model coordination has started and will continue through construction. 3D model not required to be submitted/reviewed during construction phase.
  5. Partial product submittals not acceptable and will be returned without review except as follows:
    - a. Section 260573 Power Studies including representative one-line diagram of distribution system (with bus numbers as described herein) indicating which devices will be presented in protective device coordination study and indicate additional information required to complete the study.
    - b. Section 260923 Lighting Controls including products and materials for first submittal and Shop Drawings for second submittal.
    - c. Sections 265100 Lighting and 265561 Stage Lighting Systems including products and materials for first submittal and Shop Drawings for second submittal.
    - d. Section 283111 Fire Alarm and Detection Systems including products and materials for first submittal and Shop Drawings for second submittal.
    - e. Long lead items.
    - f. Site and underground work.
  6. Clearly mark catalog pages, equipment, and model number to be used. Indicate associated specification section and paragraph number on each page. Identify required options and accessories.
  7. Format:
    - a. Adobe PDF file format.
    - b. Bookmark each submittal to facilitate browsing to each specification paragraph number.
    - c. Include table of contents for each specification section. Include catalog numbers or drawing numbers.
    - d. Include the Contractor and manufacturer's representative contact information for each product. Include job name (or abbreviation of job name), specification number, and contractor submittal number in file name.
- C. Shop Drawings:
1. Submit as specified in the individual specification sections. Submit minimum 30 days prior to starting fabrication on installation work. Do not fabricate or install until reviewed by the A/E. Include complete location dimensions, and hanger and support sizes and dimensions.
  2. "Typical" drawings and wiring diagrams not accepted unless they specifically apply to this project.
  3. Provide drawings at sufficient scale to show details clearly on same size sheets as Drawings.
  4. Show required coordination with work of other trades.
  5. Identify details and show their locations in Project.
  6. Include description of configuration and operation of proposed systems.
  7. Include outline drawings of proposed equipment in plan and elevation views including overall dimensions, weights, and clearance required.
  8. Include one-line electrical diagrams required for control and sensing.
  9. Request floor plan backgrounds in electronic format from the A/E.
  10. Direct use of the Drawings as the basis of Contractor's prepared Shop Drawings not acceptable.
  11. Format:
    - a. Adobe PDF file format.

- D. Approval: Approval of a manufacturer's name or product by the A/E does not relieve the Contractor of the responsibility for providing materials and equipment which comply in detail with requirements of the Contract Documents.
- E. As-Built Drawings: Daily updates and markups that reflect all changes made in the specifications and working drawings during the construction process, and show the exact dimensions, geometry, and location of all elements of the work completed under the contract.
- F. Re-Submittals: Clearly identify re-submittals. Provide revised tabs, indexes, page renumbering, and other formats to interface with original submittal. Identify changes and include date for project tracking.
- G. Test reports and Certificates: Submit as a package prior to Substantial Completion.
- H. Certifications: Submit written certifications from the governing building authorities stating that work has been inspected and accepted, and complies with applicable codes and ordinances.
- I. Record Drawings: Conformed set of as-builts developed during the construction process. Provide a single digital copy for each sheet in the contract documents and developed at the end of the construction phase. Comply with Article "Record Drawings" in this section.
- J. Schedule of Values:
  - 1. Comply with the requirements in Division 01 with additional requirements as indicated in this paragraph.
  - 2. Include costs in Schedule of Values as follows:
    - a. Mobilization.
    - b. Submittals.
    - c. Electrical Permit.
    - d. 3D Coordination
    - e. Electrical Site – Utility Provisions, Material.
    - f. Electrical Site – Utility Provisions, Labor.
    - g. Electrical Site – Site Lighting Rough In, Material.
    - h. Electrical Site – Site Lighting Rough In, Labor.
    - i. Electrical Site – Power and Low Voltage, Material.
    - j. Electrical Site – Power and Low Voltage, Labor.
    - k. Lighting Systems – Fixtures & Lamps Material.
    - l. Lighting Systems – Fixtures & Lamps Labor.
    - m. Lighting Systems – Branch Circuit Raceway Rough-in, Material.
    - n. Lighting Systems – Branch Circuit Raceway Rough-in, Labor.
    - o. Lighting Systems – Branch Circuit Wiring, Material.
    - p. Lighting Systems – Branch Circuit Wiring Labor.
    - q. Lighting Systems – Devices & Trim, Material.
    - r. Lighting Systems – Devices & Trim, Labor.
    - s. Power Systems – Switchgear, Disconnects, Material.
    - t. Power Systems – Switchgear, Disconnects, Labor.
    - u. Power Systems – Feeder Raceway Rough-in, Material.
    - v. Power Systems – Feeder Raceway Rough-in, Labor.
    - w. Power Systems – Feeder Conductor, Material.
    - x. Power Systems – Feeder Conductor, Labor.
    - y. Power Systems – Equipment Connections.
    - z. Power Systems – Branch Circuit Raceway Rough-in, Material.

- aa. Power Systems – Branch Circuit Raceway Rough-in, Labor.
- bb. Power Systems – Branch Circuit Wiring, Material.
- cc. Power Systems – Branch Circuit Wiring, Labor.
- dd. Power Systems – Devices & Trim, Material.
- ee. Power Systems – Devices & Trim, Labor.
- ff. Low Voltage – Fire Alarm Rough-in, Material.
- gg. Low Voltage – Fire Alarm Rough-in, Labor.
- hh. Low Voltage – Fire Alarm Trim, Material.
- ii. Low Voltage – Fire Alarm Trim, Labor.
- jj. Low Voltage – Telecommunications Pathway Rough-in, Material.
- kk. Low Voltage – Telecommunications Pathway Rough-in, Labor.
- ll. Low Voltage – Telecommunications Cabling, Material.
- mm. Low Voltage – Telecommunications Cabling, Labor.
- nn. Low Voltage – Intrusion Detection, Material.
- oo. Low Voltage – Intrusion Detection, Labor.
- pp. Low Voltage – Access Control, Material.
- qq. Low Voltage – Access Control, Labor.
- rr. Low Voltage – Security Video, Material.
- ss. Low Voltage – Security Video, Labor.
- tt. Low Voltage – Rescue Assistance Signal, Material.
- uu. Low Voltage – Rescue Assistance Signal, Labor.
- vv. Low Voltage – Emergency Responder Radio, Material.
- ww. Low Voltage – Emergency Responder Radio, Labor.
- xx. Punch List and Close Out.
- yy. Testing Commissioning and Training.

#### **1.05 DEFINITIONS AND ABBREVIATIONS**

- A. Refer to Division 01 for definitions and abbreviations. Additional definitions and abbreviations are as follows.
- B. “Approved” or “Approval” means written approval by the owner or “Owner’s agent” (A/E).
- C. “Codes” means AHJ adopted codes, rules, and ordinances and additional codes as specified herein.
- D. “Concealed” means spaces out of sight. For example, above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.
- E. The word “Contractor”, as used in Divisions 26, 27, and 28 sections, means the electrical subcontractor.
- F. “Coordination”, “Coordinating”, and “Coordinate” means to bring, or the bringing, into a common action, movement, or combination so as to act together in a smooth concerted way.
- G. “Demolition”, “Demo”, “Demolish” means to disconnect, remove and properly dispose of existing devices, components, equipment.
- H. “Directed”, “Requested”, “Accepted”, and Similar Terms means these terms imply “by the A/E” unless otherwise indicated.
- I. “Exposed” means open to view. For example, raceways installed in a tunnel or raceways installed in a room and not covered by other construction.

- J. "Furnish" means supply and deliver to the project site ready for unloading, unpacking, assembly, installation, and similar activities.
- K. "Indicated" and "Indicated on the Drawings" means shown on Drawings by notes, graphics or schedules, or written into other portions of Contract Documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meanings as "indicated", and are used to assist the reader in locating particular information.
- L. "Install" means to place in position for service or use. Includes operations at project site, such as unloading, unpacking, assembly, erection, placing, preserving, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar activities.
- M. "Provide" means furnish and install for a complete, finished, and operable system and ready for intended use.
- N. "Shop Drawings" means Document which fully details equipment and intended installation relative to this specific Project.
- O. "Structural Members" means all above and below grade elements associated with the structural support of the building or structure.
- P. "Substantial Completion" means that the entire project (or readily definable portion thereof if so designated in the Contract Documents) is acceptable to code enforcement authorities and to extent required by such authorities, has been inspected and approved by such authorities, and is suitable for occupancy by the Owner or occupant for the purpose intended. Refer to Divisions 00 and 01 for additional requirements.
- Q. "Work" or "Project" means entire scope of work required by the Contract Documents.
- R. Abbreviations:
- |        |                                                 |
|--------|-------------------------------------------------|
| A/E    | Architect                                       |
| ADS    | Acoustical Distinguishable Space                |
| AFCI   | Arc Fault Circuit Interrupter                   |
| AHJ    | Authorities Having Jurisdiction                 |
| ANSI   | American National Standards Institute           |
| ASTM   | American Society for Testing and Materials      |
| ATP    | Acceptance Test Procedure                       |
| BMS    | Building Management System                      |
| BOM    | Bill-of-Material                                |
| C      | Degrees Celsius                                 |
| CEC    | Canadian Electrical Code                        |
| CCT    | Correlated Color Temperature                    |
| CIS    | Common Intelligibility Scale                    |
| CSA    | Canadian Standards Association                  |
| CR     | Controlled Receptacle                           |
| CRI    | Color Rendering Index                           |
| CU     | Coefficient of Utilization                      |
| DAS    | Distributed Antenna System                      |
| EBS    | Educational Broadband Service                   |
| EMS    | Energy Management System                        |
| EMT    | Electrical Metallic Tubing                      |
| EPO    | Emergency Power Off                             |
| ETL    | Environmental Technology Laboratory             |
| EUSERC | Electric Utility Service Equipment Requirements |
| F      | Degrees Fahrenheit                              |
| FC     | Foot-candle                                     |
| FM     | Factory Mutual Engineering Corporation          |
| GB     | Ground Fault Circuit Interrupter Breaker        |
| GFCI   | Ground Fault Circuit Interrupter                |

|       |                                                                            |
|-------|----------------------------------------------------------------------------|
| GFI   | Ground Fault Circuit Interrupter                                           |
| GUI   | Graphical User Interface                                                   |
| HDPE  | High-density polyethylene                                                  |
| HID   | High-intensity discharge                                                   |
| HVAC  | Heating, Ventilation and Air Conditioning                                  |
| IC    | Insulation contact                                                         |
| IBC   | International Building Code                                                |
| IDF   | Intermediate distribution frame                                            |
| IEC   | International Electrotechnical Commission                                  |
| IEEE  | Institute of Electrical and Electronics Engineers                          |
| IES   | Illuminating Engineering Society                                           |
| IMC   | Intermediate Metal Conduit                                                 |
| K     | Kelvin                                                                     |
| kVA   | Kilo Volt Amps                                                             |
| LED   | Light-emitting diode                                                       |
| LPI   | Lightning Protection Institute                                             |
| MC    | Metal Clad                                                                 |
| MDF   | Main distribution frame                                                    |
| NEC   | National Electrical Code, NFPA 70 (latest adopted edition with Amendments) |
| NEMA  | National Electrical Manufacturer's Association                             |
| NETA  | International Electrical Testing Association                               |
| NFPA  | National Fire Protection Association                                       |
| NRTL  | Nationally Recognized Test Laboratory                                      |
| OSHA  | Occupational Safety and Health Administration                              |
| PCB   | Polychlorinated Biphenyl                                                   |
| PDU   | Power Distribution Units                                                   |
| PF    | Power factor                                                               |
| RMC   | Rigid Metal Conduit                                                        |
| RMS   | Root Mean Square                                                           |
| RTRC  | Reinforced thermosetting resin conduit                                     |
| SCCR  | Short Circuit Current Rating                                               |
| SPD   | Surge Protective Devices                                                   |
| STC   | Factory Standard Test Condition                                            |
| STI   | Sound transmission index                                                   |
| STIPA | STI for public address systems                                             |
| TCLP  | Toxicity characteristic leaching procedure                                 |
| THD   | Total Harmonic Distortion                                                  |
| TIA   | Telecommunications Industry Association                                    |
| UL    | Underwriters Laboratories Inc.                                             |
| UPS   | Uninterruptible Power Supply                                               |
| V     | Volts                                                                      |
| VOIP  | Voice Over Internet Protocol                                               |
| VRLA  | Valve Regulated Lead Acid Batteries                                        |

## 1.06 MATERIALS

- A. Where two or more manufacturers are listed, select for use any of those listed. The first mentioned, in general, was used as the basis of design. Bids on any manufacturer named acceptable as long as that manufacturer meets every aspect of the Contract Documents. Note that equipment layout is based on equipment listed in equipment schedules.
- B. Ensure that equipment will fit within available space. Where other than basis of design manufacturer is selected for the Project, the Contractor is responsible for verifying equipment will fit within available space and meet manufacturer's and code required clearances.

- C. Where other than basis of design manufacturer is selected for the Project, include cost of resulting additional work, coordination with other trades, and redesign of associated building services and structure as required to accommodate selected equipment. Include redesign drawings with submitted Shop Drawings.
- D. Include costs in base bid for required redesign work by A/E to accommodate proposed Product. The Owner will compensate Engineer through the A/E at rate of \$150.00 per hour for time and expense for required review of submittals and additional coordination for redesign work. Amount of compensation will be deducted from Final Payment to the Contractor.

#### **1.07 STANDARDS OF QUALITY**

- A. Materials and Equipment: UL listed and labeled or other AHJ approved testing laboratory and in compliance with other industry standards as specified.
- B. Provide manufacture's regularly catalogued items and supply as a complete unit in accordance with manufacturer's standard specifications and any optional items required for proper installation for equipment unless otherwise noted. Install equipment and materials in accordance with the manufacturer's recommendations and best trade practices.
- C. Provide new products unless indicated otherwise in the Contract Documents.
- D. Fabricator and Manufacturer Qualifications: Specialists with at least 5 years' experience and regularly engaged in manufacture of equipment and materials specified.
- E. Furnish products of a single manufacturer for items which are used in quantity. A Product, for the purpose of this paragraph, is an assembly of components such as switchboards, transformers, panelboards, and similar items. Materials such as wire and cable, raceways, outlet boxes, and similar items not requiring maintenance are not included in the single manufacturer requirement of this paragraph.
- F. Installer Qualifications: Specialists with at least 5 years' experience and regularly engaged in the installation of the system, equipment, and materials specified. Where required by the AHJ, employ licensed trades persons.

#### **1.08 SUBSTITUTIONS**

- A. Comply with requirements in Division 01 with additional requirements indicated in this article.
- B. Substitutions will be considered following bid award only when a product becomes unavailable through no fault of the Contractor.
- C. Where "Manufacturer" paragraphs include the words "or approved", prior approval of the proposed substitution is required. The A/E is sole judge of quality of proposed substitution.
- D. When the A/E approves a substitution request, the approval is given with the understanding that the Bidder:
  - 1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
  - 2. Will provide the same warranty for the Substitution as for the specified Product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.

- E. Whenever a Product is described by detail, specification, trade name, manufacturer's name or catalog reference, use only such Product, unless written approval is given for substitution prior to bid. Submit written requests on substitution request form included in Division 01. Approved substituted manufacturers will be listed by Addendum. There are no prior approvals for this project.
- F. Provide as specified certain products, materials, and systems where "manufacturer" paragraphs are followed by the words "no substitutions".
- G. Substitutions will not be considered when they are indicated or implied on Shop Drawings or product data submittals, without separate written prior approval, or when approval will require revision to the Contract Documents.

#### **1.09 DRAWINGS AND SPECIFICATIONS**

- A. General: The electrical drawings are diagrammatic. Complete details of building features which affect electrical installation may not be shown. For additional details, refer to other Contract Documents. Report any discrepancies to the A/E along with suggested revisions. Obtain written response from the A/E before proceeding with changes.
- B. Depiction of Work: Drawings do not show the exact characteristics of the work including, physical arrangement of equipment, lengths of wiring or conduit runs. Base work on actual field measurements and conditions. Provide work required to complete the installation.
- C. Dimensions: Do not scale drawings. Dimensional accuracy is not guaranteed, and field verification of dimensions, locations, and levels to suit field conditions is required.
- D. Since the Drawings of floor, wall, and ceiling installation are made at small scale, outlets, devices, equipment, and similar items are indicated only in their approximate location. Locate outlets and apparatus symmetrically on floors, walls, and ceilings where not dimensioned and coordinate such locations with work of other trades to prevent interferences.
- E. Discrepancies: Field verify dimensions and existing conditions prior to performing work. Bring to the A/E's attention any discrepancies within the Contract Documents and between the Contract Documents and field conditions. Also for any design and layout changes required due to specific equipment selection, prior to the Contractor's work (equipment and material purchasing and installation). Provide corrective work required after discovery of such discrepancies, inconsistencies, or ambiguities at no additional cost to the Owner.
- F. Specifications: These specifications are written in imperative mood and streamlined form. The imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

#### **1.10 RECORD DRAWINGS**

- A. Comply with requirements in Division 01, with additional requirements as indicated in this article.
- B. Prepare As-Built drawings: Red line As-Built Drawing prints in digital or hand drawn format (pencil and black pen not acceptable). Include:
  - 1. Corrections and Changes: Record during the progress of the Work, showing work as actually installed.
    - a. Show the measured locations of portions of the Work and changes the Contractor has made.
    - b. In general, tolerance plus or minus 1'-0" from actual location.

- c. Show addendum items, change orders, clarifications, supplemental instructions, and deviations from the Drawings. Show device or equipment changes and indicate where the change was originated. Only indicating the document where the change originated from will not be accepted.
- 2. Updates: Neatly hand-draft on daily basis and kept readily available at project site. Updates are subject to review by the A/E on a regular basis throughout construction. Updates are to include the following at a minimum:
  - a. Feeder routing indicating upstream and downstream equipment.
  - b. Installation locations for underground raceways and where they transition to above grade.
  - c. Device locations and mounting heights.
  - d. Junction and pull boxes with two or more home runs.
  - e. Junction and pull boxes with one home run.
  - f. Circuit information.
  - g. Shop Drawings: Update shop drawings with changes or deviations from the Original Shop Drawings. Provide updates to manufacturer/vendor for inclusion in Record Drawings.
- C. Record Drawings: Develop a digital set of Record Drawings for the project utilizing the as-built drawings. Digital Record Drawings can be in AutoCAD or PDF format. At end of construction, check drawings for completeness and accuracy.
- D. Shop Drawing Record Drawings: Provide updated shop drawings based on As-Built drawings for use as Record Drawings.
- E. Per project closeout procedures, submit in Digital Record Drawings and a copy of the As-Built. Note each sheet as "RECORD DRAWING".
- F. 3D Coordination Model: Include fully coordinated 3D model.

#### **1.11 COORDINATION**

- A. Coordinate Divisions 26, 27, and 28 work with other trades.
- B. Develop 3D model for coordination with other trades.
  - 1. Format: 3D drawings using industry recognized software that is compatible with general contractor's 3D software.
  - 2. Include electrical conduits, cable trays, electrical equipment, lighting fixtures and other items to be installed in ceilings, full height walls, and other items necessary to coordinate installation.
  - 3. Attend coordination meetings and make modifications to the 3D model until all items have been coordinated.
- C. Be aware of restricted space for installation of electrical systems. Include offsets and perform rerouting and coordination to fit elements in available space. Include provisions for such requirements in bid.
- D. Electrical equipment and systems shown are based on existing drawings as available and on limited project site observations to the extent possible under current conditions. Field verify existing conditions prior to commencement of work. Obtain specific locations of structural and architectural features or equipment items from referenced drawings, field measurements, or trade providing material or equipment.
- E. Coordinate raceway installations to clear light fixtures and electrical cable trays. Include clearance over light fixtures to allow removal and replacement. Include minimum 6 inch clearance above and to sides of cable trays.

F. Existing Conditions:

1. General Construction:

- a. Installation of electrical, telecommunications, and electronic safety and security work will require openings, removal and replacement of ceilings, sleeves, and restoration of general construction to match existing. Some work occurs in areas not requiring alterations as part of architectural work. Coordinate new openings and restoration work so that there is no additional cost to the Owner.
- b. General construction work shown on the architectural drawings may require removal, relocation, and reinstallation of existing electrical, telecommunications, electronic safety and security work. Since existing conditions cannot be completely detailed on the Drawings, survey the site and perform required Work at no additional cost to the Owner.

2. This project may require work in the presence of asbestos containing material (ACM). Division 26 does not provide for or cover the identification, removal, incapsulation, or disposal of such material. If the presence of ACM is suspected, notify the Owner prior to proceeding with in the vicinity of ACM.

- G. Be responsible for beam penetrations as they relate to the electrical work. Submit sizes and locations to the structural engineer for review and determination of structural details.
- H. Coordinate attachments to structure to verify that attachment points on equipment and structure can accept seismic, weight, and other loads imposed.
- I. Refer to architectural and structural drawings for location of expansion and seismic joints. Provide flexible loops for raceways and cable trays crossing expansion and seismic joints.

**1.12 WORKMANSHIP**

- A. Provide work in accordance with best trade practices. Remove substandard workmanship and provide new material at no extra cost to the Owner.

**1.13 SITE VISIT**

- A. Visit site during bidding period to note conditions affecting installation of Work. No additional charges allowed due to failure to adequately review conditions.
- B. Investigate each space through which equipment must be moved. Where necessary, arrange with equipment manufacturers to ship equipment in sections with suitable dimensions for moving through restricted spaces. For movement through occupied spaces, ascertain from the Owner as acceptable times of day or night that movement could occur. Include costs in bid for off hours labor, reassembly, and field testing.

**1.14 CERTIFICATION**

- A. By submitting a bid for the electrical, telecommunications, electronic safety and security systems, the Contractor and his subcontractors acknowledge and certify the following:
  1. That they have carefully examined and fully understand the Drawings and Specifications (including but not limited to architectural, site, utility, mechanical, structural and electrical drawings and specifications. In addition, they have determined that the Drawings and Specifications are adequate to complete the electrical systems and that they can provide a complete finished and operable system in accordance with the Contract Documents.
  2. That they have had a reasonable opportunity to discover any ambiguities in the Contract Documents and such ambiguities have been brought to the attention of the A/E in writing prior to submitting the bid.

3. That they have reviewed the project progress schedule with the general contractor, fully understand the schedule, and they have verified, prior to submitting a bid, availability of necessary labor and materials, including supervision and office backup, and can comply with the schedule requirements.
4. That there may be changes to the scope of work and that they understand that any proposal submitted for performance of additional work includes costs associated with such change including but not limited to labor, materials, subcontracts, equipment, taxes, fees, schedule impact, loss of efficiency, supervision, overhead and profit.
5. That the Contract requires them to coordinate their work with that of other trades and that responsibility for coordination includes rerouting, offsets, and similar provisions, to fit Work and address manufacturer's recommended clearances for service access, maintenance, and replacement of equipment in a manner that is compatible with work of other trades in the same area.
6. That routing of elements of electrical systems shown on the Drawings is schematic only and that offsets and rerouting probably will be required in installation and that labor and materials have been included for such in their bids.
7. That they understand submittals of material and equipment to the A/E is for the purpose of establishing what they are providing for the project. Any review undertaken by the A/E does not relieve them of their responsibilities to furnish and install materials and equipment required for work in the project nor does such review relieve them of their responsibilities for coordination with other trades and designers to ensure that such materials and equipment will fit and be suitable for purpose intended.
8. That they agree to receive payment for bid amounts as full compensation for furnishing materials and labor which may be required in prosecution and completion of work required under the Contract Documents, and in respects to complete the contract work to the satisfaction of the A/E.
9. That they include in their bids costs to furnish bonds as specified in the Contract Documents.

#### **1.15 WARRANTY**

- A. Conform to requirements in General Conditions, Supplementary Conditions, and Division 01. Where not so prescribed or defined, provide for a period of 1 year.
- B. Warranty periods within Divisions 26, 27, and 28 are based on industry standard warranty periods and commence on the Substantial Completion date. Provide extended factory warranties as required to account for the difference between standard factory warranty start time and date of the Substantial Completion.

#### **1.16 EQUIPMENT FURNISHED BY OWNER INSTALLED BY CONTRACTOR (FOIC)**

- A. Material Handling and Delivery: Coordinate delivery of FOIC equipment. Receive, off load, transport, store, hoist, unpack, dispose of packing, same as for other project equipment arriving at job site. Requirements of the Contract Documents apply to FOIC equipment.
- B. Operation and Maintenance Data: Obtain from the Owner operation and maintenance data for the FOIC equipment and incorporate them into the Operations and Maintenance Manuals.
- C. Start-up and Warranty:
  1. FOIC equipment suppliers will pass on to the Contractor start-up information, maintenance and parts information, and warranty provisions of their products in accordance with the equipment suppliers contract requirements. Organize and coordinate start-up and warranty requirements for the FOIC equipment.
  2. Include one year warranty on FOIC equipment starting at Substantial Completion regardless of shorter time limits by FOIC suppliers.

**1.17 DEMONSTRATION**

- A. Comply with requirements in Division 01 with additional requirements indicated in this article.
- B. Following installation of electrical work and prior to final acceptance, demonstrate that equipment and systems operate as indicated in the Contract Documents and in accordance with manufacturer's recommendations.
- C. Perform in presence of the A/E and Owner's representative, unless otherwise directed by the A/E. Give minimum 1 week notice prior to demonstrations.
- D. Provide instruments and personnel required to conduct demonstrations.

**1.18 SUBSTANTIAL COMPLETION**

- A. Comply with requirements in Division 01.
- B. Prepare list of items that are not complete prior to asking for a substantial completion review by the A/E.

**1.19 ALTERNATES**

- A. General: See Bid Form and Alternates described in Division 01 for possible effect on work of Divisions 26, 27, and 28.

**1.20 OPERATION AND MAINTENANCE MANUALS**

- A. Prepare Operation and Maintenance Manuals for equipment and materials furnished under Divisions 26, 27, and 28.
- B. Comply with requirements in Division 01 with additional requirements indicated in this article.
- C. Submit one hard copy and one electronic PDF format of Operation and Maintenance Manuals for review at least 4 weeks prior to Substantial Completion date. Assemble hard copy Operation and Maintenance Manual in 3-ring binder(s). Use multiple binders if pages in a single binder would exceed 4 inch thickness. Separate binders for each category, such as Electrical, Telecommunications, and Electronic Safety and Security. Where one subject matter encompasses more than one binder, differentiate by volume numbers. Include indexed tabs for each binder. Engrave cover with the project title in 1/2 inch high letters and name and address of the Contractor in 1/4 inch high letters. Provide same information in 1/8 inch high letters on spine.
- D. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Include serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, and similar information. Provide individual sheet for each item of equipment. (Example: If 2 items of equipment A and D appear on the same sheet, provide individual sheet for each unit specified.)
- E. Include the Following Information:
  - 1. Identifying name and mark number.
  - 2. Certified outline drawings and Shop Drawings.
  - 3. Parts list.
  - 4. Performance curves and data.
  - 5. Wiring diagrams.
  - 6. Manufacturer's recommended operating and maintenance instructions.
  - 7. Vendor's name, address and telephone number for all parts and equipment.
  - 8. Name, address and telephone number of Contractor performing the work.
  - 9. Test reports.

10. Product data and Record Drawings.

**1.21 TESTING**

- A. Comply with requirements in Section 260810.

**1.22 PROJECT TRAINING**

- A. Upon completion and testing of equipment and system installation, assemble equipment factory representatives and subcontractors for system training with Owner's representatives as required in specific specification sections.
- B. Provide representative and subcontractor assistance in start-up, check out, and training for their respective system and remain on-site until the total system operation is thoroughly reviewed by the Owner's representatives and are thoroughly trained. Return for additional training sessions as required to completely train Owner's Representatives.
- C. Provide factory representative and system subcontractor personal instruction on operating and maintenance of their equipment to the Owner's maintenance and operation personnel. To certify acceptance of operation and instruction by the Owner's representative, prepare a written statement as follows:
1. This is to certify that the factory representative and system subcontractor for each system listed below have performed start-up and final check out of their respective systems.
  2. The Owner's maintenance and operation personnel have received complete and thorough instruction in the operation and maintenance of each system.

SYSTEM

FACTORY REPRESENTATIVE

---

(List systems included)

(List name and address of factory representative.)

---

Owner's Representative

Contractor

- D. Submit copy of acceptance to A/E.

**1.23 PUNCHLIST AND FINAL REVIEWS**

- A. Provide electrical foreman assistance at the time of punchlist and final reviews and accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested to allow review of entire electrical system.
- B. Punch List: Review each punch list item; update field conditions to address items or provide comment response for reason the item has not been addressed in the field.

**1.24 PROJECT CLOSEOUT**

- A. Include costs of engineering services required beyond the final completion date paid by the Contractor at a rate of \$150 per hour.
- B. Punchlists by A/E at Substantial Completion and final completion dates. Submit Record Drawings and final Operation and Maintenance Manuals prior to Substantial Completion date. Subsequent reviews paid by the Contractor at a rate of \$150 per hour.

**1.25 COMMISSIONING SUPPORT**

- A. Comply with requirements in Sections 019113 and 260810.
- B. Division 26 subcontractor: assist in developing final Functional Test Procedures as specified in Sections 019113 and 260810.

- C. Start-up and testing services and Functional Performance Testing provided by equipment manufacturer's authorized representatives as specified in Sections 019113 and 260810.
- D. Submit equipment start-up and test procedures and preliminary Operation and Maintenance Manuals to the Commissioning Authority. Submit under separate bound cover.

**PART 2 PRODUCTS**

Not used.

**PART 3 EXECUTION**

Not used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes basic electrical requirements specifically applicable to Divisions 26, 27, and 28 sections including general material and installation requirements and site work.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to the Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. UL Compliance: Where UL fire-resistance rating is indicated for construction penetrated by access units, furnish UL listed and labeled units, except for those units which are smaller than minimum size requiring ratings as recognized by governing authority.
- C. Codes and Standards:
  - 1. ASTM D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>).

### **1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods to prevent damage, deterioration, and loss, including theft.
- B. Deliver products to site in manufacturer's original containers, complete with labels.
- C. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- D. Store products subject to damage by weather conditions above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Furnish specified items acceptable to AHJ as suitable for intended use.
- B. New, unless otherwise indicated, free from defects and the standard products of reputable manufacturers regularly engaged in production of such equipment.
- C. Furnish similar items of equipment by same manufacturer.
- D. Materials and Equipment: UL listed and labeled or other AHJ approved testing laboratory and in compliance with other industry standards as specified.
- E. Remove rejected or damaged material from site.
- F. Samples may be required for non-standard or substituted items before installation. Submit samples as required in specific specification sections.
- G. Furnish required items necessary for installation and testing procedures.

## **2.02 POSTED INSTRUCTIONS**

- A. Posted Operating Instructions: Furnish simplified, consolidated equipment control and power diagrams. Graphically represent entire system and actual equipment installed. Include concise written instructions on how to start and stop systems. Show settings and conditions to be observed. Indicate what control adjustments are to be made or maintained by the operator.
  - 1. Include control diagrams and specific operating instructions.
  - 2. Indicate how to energize each major component of systems. Show what action must be taken in an emergency, how to restore power following an outage, and what precautions to be taken when maintenance is required.
  - 3. Include photographic or comparable non-fading reproductions, either framed under glass or encased in non-discoloring plastic.
  - 4. Include one-line diagrams of electric power distribution riser.
- B. Copies of operating instructions shall be used with Operation and Maintenance Manuals as basis in training Owner's employees in the operation and maintenance of systems and related installed equipment.

## **2.03 ENCLOSURES**

- A. NEMA Type 1 – Dry Interior locations unless otherwise noted on drawings or as specified below.
- B. NEMA 3R Weather-proof/Rain-proof – Windblown rain, sleet, ice – Provide in all locations where exposed to moisture unless otherwise noted.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify installation conditions as satisfactory to receive work of the various sections. Do not install until unsatisfactory conditions are corrected.

### **3.02 INSPECTIONS**

- A. Confirm that installations have been inspected before enclosure within building features, buried, or otherwise hidden from view. Pay costs associated with uncovering or exposing installations and features not previously inspected and for repair to exposed surfaces.

### **3.03 PREPARATION**

- A. Protect surrounding areas and surfaces to prevent damage as work is installed.
- B. Obtain equipment roughing-in dimensions from approved Shop Drawings or actual measurements.
- C. Be familiar with the location of other trade's equipment. Eliminate conflicts. Check door swings before installing switches. Locate switches on strike side of doors unless noted otherwise.
- D. Layout electrical, telecommunications, and electronic safety and security work in advance of construction to eliminate unnecessary cutting, drilling, channeling, and similar activities. Where such cutting, drilling, channeling and similar activities become necessary for proper installation, perform with care using skilled mechanics of trades involved. Repair damage to building and equipment at no additional cost to the Owner.
- E. Perform cutting work of other trades only with consent of that trade. Cutting structural members not permitted without consent of the A/E.

### 3.04 INSTALLATION

- A. Install Work as specified and in accordance with the Drawings and manufacturer's instructions. Where these conflict, manufacturer's instructions govern.
- B. Review Architectural, Mechanical and other applicable drawings and applicable Shop Drawings to prevent switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, and similar items, or from being located in whiteboards, tackboards, glass panels, and similar items. Relocate electrical devices and connections as directed by the A/E at no additional cost to the Owner if the work is not properly coordinated.
- C. Where conduit, outlets, and apparatus are encased in concrete, locate and secure at point of installation. Check locations of electrical items before and after concrete and masonry installation and relocate displaced items.
- D. Provide block-outs, sleeves, demolition work, and similar items required for installation of Work specified in this division.

### 3.05 WORKMANSHIP

- A. Work and materials will be subject to observation at any time by the Owner and the A/E.
- B. Install material and equipment in accordance with manufacturer's instructions. Provide calibrated torque wrenches and screwdrivers as required.
- C. Cutting and Patching: Do not weld to, cut, or notch structural members or building surfaces without approval of the A/E. Restore surfaces neatly to original condition after cutting, channeling, chasing, and drilling of walls, partitions, ceilings, paving, and anchorage of conduit, raceways, and other electrical equipment.

### 3.06 WELDING, CUTTING, AND DRILLING

- A. Perform in accordance with American Welding Society Standards.

### 3.01 EARTHWORK

- A. Perform earthwork required for installation of electrical work below grade. Provide earthwork meeting requirements in this article and Division 31, whichever is most stringent. Provide earthwork meeting requirements of the serving utility company where earthwork is related to utility infrastructure.
- B. Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner which protects walls, footings, and other structural members from being disturbed or damaged in any way.
- C. Place and maintain barricades, warnings, construction signs, illumination and guards as required during periods of open excavation to protect persons from injury and to avoid property damage. Provide bracing and shoring as necessary to maintain stability of excavation and to comply with safety codes.
- D. Coordinate excavations with weather conditions to minimize possibility of washouts, settlements and other damages and hazards.
- E. Do not excavate until required materials are on site and the Work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimal. Refer to other sections for additional requirements for excavating.
- F. Store excavated material (temporarily) near excavation in manner which will not interfere with or damage excavation or other work.

- G. Retain excavated material which complies with requirements for backfill material. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site and dispose of in lawful manner.
- H. Backfill trenches only after observation by the A/E. Install backfill material under, around, and between conduit and sides of trench by hand, shovel tamped in place. Cover in 6 inch layers to 12 inch thickness over top of conduit or cabling. For final backfill, fill and tamp remainder of backfill material in 6 inch layers. Provide backfill materials as follows for buried conduit or cable (other than concrete encased):
  - 1. Backfill below, on sides of, and over conduit or cable: Sand or pea gravel. Minimum thickness of 6 inches above, below and at sides of outer conduits. Minimum 3" spacing between conduits.
  - 2. Backfill to within 6 inches of Final Grade: Soil material suitable for compacting to required densities. Per Division 31 requirements.
  - 3. Backfill for top 6 Inches of excavation: Topsoil except where excavations occur below paved or gravel area provide compacted gravel backfill or surface area as indicated.
- I. Compacting:
  - 1. Perform compacting individually, for each 6 inch layer (maximum) loose thickness of initial and final backfill. Comply with ASTM D 1557. Where roadway or parking area surfaces will be placed over backfill, and to 10 feet beyond building perimeter, compacted to 95 percent of maximum density. Elsewhere, 90 percent. Test in accordance with Divisions 1 and 31.
  - 2. Take special care in compacting under services where they enter building to prevent settling. Contractor fully responsible for damage to piping and property as a result of settling around service conduit and cabling.
- J. Subsidence: Where subsidence is measurable or observable at electrical work excavations during project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

### 3.02 CONCRETE BASES

- A. Unless noted otherwise, provide 4 inch high reinforced concrete bases for floor mounted and floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, and similar equipment. Extend bases 4 inches beyond equipment or mounting rails in each direction unless noted otherwise on the Drawings.
- B. Concrete bases shall be provided under Division 26. Coordinate size and location of bases and provide required anchor bolts, sleeves, and templates required to obtain proper installation.
- C. Provide concrete pads and vaults for power company furnished pad mounted transformers in accordance with power company clearance requirements.

### 3.03 CLEANING

- A. Clean equipment, conduit, and fittings and remove packing cartons and other debris created by Divisions 26, 27, and 28 Work.
- B. Before Substantial Completion, carefully clean equipment, fixtures, exposed raceways and similar items. Remove construction labels, dirt, cuttings, paint, plaster, mortar, concrete, and similar items. Clean fixtures, interiors and exteriors of equipment and raceways.

**3.04 IDENTIFICATION**

- A. Provide nameplates and decals required to identify equipment and components, comply with requirements in Section 260553.
- B. Mount operating instructions and diagrams near equipment or elsewhere as otherwise designated by the Owner.

**3.05 PROTECTION**

- A. Protect equipment during and after electrical hookup, painting, and final testing.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description: Work includes final electrical connection to equipment having electrical requirements. Contractor shall make final connections for Owner furnished equipment including switches, receptacles, and similar items. See other applicable specification sections for building temperature control wiring requirements specified in Divisions 21, 22, and 23.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.
- C. Connection to Equipment Specified in Divisions 21, 22, and 23 as Follows unless Specified Otherwise in Divisions 21, 22, and 23:
  - 1. For motorized only equipment with built-in controllers (packaged equipment), Connect power and provide an external disconnect at equipment. Division 23 will provide control wiring.
  - 2. For motorized only equipment with external controller (non-packaged equipment), provide external motor controller, disconnect switch, and make power wiring complete to equipment. Division 23 will provide control wiring.
  - 3. For electric duct heaters with built-in controllers (packaged type equipment), connect power complete and provide external disconnect switch at equipment. Division 23 will provide control wiring.
  - 4. For electric duct heaters with remote controllers (non-packaged type equipment), provide external controller, disconnect switch, and make power wiring to equipment. Division 23 will provide control wiring.
  - 5. For combination motorized and electric heating packaged units specified with built in controllers and specified with "single point electrical connection" under Division 23, connect power and provide external disconnect switch. Division 23 will provide control wiring.
  - 6. For equipment requiring a full voltage non-reversing starter, include as a combination disconnect unit.
- D. Refer to Division 23 sections for control system wiring.
- E. Refer to sections of other divisions for specific individual equipment power requirements.

**1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. NEC Compliance: Comply with applicable portions of NEC as to type of products used and installation of electrical power connections.
- C. Comply with applicable NEMA standards and refer to NEMA standards for definitions of terminology herein. Comply with NEC for workmanship and installation requirements and to applicable Division 26 sections.
- D. UL Labels: Provide electrical connection products and materials which have been UL listed and labeled.

## **PART 2 PRODUCTS**

### **2.01 ELECTRICAL CONNECTIONS MATERIALS**

- A. For each electrical connection indicated, include complete assembly of materials, including but not limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories to complete splices, terminations, and connections.
- B. Comply with requirements in Section 260519 for wires and cables, Section 260533 for raceway systems, and Section 262726 for wiring devices.
- C. Include Final Connections for Equipment Consistent with the Following:
  - 1. Permanently Installed Fixed Equipment: Flexible seal-tite conduit from branch circuit terminal equipment, and raceway to equipment, control cabinet, terminal junction box, and wiring terminals. Totally enclose wiring in raceway.
  - 2. Movable and/or Portable Equipment: Wiring device, cord cap, and multi-conductor cord suitable for equipment and in accordance with NEC requirements.
  - 3. Other methods as required by NEC and as required by special equipment and field conditions.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION OF ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.
- C. Coordinate installation of electrical connections for equipment with installed equipment.
- D. Verify electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, and similar characteristics) for equipment furnished under other divisions, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report variances from electrical characteristics noted on electrical drawings to the A/E before proceeding with rough-in work.
- E. Obtain and review equipment submittals and shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.
- F. Comply with requirements in Section 260553 for identification of electrical power supply conductor terminations.

### **3.02 STARTERS (CONTROLLERS)**

- A. Install non-packaged starters and wiring devices near motors or as indicated on the Drawings. Securely support and anchor in accordance with manufacturer's installation instructions. Locate for proper operational access, including visibility for safety.

### **3.03 PROVISIONS FOR MECHANICAL CONTROLS**

- A. Provide 120 Volt, 20 Amp circuit at locations required and described in Section 230900. Coordinate exact locations prior to installation.
- B. Install power metering equipment at panelboards and switchboards furnished by control system subcontractor at locations required and described in Section 230900.

### 3.04 EQUIPMENT SHORT CIRCUIT CURRENT RATING

- A. All mechanical equipment, packaged systems, control panels, motor starters, motor controllers, variable frequency drives and similar equipment shall carry a Short Circuit Current Rating (SCCR) equal to or greater than the available fault current delivered from the electrical system. Coordinate final available fault currents with the contractors providing this equipment.

### 3.05 MECHANICAL – ELECTRICAL INTERFACE SCHEDULE

- A. Establishing the separation of work between trades and subcontractors is not within scope of these Contract Documents. The following schedule is proposed for assistance in bidding only.
- B. Unless otherwise indicated in the Contract Documents, mechanical equipment and controls are suggested to be furnished, installed, and wired in accordance with the following schedule. Coordinate work with Division 22 and 23 sections.

| Item                                                                                                                                                    | Furnished By: | Installed By: | Power Wiring By: | Control Wiring By: |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|------------------|--------------------|
| 1. Equipment Motors:                                                                                                                                    | M             | M             | E                | M                  |
| 2. Magnetic Motor Starters and Equipment Connections:                                                                                                   |               |               |                  |                    |
| a. Automatically Controlled with or without HOA Switches:                                                                                               | E             | E             | E                | M                  |
| b. Manually Controlled:                                                                                                                                 | E             | E             | E                | E                  |
| c. Furnished with Mechanical Equipment, Factory Mounted:                                                                                                | M             | M             | E                | M                  |
| d. Furnished with Mechanical Equipment, Field Mounted:                                                                                                  | M             | E             | E                | M                  |
| 3. Disconnect Switches and 120 Volt Receptacles per IMC and NEC:                                                                                        | E             | E             | E                | --                 |
| 4. Manual Motor Starters, Thermal Overload Switches:                                                                                                    | E             | E             | E                | --                 |
| 5. Combination Fire/Smoke Dampers, Smoke Dampers:                                                                                                       | M             | M             | E                | E                  |
| 6. Section 230900 Automatic Temperature Controls: Valve and Damper Actuators, Low Voltage Electric Thermostats, Switches, other Miscellaneous Controls: | M             | M             | M                | M                  |
| 7. Electric Radiant Heating Panels, Baseboard Heaters, Cabinet Heaters, Unit Heaters:                                                                   | M             | M             | E                | M                  |
| 8. Electric Duct Heating Coils:                                                                                                                         | M             | M             | E                | M                  |
| 9a. Duct Smoke Detectors:                                                                                                                               | E             | M             | E                | E                  |
| 9b. Relays and Ancillary Devices Associated with HVAC Unit Shutdown by Duct Smoke Detectors:                                                            | E             | E             | E                | E                  |
| 10. Electric Heat Trace:                                                                                                                                | M             | M             | E                | M                  |
| 11. Variable Frequency Drives:                                                                                                                          | M             | M             | E                | M                  |
| 12. Section 230900 Control Panels:                                                                                                                      | M             | M             | E                | M                  |

SECTION 26 05 11  
ELECTRICAL CONNECTIONS FOR EQUIPMENT

M = Division 22 and 23, Plumbing and HVAC  
E = Division 26, Electrical

For purposes of the above table, responsibility of power and control wiring includes raceways, connections and other components as required for complete installation of wiring system.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes total demolition of existing electrical work as indicated in the Contract Documents.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

### **3.01 EXISTING CONDITIONS**

- A. Dust Control: Provide protective measures to minimize transfer of noise, dust, dirt, and refuse to adjacent areas of building. Such measure may include dusttight barriers, temporary walls, portable exhaust fans, vacuum systems, and temporary partitioning.
- B. Extent: Keep areas of demolition as clean and orderly as physically possible. Do not allow demolition debris to accumulate. Gather debris and dispose daily. Broom or vacuum-clean work areas on daily basis.
- C. Protection: Protect existing equipment, furnishing, and systems with protective coverings. Protect finished surfaces including floors, ceilings, and walls.

### **3.02 DAMAGES**

- A. Repairs: Promptly repair damage to existing surfaces, equipment, finishes, or adjacent facilities at no cost to the Owner and to the satisfaction of the A/E and the Owner.

### **3.03 DEMOLITION**

- A. General: Provide demolition work required in existing building for removal of existing electrical equipment, raceways, and conductors and for installation of new electrical equipment, raceways, and conductors. Relocate and modify existing electrical equipment, raceways and conductors as required by general construction alterations and by installation of new electrical equipment, raceways, and conductors in existing building to achieve a complete and functioning installation as defined in the Contract Documents.
- B. Extent: Remove and dispose of existing materials indicated in the Contract Documents to be removed.
- C. Reuse: Do not reuse existing products unless indicated on the Drawings.
- D. Materials to Owner: Deliver items to the Owner's Representative as indicated in the Contract Documents.
- E. Materials to Contractor: Materials other than those reserved by the Owner.

- F. Existing Conditions: Comply with requirements in Division 01. Verify specific demolition work and operating conditions to be encountered from on-site review and coordination with the Owner. Maintain service to existing equipment and devices during new construction work as required by construction sequencing/scheduling provisions. In areas adjacent to new construction work, provide temporary services as necessary to meet these conditions. Protect active conductors encountered. Notify the A/E of utilities encountered whose services are not known.
- G. Repair of Damages to Underground Utilities: Exact location of existing underground utilities is not definitely known. Should any underground utilities be damaged in excavations, restore such utilities without additional cost to the Owner.
- H. Drilling of Concrete: Drill openings through existing concrete with diamond tipped rotary core-drilling equipment or carbide tipped drills.
- I. Saw-Cutting of Concrete: Saw cut through existing concrete with diamond tipped or carbide tipped saw blade.
- J. Outlet Boxes: Cover existing to remain outlet boxes in walls or ceilings as follows:
  - 1. Existing with mud ring: Provide blank stainless steel cover plate large enough to cover mud ring
  - 2. Existing without mud ring: Provide flat mud ring and blank stainless steel cover plate to ensure there are no holes or gaps between the box and the finish surface. Where gaps occur provide the following:
    - a. Small gaps between outlet box and finished surface:
      - 1) Provide an oversized cover plate
    - b. Large gaps between outlet box and finished surface:
      - 1) Provide patching and painting in accordance with Division 09 specifications.
      - 2) Provide an oversized cover plate

#### **3.04 DISPOSAL OF DEMOLISHED MATERIALS**

- A. Disposal: Remove debris, rubbish, and other materials resulting from demolition operations from building site unless reinstalled or delivered to the Owner as indicated in the Contract Documents. Transport and legally dispose of material off site.
- B. Burning: Burning of removed materials is not permitted on project site.

#### **3.05 CLEAN-UP AND REPAIR**

- A. Clean-Up: Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protection and leave interior areas clean.
- B. Repair: Repair demolition performed in excess of that required at no additional cost to Owner. Return structures and surfaces to conditions existing prior to commencement of demolition work or as directed by the Owner.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes wire, cable, splices, and terminations for systems 600 Volts and less and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. NFPA 70, National Electrical Code (NEC).
  - 2. UL 83, Thermoplastic-Insulated Wires and Cables.
  - 3. UL 62275, Cable Ties for Electrical Installations
- C. Comply with NEC as applicable to construction and installation of electrical wire and cable. Electrical wire and cable UL listed and labeled.
- D. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of wire and cable.
- E. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of wire and cable.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for each type of wire, cable, and appurtenance.
- C. Test Reports:
  - 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

## **PART 2 PRODUCTS**

### **2.01 POWER AND LIGHTING CIRCUITS**

- A. Factory-fabricated conductors of sizes, ratings, materials and types indicated on the Drawings for each service. Where not indicated, select to comply with project's installation requirements and NEC standards. Comply with the following:
  - 1. UL 83.
  - 2. Copper Conductor - Stranded.
  - 3. Note: THWN-2 or XHHW-2 have the same temperature ratings and capacity. Leave both if you want to allow the contractor to choose between the two. If you have GFCI circuit breakers it is recommended XHHW-2 be used to help limit the potential for ghost tripping on the circuits.
  - 4. Insulation type THHN/THWN-2 dual rated, 600 Volt for circuits from 115 to 600 Volts.
  - 5. Use only 90 C insulated conductors based on 75 C ampacity tables of the NEC.

## **2.02 CONTROL AND SIGNAL CIRCUITS**

- A. Class 1:
  - 1. UL 83.
  - 2. Stranded copper conductor.
  - 3. Insulation type THHN, or THWN, 600 Volt for circuits from 115 to 600 Volts.
- B. Class 2 and 3:
  - 1. Copper conductor, 300 Volt insulation, rated 75 C in dry locations and 60 C in wet locations. Individual conductors twisted together and covered with non-metallic jacket unless otherwise noted on the Drawings.
  - 2. UL listed for use in air handling ducts and hollow spaces used as ducts and plenums.
  - 3. Category UTP cabling for electrical control systems:
    - a. Cable type per system manufacturer and shop drawings.
    - b. Comply with the most current technical characteristics of TIA-568-C standard.
    - c. Comply with NFPA 262 CMP (plenum) rated, unless otherwise noted.

## **2.03 PLASTIC CABLE TIES**

- A. Teflon or nylon, locking type

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### **3.04 WIRING AND CABLE INSTALLATION, GENERAL**

- A. Install electric conductors and cables as indicated on the Contract Drawings, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation," and in accordance with recognized industry practices.
- B. Coordinate installation work with electrical raceway and equipment installation work for proper interface.

- C. Pull cables by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device made through approved swivel connection. Non-metallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop to which pull wire can be attached. Remove insulation from conductors before forming loop. Larger sizes of cable may be pulled by using basket weave pulling grip, if pulling force does not exceed limits recommended by manufacturer. If pulling more than one cable, bind them together with friction tape before applying grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.
- D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to conductors limited to 0.008 lbs. per circular mil of conductor cross-section area.
- E. Pull in cable from end having the sharpest bend (bend closest to reel). Keep pulling tension to minimum by liberal use of lubricant, turning of reel, and slack feeding of cable into duct entrance. Employ not less than one person at reel and one in vault during this operation.
- F. For training of cables: provide 12 times cable diameter minimum bend radius to inner surface of cable.
- G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50 percent greater than specified above for training.
- H. Apply wire and cable pulling compound recommended by specific cable manufacturer.
- I. Seal cable ends unless splicing is done immediately.
- J. Support cables in vaults, concrete trenches, and similar locations by cable racks. Secure to rack insulators with nylon cord or self-locking nylon cable ties. Place each cable on separate insulator.
- K. Follow manufacturer's instructions for splicing and cable terminations.
- L. Provide separate neutral conductor for each circuit serving single phase loads, unless indicated otherwise on the Contract Drawings. Where shared neutrals are indicated for multi-wire branch circuits, provide circuit breaker handle ties per Section 262813.
- M. Branch circuit wiring:
  - 1. Group in separate raceways as indicated on the Contract Drawings. Where branch circuit raceways are not indicated on Contract Drawings, a maximum of three circuits may be installed in the same raceway if each circuit originates from the same panelboard.
  - 2. GFCI Circuit Breakers: XHHW-2 insulation

### **3.05 WIRING METHODS, GENERAL**

- A. Install wiring in raceways unless indicated otherwise on the Contract Drawings or authorized by the A/E.
- B. Install Wire After:
  - 1. Interior of building is protected from weather.
  - 2. Mechanical work likely to injure conductors is completed.
  - 3. Conduits have been cleaned and moisture removed.
- C. Neatly train and lace wiring inside boxes, equipment, and panel boards.
- D. Clean raceway system before installing conductors.
- E. Use half-lapped synthetic tape if taping is utilized for insulation purposes.
- F. Provide conductor support devices as required by NEC in vertical conduit runs.

- G. Torque conductor connections and terminations to manufacturer's recommended values.
- H. Maintain minimum 12-inch clearance between open cabling and heat sources such as flues, steam pipes, and heating appliances.

### **3.06 MINIMUM SIZES**

- A. Minimum No. 12 AWG for power and lighting circuits.
- B. Minimum No. 14 AWG for control wiring.
- C. Review lengths/loads and minimum sizes per project to confirm these minimums are acceptable
- D. Power and lighting circuits with home run lengths greater than 100 feet. No. 10 AWG minimum.
- E. Power and lighting circuits with home run lengths greater than 150 feet. No. 8 AWG minimum
- F. Review lengths/loads and minimum sizes per project to confirm these minimums are acceptable

### **3.07 CLASS 2 AND 3 CABLE INSTALLATION**

- A. Class 2 and 3 Cable: Install using open cabling support methods at indoor locations where allowed by codes, and where raceways are not required per Contract Drawings or for protection of cabling

### **3.08 OPEN CABLING INSTALLATION**

- A. Class 2 and 3 cabling: run exposed as "open cabling" above accessible ceilings, accessible ceiling plenums and where exposed in unfinished spaces, unless otherwise noted. Install class 2 and 3 cabling in raceway above hard ceilings, where exposed in finished spaces and where subject to damage.
- B. Provide all hanger supports and cable supports for cabling specified by Division 26, 27 and 28. All support structures adhere to the requirements in the National Electrical Code. Comply with requirements in Section 260529 Supporting Devices.
- C. Install cable bundles horizontal with a maximum deflection of two inches from the bottom of the cable support.
- D. Provide additional cable management products to protect exposed cabling and complete the installation of cabling in a neat professional manner.
- E. Maintain 12" clear from mechanical equipment and ductwork, fire protection piping and electrical raceways systems. Where limited space exists for cable routing, cables may cross ducts, piping and conduit systems perpendicular with minimum 4" separation. Maintain separation from all mechanical and electrical equipment, ductwork, piping, conduit, clearance spaces and structure.
- F. Maintain proper bend radius of cabling bundles and supports changing pathway direction as to not impact the physical jacket construction of the cabling. Replace cabling that becomes damaged during this transition in its entirety.
- G. Follow manufacturer's recommendations for quantity of cables supported in J-hooks and adjustable cable supports. Comply with requirements in Section 260529 Supporting Devices.
- H. Observe the applicable requirements and recommended good practices contained within TIA-568-C standard for cabling installation requirements.
- I. Protect exposed cables where subject to damage. Provide conduit sleeves with bushings at all wall, ceiling and floor penetrations.

### 3.09 WIRING SPLICES AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Splices and Taps:  
Review with Owner if spring clamp connectors ("Wago" connectors) are acceptable. Typically design/build or prefab use.
  - 1. No. 10 AWG and smaller: Compression-set pressure connectors with insulating covers or screw-on pressure (wire nuts).
  - 2. No. 8 AWG and larger: Compression-set pressure connectors with insulating covers. Split bolt splices and connectors not acceptable.
- C. Terminations: Eye-type compression lug when termination is to a bolt or screw terminal.
  - 1. 250 kcmil and larger, two-hole long barrel compression lugs.
  - 2. Smaller than 250 kcmil: Single hole compression lug.
- D. Tape un-insulated portions of conductor and connectors with electrical tape to 150 percent of conductor insulation value.
- E. Clean wires before installing lugs and connectors.
- F. Make splices, taps, and terminations to carry full capacity of conductors without perceptible temperature rise.
- G. Leave minimum 8 inches of pigtail at outlet boxes for connection to fixtures and devices. Where wiring is continued to other outlets, splice connection wire in a tap. In no case will continuity through double terminal of device be allowed for either hot or neutral leg of circuit.
- H. Insulate ends of spare conductors with electrical tape or wire nut.
- I. Terminate control circuit conductors at terminal blocks only.
- J. Utilize eye or forked tongue type compression set terminator for conductors No. 12 AWG and smaller when termination is to a bolted or screw set type terminal block or terminal cabinet.
- K. Make below grade splices in handholes and vaults watertight with epoxy resin type splicing kits similar to Scotchcast.

### 3.10 FIELD QUALITY CONTROL

- A. Test for Wires and Cables in accordance with Section 260810.
- B. Test Category 5e UTP cabling as follows:
  - 1. Horizontal cabling: certified to meet or exceed the permanent link performance specifications for Category 5e horizontal cabling tested with a frequency range from 1MHz to 100 MHz as defined in TIA-568-C.
  - 2. Certifications include the following parameters for each pair of each cable installed:
    - a. Building System
    - b. Cable identification between system devices
    - c. Date of test
    - d. Test equipment manufacturer and model number
    - e. Wire map
      - 1) Continuity to the remote end.
      - 2) Shorts between any two or more conductors
      - 3) Reversed pairs
      - 4) Split pairs

- 5) Transposed pairs
- 6) Any other miswiring
- f. Length
- g. Near-end crosstalk (NEXT)
- h. Power sum-near-end crosstalk (PS-NEXT)
- i. Return loss (RL)
- j. Propagation delay (PD)
- k. Delay skew (DS)
- 3. Test horizontal cabling using a Permanent Link configuration as defined in TIA-568-C.
- 4. Document test reports with an asterisk (\*) or fails, identifying the reason for the test failure and a corrective action plan developed.
- 5. Re-test the permanent link after corrective action has been completed,.
- 6. Ensure 100 percent of the horizontal cabling system links pass all tests.
- C. Organize test results by building system type and cable identification number. Provide test results including the date and time of when each test was saved in the memory of the tester. Record test results in both PDF and manufacturer software formats and provide in the O&M manuals.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes grounding and bonding systems, equipment, and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. IEEE C2, National Electrical Safety Code (NESC).
  - 2. IEEE 81, Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System Part 2: Normal Measurements.
  - 3. IEEE 837, Standard for Qualifying Permanent Connections Used in Substation Grounding
  - 4. NFPA 70, National Electrical Code (NEC).
  - 5. NFPA 780, Standard for the Installation of Lightning Protection Systems
  - 6. UL 467, Standard for Grounding and Bonding Equipment.
  - 7. UL486A-486B, Wire Connectors
  - 8. ANSI C119.4, Electric connectors - connectors to use between Aluminum-to-aluminum or aluminum-to-copper conductors
- C. Comply with NEC and IEEE requirements as applicable to electrical grounding and ground fault protection systems.
- D. Products UL listed and labeled.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for each item and appurtenance.
- C. Shop Drawings: Plans showing dimensioned location of grounding system features, including ground rods, ground rings, test wells, grounding electrode system connections, and routing of grounding electrode conductors.
- D. Test Reports:
  - 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

## **PART 2 PRODUCTS**

### **2.01 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### **2.02 GROUNDING ELECTRODES AND CONDUCTORS**

- A. Ground Rods: Copper clad steel, 3/4 inch diameter by 10 foot long. Copper-Weld Erico, Burndy, Harger, Thomas & Betts or approved.

- B. Bare Ground Conductors: Soft drawn copper. Stranded unless indicated otherwise. Tinned where indicated. Solid for No. 8AWG and smaller. Stranded conductors for No. 6 AWG and larger.
- C. Insulated Ground Conductors: Copper with 600 Volt insulation in accordance with Section 260519.
- D. Ground Bars: Predrilled rectangular bars of annealed copper, 1/4" inch by 4 inches with holes spaced 1-1/8 inches apart to accommodate lug connections. Length 18 inches unless indicated otherwise. Standoff insulators for wall-mounting.

### **2.03 GROUND CONNECTORS**

- A. Listed and labeled for applications and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connections: Exothermic-welding kits of type recommended by kit manufacturer for materials being joined and installation conditions. Manufacturer: Cadweld, Thermoweld, Thomas & Betts, or approved.
- C. Compression Ground Connectors: Conform to IEEE 837 and UL 467.
  - 1. Cable-to-Cable Connections: Copper or copper alloy. Approved for direct burial or in concrete applications. Manufacturer: Thomas & Betts EZ-Ground® or approved.
  - 2. Cable-to-Busbar Connections: Two-hole long barrel compression lug, unless indicated otherwise on Contract Drawings.
  - 3. Cable-to-Cable Tray Connections: Two-hole long barrel compression lug.
- D. Mechanical Ground Connectors: Conform to IEEE 837 and UL 467.
  - 1. Cable-to-Water Piping Connections: Two-piece silicon bronze with stainless steel bolts. Listed for direct bury.
  - 2. Split-Bolt Connectors: Not acceptable.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.
- C. Preparation of Surfaces: Clean contacting surfaces of ground connections to bright metal before connecting.

### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.
- B. System ground not to exceed maximum 5 ohms meggered resistance.
- C. Ground each separately-derived system neutral to nearest building steel.

- D. Bond together system neutrals, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, underground metal water piping systems, and gas piping systems.

### **3.04 GROUNDING ELECTRODE AND CONDUCTOR INSTALLATION**

- A. Equipment Ground Conductor: Install separate, insulated equipment ground conductor in each feeder and branch circuit. Terminate each end on grounding lug, bus, and bushing and to intermediate metallic enclosures.
- B. Isolated Ground Conductor: For isolated ground branch circuits and feeders, install insulated isolated ground conductor. Isolated ground conductor is in addition to equipment ground conductor. Terminate each end on isolated ground bus.
- C. Connect grounding conductors to motors in accordance with NEC. Remove paint, dirt, and other surface coverings at grounding conductor connection points so that good metal-to-metal contact is made.
- D. Bare Grounding Conductors Below Grade:
  - 1. Minimum 30 inches below grade.
  - 2. Not in contact with gravel fill or concrete. Provide Schedule 40 PVC sleeve where routing through concrete.
  - 3. Train neatly around foundations and footings.
- E. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4/0 AWG. Bond to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- F. Size main grounding system per NEC. Provide conduit to protect ground wire from damage to an area 6 feet above floor.
- G. Conductor to Conductors, Conductor to Steel, and Conductor to Ground Rod: Exothermic-welded type connectors. Cadweld, Thermoweld, Thomas & Betts, or approved.
- H. When making bolted connection to aluminum and galvanized structures, apply corrosion-inhibitor to contact surfaces between cable, connector, and surface of structure. Penetrox A or approved.
- I. Ground Bars: Install where indicated on Contract Drawings. Install horizontally at 12 inches above finished floor, unless indicated otherwise.

### **3.05 GROUND CONNECTORS**

- A. Welded Connections:
  - 1. Provide for underground connections.
  - 2. Provide for connections to structural steel.
  - 3. Provide for connections to ground bars where indicated.
  - 4. Provide full weld between coupling and ground rod at joint.
  - 5. Connect grounding conductors to ground rods at upper end of rod with end of rod and connection point below finished grade, except provide bolted connections at test wells and as otherwise indicated.

6. When making connections, wire brush or file point of contact to bare metal surface. Use welding cartridges and molds in accordance with manufacturer's recommendations. After welds have been made and cooled, brush slag from the weld area and clean joint. Use connectors of specified size for conductors and ground rods. Notify A/E before backfilling ground connections.
- B. Ground shields of shielded power and control cable at each splice and termination as recommended by manufacturer.
- C. Ground metal sheathing and exposed vertical metal structural elements of building. Ground metal fences enclosing electrical equipment. Bond metal equipment platforms which support electrical equipment to equipment ground. Provide electrical contact between metal frames and railings supporting pushbutton stations, receptacles, instrument cabinets, raceways, and similar items carrying circuits to these devices.

### **3.06 FIELD QUALITY CONTROL**

- A. Comply with requirements in Section 260810.
- B. Testing agency, approved by the Owner and the A/E, shall perform ground resistance testing of system. Perform test by means of fall-of-potential method. Maximum acceptable value 5 ohms.
  1. Testing Instrument: Battery-powered or hand-cranked AC tester.
    - a. Indicates ground resistance in ohms from digital decade switches when unit's self-contained meter indicates null condition.
    - b. Range: 0.01 to 9990 ohms in 4 overlapping ranges.
    - c. Null condition occurs when no current flows through potential electrodes.
    - d. Instrument accuracy: Plus 2 percent or greater.
  2. Fall-of-Potential Test:
    - a. Connect instrument according to manufacturer's instruction.
    - b. Place rod P2 at various locations in line between tested electrode and probe C2 and plot results on graph (distance vs. resistance). Take sufficient readings to yield portion of plotted curve as being constant (rate of resistance change becomes so small with respect to distance as to be insignificant).
  3. Conduct 2 separate tests on opposite sides of grounding grid.
  4. Report failure to obtain specified ground resistance to the A/E.
- C. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- D. Include field test reports of grounding system in the Operation and Maintenance Manual.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes conduit and equipment supports, fastening hardware, and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data, rated capacities and accessories for each item and appurtenance.

## **PART 2 PRODUCTS**

### **2.01 MATERIAL**

- A. General: Built-up framing for electrical raceway and equipment supporting systems, including but not limited to channel, rod, clamps, and hardware. Comply with requirements in Section 260548 for seismic restraints. Unless design is shown on the Drawings, size for 400 percent of calculated load.
- B. Channel: 12 gauge galvanized formed metal with or without pre-drilled holes, Pre-galvanized. Cooper B-Line, Unistrut, Powerstrut, or approved.
- C. Beam Clamps, in Pairs, at each Supporting (Structural) Beam: B-line B441-22 and B441-22A; Superstrut U-501 and U-502; Unistrut P2785, P2786, and P1379S, or approved. Submit other manufacturers for approval with evidence proving clamp complies with IBC and ASCE 7-05 for seismic requirements. Submitted proof can consist of letter signed and stamped by a professional engineer licensed in engineering in the state in which the Work is performed.
- D. Beam Clamps for Use with Rods: B-Line B751-J4, B751-J6, B751-J9, and B751-J12; Superstrut U-569; Unistrut P2824-6, P2824-9, and P2824-12, or approved. Submit other manufacturers for approval with evidence proving clamp complies with seismic requirements. Submitted proof can consist of letter signed and stamped by a professional engineer licensed in engineering in the state in which the Work is performed.
- E. Fittings for Attaching Channel-to-Channel for Built-Up Framing: Unistrut P6028, P6033, P6069, P6290, P6291, P6326, P6331, P6332, P6346, P6358A, P6359, P6381, P6382, P6726A, P6917, P6962, or approved.
- F. Connectors for Bracing: Unistrut P6186, P7097, P7098, P7100, P7101, P7108, P7109, P7110, P6546, or approved.
- G. Hardware, including Nuts (Locking Type), Bolts, and Set Screws: Corrosion resistant, designed for intended use.
- H. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

- I. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
- J. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58
- K. Hanger Rods: Threaded steel
- L. Spring Steel Conduit Clips: Erico K series or approved.
- M. MC Cable Support Brackets: Erico MCS Series or approved.
- N. Circular Cable Retainer:
  - 1. Cable retainers shall be of plastic material with rounded edges, plenum rated, utilizing an easy-lock closure and an attachment base. Cable retainers shall be screwed into structure and only be utilized in spaces that are extremely tight and J-hooks do not have sufficient space to be mounted.
    - a. Manufacturer: Erico Caddy, Part No. CAT CR50
- O. J-Hooks:
  - 1. J-hooks shall have a galvanized finish with rounded edges for smoother cable pull and greater corrosion resistance.
    - a. Manufacturer: Erico Caddy or approved:
      - 1) 1" Dia., Part No. CAT16HP
      - 2) 1-5/16" Dia., Part No. CAT21HP
      - 3) 2" Dia., Part No. CAT32HP
      - 4) Note: The paragraph below is intended for use when you have 100+ cables in a bundle
- P. Adjustable Cable Support:
  - 1. Adjustable cable supports shall be of steel and polyethylene, plenum rated, with unlocking and locking bar allowing additional cables to be added easily after installation.
    - a. Manufacturer: Erico Caddy, Part No. CAT425
- Q. Outlet Box Support:
  - 1. Where more than one outlet box is shown on the Contract Drawings, and indicated to be at same elevation, align them exactly on center lines horizontally with wall mounting bracket.
    - a. Manufacturer: Cooper B-Line Series BB8 or approved:

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

#### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### 3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### 3.04 SUPPORTING DEVICES INSTALLATION

- A. Comply with requirements in Section 260548 for seismic restraints.
1. Install diagonal bracing for trapeze support systems at 2 right angle planes to brace against:
    - a. Horizontal and torsional movement lateral seismic forces.
    - b. Vertical (uplift) movement caused by vertical seismic forces.
    - c. Horizontal distortions in conduit system caused by wire pulling.
- B. Unless otherwise shown on the Contract Drawings, attach connectors to vertical framing members with 2 bolts
- C. Install toggle bolts or hollow wall fasteners in hollow masonry, plaster, and gypsum board partitions and walls. Install expansion anchors or preset inserts in solid masonry walls, self-drilling anchors, and expansion anchors on concrete surfaces. Comply with requirements in Section 260548 for seismic anchors.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated:
1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.
  3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.
  5. To Steel: Beam clamps MSS SP-58, Type 19 or 23, complying with MSS SP-69.
  6. To Light Steel: Sheet metal screws.
  7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements
- E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under nuts.
- F. Free Standing Electrical Equipment: Bolt to concrete base with leveling channels. Comply with requirements in Section 260510 for concrete base and Section 260548 for seismic restraints.
- G. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- H. Transformer Support: Comply with requirements in Section 262200.
- I. Lighting Fixture Supports: Fixture support wires for recessed ceilings, match ceiling support requirements. All fixture supports to comply with requirements in Section 265100 and Section 260548.
- J. Open Cabling Support Installation
1. Provide hanger supports and cable supports for cabling specified in Division 26. All support structures shall adhere to the requirements in the National Electrical Code.
  2. Space cabling supports no further than 4'-0" apart.

3. Install cabling supports on their own dedicated support system.
- K. Raceways:
1. Single raceway runs: Spacing to comply with requirements of Section 260533
    - a. Suspended: support by threaded rod with spring steel conduit clips. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings
    - b. Mounted to building structure: double hole pipe straps.
  2. Two or more parallel runs of raceway: Install trapeze support systems with 25 percent space (6 inches minimum) for future conduit runs. Refer to Section 260533 for spacing requirements.
  3. Welding conduit and conduit fittings to structure not acceptable.
  4. Spacing: Space so that fittings are accessible to accommodate pulling or splicing.
- L. MC Cable:
1. Single cable runs mounted to building structure with single hole straps specifically designed for MC cabling. Spacing shall comply with requirements of Section 260521.
  2. Where two or more cables runs are routed in parallel, mount to building structure with MC Cable brackets. Spacing shall comply with requirements of Section 260521.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes conduit, electrical metallic tubing, wireway, surface metal raceway, and associated appurtenances within building perimeter.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.
- C. Refer to Section 260543 underground electrical work beyond building perimeter.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county and state codes and ordinances. Comply with local Utility requirements and standards.
- B. Codes and Standards:
  - 1. UL 1, Standard for Flexible Metal Conduit.
  - 2. UL 5, Standard for Surface Metal Raceways and Fittings.
  - 3. UL 6, Standard for Rigid Metal Conduit.
  - 4. UL 360, Standard for Liquid-Tight Flexible Metal Conduit.
  - 5. UL 514B, Standard for Conduit, Tubing, and Cable Fittings.
  - 6. UL 651, Standard for Schedule 40 and 80 Rigid PVC Conduit.
  - 7. UL 651A, Standard for Type EB and A Rigid PVC Conduit and HDPE Conduit.
  - 8. UL 797, Standard for Metallic Tubing – Steel.
  - 9. UL 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
  - 10. UL 1242, Standard for Intermediate Metal Conduit – Steel.
  - 11. UL 2420, Standard for RTRC Conduit and Fittings for underground – Fiberglass
  - 12. UL 2515, Standard for RTRC Conduit and Fittings for above ground - Fiberglass
- C. NEC Compliance: Comply with applicable portions of NEC as to type of products used and installation of electrical power connections.
- D. Comply with applicable NEMA standards and refer to NEMA standards for definitions of terminology herein. Comply with NEC for workmanship and installation requirements of raceway systems.
- E. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes specified and whose products have been in satisfactory use in similar service for not less than 3 years.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for each type of raceway system and appurtenance.

## **PART 2 PRODUCTS**

### **2.01 RIGID METAL CONDUIT (RMC) AND FITTINGS**

- A. Ferrous Metal Conduit: Steel, UL 6, hot-dip galvanized.
- B. Fittings and Conduit Bodies: UL 514B, threaded galvanized.

**2.02 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS**

- A. Ferrous Metal Conduit: Steel, UL 1242, hot-dip galvanized.
- B. Fittings and Conduit Bodies: UL 514B, threaded galvanized.

**2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**

- A. Ferrous Metal Conduit: Steel, UL 797, hot-dip galvanized.
- B. Fittings: UL 514B, galvanized steel, insulated throat, rain tight compression ring type through 1-1/4 inch, set screw type for 1-1/2 inch and larger. Drive-on type and cast fittings not acceptable.

**2.04 FLEXIBLE METAL CONDUIT AND FITTINGS**

- A. Ferrous Metal Conduit: Steel, UL 1, galvanized. UL listed for grounding as available. Aluminum and flexible metallic tubing not acceptable.
- B. Fittings: Insulated throat, UL 514B, galvanized steel, UL listed for grounding as available.

**2.05 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS**

- A. Ferrous Metal Conduit: Galvanized with PVC weatherproof cover, UL 360 listed for grounding as available.
- B. Fittings: Insulated throat, UL 514B, galvanized steel, UL listed for grounding as available.

**2.06 RIGID NON-METALLIC CONDUIT**

- A. PVC Conduit: Schedule 40, UL 651, rigid type unless noted otherwise. UL 651A Type A permitted for underground concrete duct banks.
- B. Fittings: UL 651, UL 651A, UL 2420 and UL 2515.
  - 1. For electric (power) duct, 90 degree elbows with minimum 48 inch radius, factory manufactured rigid steel or Fiberglass (RTRC) with minimum 48 inch
  - 2. For telecommunications service provider ducts, 90 degree elbows with minimum 48 inch radius, factory manufactured rigid steel or Fiberglass (RTRC)
  - 3. For telecommunications on-site distribution ducts, 90 degree elbows with minimum 36 inch radius factory manufactured rigid steel (RMC)

**2.07 SURFACE METAL RACEWAY**

- A. UL 5, sheet metal channel with fitted cover. Type and size as shown on the Drawings.
- B. Finish: Enamel. Field paint to match wall color.
- C. Fittings, Boxes, and Extension Rings: Designed for use with raceway systems.
- D. All raceway and fittings to be supplied by one manufacturer.
- E. Manufacturers: Mono-Systems, Wiremold, or approved.

**2.08 CONDUIT BODIES**

- A. Conduit bodies cast malleable iron, zinc or cadmium plated with threaded connections. Covers gasketed, blank steel, or cast malleable iron, zinc or cadmium plated, and of same manufacturer as conduit body. Where conduit bodies are used as junction or splice boxes, comply with NEC.

- B. Conduit bodies (Smart LB) for telecommunications cables shall be die cast aluminum, gray powder coat paint finish, threaded connections with internal built-in radius. Covers gasketed, die cast aluminum, and of same manufacturer as conduit body. Madison Electric or approved equal.
  - 1. 1-1/4" Smart LB, Madison Electric, KLB120
  - 2. 2-1/2" Smart LB, Madison Electric, KLB 250
  - 3. 4" Smart LB, Madison Electric, KLB400

## **2.09 WIREWAY AND AUXILIARY GUTTER**

- A. UL 870, lay-in type, with hinged cover but without knockouts.
- B. Size: As shown on the Drawings, 4 by 4 inch minimum.
- C. Finish: Rust-inhibiting primer coat with manufacturer's standard enamel finish.

## **2.10 EXPANSION FITTINGS**

- A. Malleable iron, hot-dip galvanized allowing 4 inches (plus or minus 2 inches) conduit movement.
  - 1. RGC and IMC Raceway: OZ/Gedney Type AX series, Thomas and Betts Type EJJ series or approved
  - 2. EMT Raceway: OZ/Gedney Type TX series, Thomas and Betts Type XJJ series or approved.

## **2.11 SEALING FITTINGS**

- A. Wall Sealing Fittings: At each wall sealing fitting, include conduit seal fitting, OZ/Gedney FSK Series or approved.
- B. Raceway Stubups and Stubouts: Conduit seals together with wall sealing fittings. OZ/Gedney CSB Series or approved.
- C. For Exterior Wall Penetrations below Grade: Include sealing bushing at interior end of penetrating raceway. Only threaded fittings are permitted in entering raceways ahead of sealing bushing. OZ/Gedney Type CSB or approved.

## **2.12 CONDUIT SUPPORTS**

- A. Conduit Clamps, Straps, and Supports: Steel or malleable iron. Comply with requirements in Section 260529.

## **2.13 FIRE RATED SEALING COMPOUND**

- A. Dow Corning 3-548 Silicone RTV Foam or approved.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### 3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### 3.04 RACEWAY SIZING, ARRANGEMENT, AND SUPPORT

- A. Unless otherwise shown on the Drawings, size conduit for conductor type installed. Minimum size 3/4 inch.
- B. Install conduit to maintain headroom and present neat appearance in unfinished spaces. Install a minimum of 9'-6" above finished floor in spaces unless otherwise indicated on the Contract Drawings.
- C. Install conduit concealed in walls, below floors, and above ceiling in spaces, except conduit may be exposed in mechanical rooms, electrical rooms, and similar unfinished spaces. Horizontal conduit installation is not allowed in floor slab unless specifically noted on electrical and structural drawings.
- D. Route conduit parallel and perpendicular to building planes.
- E. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, steam pipes, heating and hot water pipes, and heating appliances.
- F. Brace conduit or conduit supports to prevent distortion of alignment by wire-pulling operations.
- G. Where conduit is run in parallel, group on formed channel supports. Comply with requirements in Section 260529.
- H. Do not fasten or support with wire or perforated pipe straps. Remove temporary conduit supports used during construction before conductors are pulled.
- I. Raceway to be routed around structural members. Structural Engineer to approve proposed modifications of structural elements prior to commencement of work.

### 3.05 RACEWAY INSTALLATION

- A. Cut conduit square using a saw or pipe cutter. Deburr cut ends.
- B. Bring conduit to shoulder of fittings and couplings and tighten securely.
- C. Use conduit hubs for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Do not use conduit bodies to make sharp changes in direction unless shown on the Drawings.
- E. Use hydraulic one-shot conduit bender or factory elbows for bends in 2 inch conduit and larger.
- F. Provide plastic bushings on conduit stubs used for transition from conduit to open cable runs.
- G. During construction, use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- H. Distance Between Supports:
  - 1. Threaded Rigid Metal Raceways: Maximum ten foot centers and within 18 inches of each outlet, junction box, and bend.
  - 2. Electrical Metallic Tubing: Maximum ten foot centers at each bend and within 12 inches of each outlet, junction box, and coupling.
  - 3. Surface Metal Raceway, Auxiliary Gutter, and Wireway: Maximum 5 foot centers or in accordance with manufacturer's instruction, whichever is less, unless otherwise shown on the Drawings.

- I. Provide polyester mule tape with printed footage indicators secured at each end of each empty conduit, except sleeves and nipples. Identify with tags at each end indicating origin and destination of empty conduit. Minimum tensile strength of 1250 pounds for conduits 2-inch and smaller and 2500 pounds for conduits larger than 2-inch.
- J. Route conduit through roof inside openings for ductwork where possible. Otherwise, install through roof jack and seal weather tight.
- K. Install no more than equivalent or four 90 degree bends between boxes.
- L. Avoid moisture traps where possible. Where unavoidable, install junction box with drain fitting at conduit low point.
- M. Raceway Installation below Slab on Grade:
  - 1. Installed a minimum of 2 inches below bottom of slab.
  - 2. Arrange and slope raceway to drain away from building.
  - 3. Install insulated grounding bushings at conduits stubbed up or out from underground unless capped for future (spare).
  - 4. Wipe PVC conduit clean and dry before jointing. Apply full even coat of cement to entire area to be inserted into fitting. Let joint cure for minimum 20 minutes.
  - 5. Install conduit that stub up through floor at such depth that exposed conduit is vertical and no curved section of elbow is visible.
- N. Sealing of Conduit Penetrations:
  - 1. Exterior Wall Surfaces Above Grade: Seal around penetrations with caulking approved by the A/E. For concrete construction above ground level, cast conduit in wall or core drill wall and hard pack with mixture of equal parts of sand and cement.
  - 2. Exterior Wall Surfaces Below Grade: Cast conduit into wall (and floor) or use manufactured seal assembly cast in place.
  - 3. Roofs: Install mopped and flashing roof jack and where conduit penetrates roof membrane.
  - 4. Fire Rated Construction: Seal penetrations with fire rated sealing compound to maintain fire rating of construction penetrated.
- O. Sealing of Raceways: Seal interior of raceways that pass through building roof and through outside walls of building, above or below grade. Seal on end inside building. Use raceway sealing fittings manufactured for purpose sealed with non-hardening, compound-type mastic, specially designed for such service. Pack around wires in raceways.
- P. Raceways on exterior surface of building: install only when shown on the Drawings and as approved by the A/E.
- Q. Where flexible metal or liquid tight flexible metal conduit is installed, install bonding conductor to insure electrical continuity of raceway. Route bonding jumper inside conduit and terminate at grounding bushing or grounding locknut installed on inside of junction boxes at each side of flexible section. In instances where this method is not feasible (such as when cast boxes with hubs are used or where required by the NEC, route bonding jumper on outside of flexible conduit and terminate in accordance with methods acceptable to the AHJ.
- R. Raceway shall not penetrate sheet metal ducts.
- S. Branch circuits: install overhead, except circuits serving floorboxes, outdoor circuits or unless indicated otherwise on the Contract Documents.
- T. Support raceways below roof decking: provide minimum 1-1/2" separation from raceway surface to nearest surface of metal roof decking.

- U. Spare Raceways: Install 6 spare 3/4 inch conduits (capped) from each recessed/flush mounted branch panelboard into ceiling space or mechanical platform if one exists. Extend conduits required distance necessary to reach accessible ceiling space.
- V. In finished areas with exposed structure, subject to the approval of the A/E, raceways may be installed exposed. Install raceways as high as possible, provide minimum 1-1/2" separation from raceway surface to nearest surface of metal roof decking, and neatly arranged. Submit shop drawing indicating routing of proposed surface raceways and boxes in finished areas.
- W. Service Entrance Feeders: Where raceway for service entrance, install conduit under ground level slab or in 2 inch thick concrete encasement. Coordinate concrete encasement installation with A/E prior to installation to avoid conflicts with other disciplines. Comply with NEC requirements.

### **3.06 SURFACE METAL RACEWAY INSTALLATION**

- A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
- B. Install insulating bushings and inserts at connections to outlets and corner fittings.
- C. Maintain grounding continuity between raceway components for continuous grounding path.
- D. Fastener Option: Use manufacturer's standard clips and straps for installed purpose.

### **3.07 AUXILIARY GUTTER INSTALLATION**

- A. Bolt auxiliary gutter to steel channels fastened to wall or in self-supporting structure. Install level.
- B. Gasket each joint in oil-tight gutter.
- C. Mount rain tight gutter in horizontal position only.

### **3.08 RACEWAY SCHEDULE**

- A. Rigid Metal Conduit:
  - 1. Acceptable in all locations except as modified in this section.
  - 2. Where in contact with earth or concrete, install protective coating consisting of spirally wrapped 20 mil PVC tape with 1/2 inch minimum overlap – 3M Scotchrap Tape 51 or approved - or utilize PVC Coated Rigid Metal Conduit. Completely wrap and tape field joints.
- B. PVC Coated Rigid Metal Conduit:
  - 1. Required in corrosive environments or where indicated on the Contract Drawings.
- C. Intermediate Metal Conduit:
  - 1. May be used in lieu of rigid metal conduit unless otherwise prohibited by code or indicated on the Contract Drawings.
  - 2. Not acceptable for circuits over 600 Volts.
- D. Electrical Metallic Tubing:
  - 1. Acceptable for dry interior locations where not exposed to moisture or physical damage.
  - 2. Not acceptable for circuits over 600 Volts.
- E. Rigid Non-Metallic Conduit:
  - 1. Acceptable below concrete slab on grade installed a minimum of 2 inches below bottom of slab.
  - 2. Acceptable within masonry walls.
  - 3. Not acceptable for exposed raceways extending through floor slab; utilize Rigid Metal Conduit.

4. Not acceptable for bends 45 degrees and greater unless concrete encased; utilize Rigid Metal Conduit as specified herein, PVC Coated Rigid Metal Conduit or Fiberglass (RTRC). Field bends not acceptable.
  5. Concrete encased where indicated on Contract Drawings or where required by Code or Utility.
- F. Flexible Steel Conduit:
1. For connections to recessed light fixtures and devices installed in suspended ceilings, maximum six foot length.
  2. For connections to motors, transformers and other equipment subject to vibration. Minimum of three foot and maximum of six foot length with 90 degree loop.
- G. Liquid-Tight Flexible Metal Conduit.
1. For pump motors and equipment subject to vibration in damp and wet locations, in areas subject to being washed down, and for machinery where cutting oil is used. Minimum of three foot and maximum of six foot length with 90 degree loop.
- H. Surface Metal and Multi-Outlet Raceway: Install where indicated on the Contract Drawings.
- I. Auxiliary Gutters and Wireways: Install where indicated on the Contract Drawings and as required in unfinished spaces. Elsewhere as approved by the A/E.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes outlet, junction, and pull boxes and associated appurtenances required to enclose devices, permit pulling conductors, and for wire splices and branches.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NFPA 70, National Electrical Code (NEC).
  - 3. UL 514A, Metallic Outlet Boxes.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for each type of outlet box and appurtenance.

## **PART 2 PRODUCTS**

### **2.01 OUTLET BOXES FOR INTERIOR WIRING**

- A. General: Outlet and pull boxes pressed steel, zinc coated with plaster ring where applicable, minimum 4 inch size.
- B. Telecommunications and Audio Visual: Outlet and pull boxes galvanized steel, with plaster ring where applicable, minimum 4-11/16 inch, 3-1/4-inches deep.
- C. Surface Metal Raceway: Boxes of same manufacturer and to match raceway. Boxes to accommodate standard devices and device plates.
- D. Concrete and Masonry: Boxes for casting in concrete and mounting in masonry walls of type specifically designed for that purpose.
- E. Ceiling Outlet Boxes: Galvanized octagonal 4 inch, 1-1/2 inches deep (without fixture stud) and 2-1/8 inch deep (with fixture stud).
- F. Sheet Metal Boxes Larger than 12 Inches in any Dimension: Include hinged enclosure.
- G. Cut in Outlet Boxes: Retro-Ring 205RAC to position 4" sq. steel junction box in covered wall cavity.

### **2.02 OUTLET BOXES FOR EXTERIOR WIRING**

- A. General: Weather resistant and rain tight, with appropriate covers, gaskets, and screws.
- B. Above Grade: Outlet and junction boxes cast or malleable iron or cast of corrosion resistant alloy compatible with raceway to which they are connected. Pull boxes fabricated of hot dipped galvanized heavy gage steel. Boxes with gasketed covers.
- C. Below Grade: Provide underground vaults as specified in Section 260543.

## **2.03 OUTLET BOXES CONTAINING MULTIPLE DEVICES**

- A. Outlet Boxes Containing Emergency and Normal Devices: Permitted only with steel barriers manufactured especially for purpose of dividing outlet box into 2 completely separate compartments.
- B. Outlet Boxes Containing Multiple Devices and Wiring Rated over 150 Volts to Ground and Over 300 Volts Between Conductors: Permitted only with steel barrier manufactured especially for purpose of dividing outlet box into separate compartments for each device having exposed live parts.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### **3.04 COORDINATION OF OUTLET BOX LOCATIONS**

- A. Locate as shown on the Drawings and as required to facilitate pulling. Limit number of bends per NEC.
- B. Electrical box locations shown on the Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets before roughing in.
- C. Locate outlet boxes to allow access. If inaccessible, furnish, arrange, and pay for installation of access doors.
- D. Coordinate Work of this section with the Work of other sections and trades to avoid conflicts. Check and verify door swings and locations of built-in cabinets, plumbing, heating, and ventilating equipment.
- E. Install outlet boxes of sizes and at locations necessary to serve equipment furnished under this or other divisions of the specifications. Make final connections thereto. Outlet boxes required if equipment is furnished with pigtail for external connection, does not have space to accommodate branch circuit wiring, or requires wire with insulation rating different from branch circuit wiring. Review equipment Shop Drawings for required outlet locations.
- F. Where more than one outlet box is shown on the Drawings, and indicated to be at same elevation or one above the other, align them exactly on center lines horizontally or vertically. Relocate outlet boxes which are not so installed (including lighting, receptacle, power, signal, and temperature control outlets) at no additional cost to the Owner.
- G. Centered on Built-In Work: In the case of doors, cabinets, recessed or similar features, or where outlet boxes are centered between such features, such as between door jamb and cabinet, make these outlet box locations exact. Relocate outlet boxes which are not centered.

- H. Flush mount boxes with front edge of box or plaster ring even with finished surface of wall and ceiling, except those mounted above accessible ceilings and where surface mounting is permitted.
- I. Locate to maintain headroom and to present a neat appearance.
- J. Route conduit from switch and receptacle boxes in walls vertically to space above ceiling. Install junction box before horizontal run.
- K. Offset outlet boxes minimum of one stud horizontal separation between flush boxes mounted on opposite sides of acoustic rated common wall.
- L. Install outlet boxes with minimum 6 inch horizontal separation between closest edges of flush boxes mounted on opposite sides of common wall.
- M. Ceiling Locations: Locate outlet either at corner joint or in center of a panel, whichever is closer to normal spacing. Locate outlet boxes in same room in same panel locations.
- N. Conceal outlet boxes for electric water coolers behind cooler unit housing.

### **3.05 OUTLET BOX INSTALLATION**

- A. Anchor boxes so they will not shift or rock when devices are operated (including insertion and removal of cord caps).
- B. Firmly anchor flush outlet boxes directly or with concealed bracing to studs and joists.
- C. Close unused openings.
- D. Support boxes independently of conduit except for cast outlet boxes that are connected to 2 rigid metal conduits, both supported within 12 inches of outlet box.
- E. Use multiple-gang outlet boxes where 2 or more devices are mounted together. Do not use sectional boxes.
- F. Install blank covers or plates over outlet boxes that do not contain devices.
- G. In inaccessible ceiling areas, install outlet and junction boxes within 6 inches of recessed luminaire to be accessible through luminaire ceiling openings.
- H. Install recessed outlet boxes in finished areas. Secure outlet boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall and adjustable steel channel fasteners for flush ceiling outlet boxes.
- I. Install outlet boxes in walls without damaging wall insulation.
- J. Seal conduit boxes, telephone boxes, and similar items air tight with acoustical caulk where located in acoustical rated walls that are not fire rated.
- K. Install outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use outlet boxes with sufficient depth to permit conduit hubs to be located in masonry void space.
- L. Install pull boxes to be accessible after completion of building construction.

### **3.06 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK, AND CASEWORK**

- A. Install as shown on the Drawings. Furnish templates to other trades for drilling and cutting to ensure accurate location of electrical fixtures (outlets and devices) as verified with the A/E. Install wiring, devices, plates, and connections required by said fixtures.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description: Underground electrical work beyond building perimeter including vaults, handholes, direct-buried conduit, ductbanks, and associated appurtenances.
- B. Provide, coordinate and obtain approval for underground electrical work for utility systems in accordance with utility company requirements.
- C. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.
- D. Refer to Section 260533 for work within building perimeter.
- E. Refer to Section 260510 for additional earthwork requirements

**1.02 DEFINITIONS**

- A. Vault: Underground structure for electrical equipment and wiring.

**1.03 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances. Comply with local Utility requirements and standards.
- B. Codes and Standards:
  - 1. UL 6, Standard for Rigid Metal Conduit.
  - 2. UL 651, Standard for Schedule 40 and 80 Rigid PVC Conduit.
  - 3. UL 651A, Standard for Type EB and A Rigid PVC Conduit and HDPE Conduit.
  - 4. UL 2420, Standard for RTRC Conduit and Fittings for underground – Fiberglass.
  - 5. AASHTO M-306, Standard for Drainage, Sewer, Utility and Related Castings.
  - 6. Electric Utility Requirements.
- C. NEC Compliance: Comply with applicable portions of NEC as to type of products used and installation of electrical power connections.
- D. Comply with applicable NEMA standards and refer to NEMA standards for definitions of terminology herein. Comply with NEC for workmanship and installation requirements of underground vaults, conduit and ducts.
- E. Manufacturers: Firms regularly engaged in manufacture of vaults, handholes, conduit and ducts of types and sizes specified and whose products have been in satisfactory use in similar service for not less than 3 years.

**1.04 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for each type of vault, handhole, conduit, duct and appurtenance.
- C. Shop Drawings for vaults: Include plans, elevations, sections, details and accessories, including the following:
  - 1. Duct entry provisions, including locations and duct sizes.
  - 2. Cover design and vault frame support rings.
  - 3. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
  - 4. Joint details.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- B. Lift and support precast concrete units only at designated lifting or supporting points.

**1.06 COORDINATION**

- A. Coordinate layout and installation of ducts, vaults and handholes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of duct entrances into vaults and handholes with final locations and profiles of ducts as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to vaults and handholes, and as approved by A/E.

**PART 2 PRODUCTS**

**2.01 RIGID METAL CONDUIT (RMC) AND FITTINGS**

- A. Ferrous Metal Conduit: Steel, UL 6, hot-dip galvanized.
- B. Fittings and Conduit Bodies: UL 514B, threaded galvanized.

**2.02 RIGID NON-METALLIC CONDUIT**

- A. PVC Conduit: Schedule 40, UL 651, rigid type unless indicated otherwise.
- B. Fittings: UL 651, UL 651A, UL 2420 and UL 2515.
  - 1. For electric (power) duct, 90 degree elbows with minimum 48 inch radius, factory manufactured rigid steel or Fiberglass (RTRC).
  - 2. For telecommunications service provider ducts, 90 degree elbows with minimum 48 inch radius factory manufactured rigid steel
  - 3. For telecommunications on-site distribution ducts, 90 degree elbows with minimum 36 inch radius factory manufactured rigid steel (RMC)

**2.03 Duct Accessories**

- A. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
- B. Conduit Fittings at Vaults and Handhole Entrances: End Bells.

**2.04 PRECAST HANDHOLES**

- A. Handholes: Precast concrete with open bottom unless indicated otherwise on the Contract Drawings.
- B. Rating: Rated for application where installed: AASHTO H-20 highway loading where installed in roadways and drive lanes, medium duty loading in off-street locations that are not subject to high density traffic or light duty pedestrian traffic in walkways not subject to vehicle traffic..
- C. Identification: Permanently engrave handhole covers with the system designation. Handhole designations visible from the surface.
  - 1. Electrical handhole labeled "ELECTRIC".
  - 2. Telecommunications handhole labeled "COMMUNICATIONS".

- D. Frame and Cover: Weatherproof cast iron frame. Cast iron cover with on-skid surface and lift or pull slots. Capable of being secured to the body with tamper resistant fasteners.
- E. The manufacturer's name and model number must be permanently indicated to an interior wall face.
- F. Acceptable Manufacturers: Oldcastle, Christy, Hanson, Hubbell, or approved.

## **2.05 HANDHOLES OTHER THAN PRECAST**

- A. Handholes: HDPE with an open bottom unless indicated otherwise on the Contract Drawings.
- B. Rating: Rated for light duty: pedestrian traffic. Suitable for landscape areas only.
- C. Identification: Permanently engrave handhole covers with the system designation. Handhole designations visible from the surface.
  - 1. Electrical handhole labeled "ELECTRIC".
  - 2. Telecommunication handholes designated "COMMUNICATIONS".
- D. Cover: Weatherproof with non-skid surface, and lift or pull slots. Capable of being secured to the body with tamper resistant fasteners.
- E. The manufacturer's name and model number must be permanently indicated to an interior wall face.
- F. Finish: Gray in concrete or paved areas. Green in landscape areas.
- G. Acceptable Manufacturers: Oldcastle, Christy, Hanson, Hubbell, or approved

## **2.06 PRECAST CONCRETE VAULTS**

- A. Vaults: Precast concrete with minimum 4,000 psi strength at 28 days. Solid bottom with recessed sump to allow for drainage, embedded galvanized channels in each wall, a 1-inch diameter ground rod knockout in the floor, pulling-in hooks, and galvanized pull/lift irons in each corner.
- B. Design: Tops and walls shall meet AASHTO H-20 highway loading, conform to ASTM C478, with 30 percent loading added for impact.
  - 1. Walls shall withstand all soil pressures, taking into consideration the soil to be encountered and groundwater level present at the site. Assume ground water level is at ground surface unless a lower water table is indicated in the boring logs.
  - 2. Designed and constructed not to float.
  - 3. Assembled Sections: Mating edges with tongue-and-groove joints. Design joints to firmly interlock adjoining components, and provide waterproof junctions. Joints sealed watertight using preformed plastic strips installed in accordance with the manufacturer's instructions.
  - 4. Steel components other than reinforced steel hot-dip galvanized after fabrication.
  - 5. Identify vaults using the manufacturer's name embedded in, or otherwise permanently attached to, an interior wall face.
- C. Vault Cover Ratings:: Provide per vault schedule.
  - 1. Medium Duty Covers: Provide with traffic rated galvanized steel hatches unless noted otherwise on the Drawings. Include a locking latch, a recessed lift handle, and a hinging system that allows the cover to open a full 180 degrees.
  - 2. Non-Traffic Covers: Provide where indicated on the Contract Drawings.
- D. Identification: Permanently label vault covers with the system designation. Vault designations visible from the surface.
  - 1. Electrical vaults labeled "ELECTRIC".
  - 2. Telecommunication vaults labeled "COMMUNICATIONS".

3. Cast covers shall have the designation cast into the cover at the casting foundry. If casting the designation into the cover is not an option, the Contractor shall propose other means to permanently label the vault.
  4. Galvanized steel hatches shall include the bead welded designation onto the cover. If the cover cannot be bead welded, the Contractor shall propose other permanent marking options.
- E. Riser Collars: Riser collars shall match casting, concrete and 6" in height.
- F. Connections: Conduit entries through vertical vault walls must be through cast-in-place molded plastic duct connections such as Term-A-Ducts.
- G. Acceptable Manufacturers: Oldcastle, Hanson, or approved.

## **2.07 VAULT ACCESSORIES**

- A. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment. Maintain 18" from corner of wall. Provide additional stanchions if spacing exceeds 30".
  2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms must be minimum 8" long with 3 arms per stanchion, with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm must be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- B. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35°F. Capable of withstanding temperature of 300°F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- C. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- D. Mechanical Duct Plugs: Duct plugs, high-impact plastic components, combined with durable elastic gaskets, are corrosion proof. Blank plug must be equipped with a rope tie device to allow the securing of pull rope to the plug's back compression plate.

## **2.08 GROUNDING**

- A. Grounding: Install ground rod and bonding connections, provide as specified in Section 260526 and as indicated herein.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of ducts, vaults, and handholes with final arrangement of other utilities, site grading, and surface features as determined in the field prior to commencing work of this section.

- B. Coordination: Coordinate elevations of conduit, ducts and duct bank entrances into vaults and handholes, with final locations and profiles of conduit, ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that conduit and duct runs drain away from building to vaults and handholes, and as approved by A/E.
- C. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### 3.03 EARTHWORK

- A. Provide as specified in Section 260510 and as indicated herein.
- B. Work with extreme care near existing utilities to avoid damage. Cut the trenches neatly and uniformly.
- C. Pitch the trenches uniformly toward vaults and handholes or both ways from high points between vaults for the required duct line drainage. Avoid pitching the ducts towards buildings.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoil, seed, sod, and/or mulch according to Division 32.
- E. Cut and patch existing pavement in the path of underground conduit and ducts according to Division 01.

### 3.04 RACEWAY INSTALLATION

- A. Install top raceway at depth shown on the Contract Drawings or minimum 24 inches below finished grade, whichever depth is deeper.
- B. Install detectable marker tape over underground raceway as specified in Section 260553. Warning marker tap must be 12 inches below finished grade directly above duct bank.
- C. Install raceway with minimum slope of 4 inches per 100 feet to drain away from building. Slope ducts from a high point in runs between two vaults to drain in both directions.
- D. Duct Entrances to Vaults: Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Cut conduit square using a saw or pipe cutter. Deburr cut ends.
- F. Bring conduit to shoulder of fittings and couplings and tighten securely.
- G. During construction, use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- H. Provide polyester mule tape with printed footage indicators secured at each end of each empty conduit, except sleeves and nipples. Identify with tags at each end indicating origin and destination of empty conduit. Minimum tensile strength of 1250 pounds for conduits 2-inch and smaller and 2500 pounds for conduits larger than 2-inch.
- I. Raceway bends between vaults and handholes.
  - 1. Power: No more than equivalent of three 90 degree bends
  - 2. Telecommunications: No more than equivalent of two 90 degree bends
- J. Underground Raceway Installation:
  - 1. Install insulated grounding bushings at conduits stubbed up or out from underground unless capped for future (spare).
  - 2. Wipe PVC conduit clean and dry before jointing. Apply full even coat of cement to entire area to be inserted into fitting. Let joint cure for minimum 20 minutes.

- 3. Install conduit that stub up through floor at such depth that exposed conduit is vertical and no curved section of elbow is visible.
- K. Do not install conduit on exterior surface of building, except as shown on the Drawings and as approved by the A/E.

### **3.05 UNDERGROUND Concrete encased DUCT BANK INSTALLATION**

- A. Install top of duct bank at depth shown on the Contract Drawings or minimum 24 inches below finished grade, whichever depth is deeper.
- B. Install marker tape over underground raceway as specified in Section 260553. Warning marker tap must be 12 inches below finished grade directly above duct bank.
- C. Install conduit with minimum slope of 4 inches per 100 feet.
- D. Use suitable separators and chairs installed not greater than 4 foot on center. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement.
- E. Duct Entrances to Vaults: Grout end bells into structure walls from both sides to provide watertight entrances.
- F. Provide minimum 3 inch concrete cover at bottom, top, and sides of duct bank, concrete must be rated at 3,000 PSI.
- G. Stagger conduit joints in concrete encasement minimum 6 inches.
- H. Do not use union-type fittings without approval of the A/E.
- I. Construction:
  - 1. When termination of duct is not detailed on the Contract Drawings, extend conduit 1'-0" beyond concrete encasement and end cap.
  - 2. Plug and cap ends of conduit to protect from damage during construction and at end of each day's concrete pour. Protect ends of conduits not used for long periods from dirt and rodents with wooden or manufactured plugs. Non-setting mastic may be used on plug to adhere to conduit end. Drill 1/4 inch hole in lower portion of plug for drainage of conduit.
  - 3. Swab conduits immediately upon completion of concrete pour. After cement has set, but before backfilling, pull mandrel having diameter equal to nominal conduit inside diameter, minus 1/2 inch, and not less than 12 inches long, through each conduit. Mandrel must be lead-covered or painted white to indicate protrusion inside conduit which might damage cable sheath. Attach pull string to rear end of swab mandrel to replace pull string being pulled out. When not in use, fasten pull string securely at both ends of duct.
- J. Observation: Ducts will be reviewed by the Owner's Representative before pouring concrete. The Owner's Representative will review for backfill compaction, drainage slope, spacers, floatation ties, conduit condition, and joints. Concrete shall not be poured until the observation is complete.

### **3.06 RACEWAY SCHEDULE**

- A. Rigid Metal Conduit:
  - 1. Acceptable in all locations except as modified in this section.
  - 2. Where in contact with earth or concrete, install protective coating consisting of spirally wrapped 20 mil PVC tape with 1/2 inch minimum overlap – 3M Scotchrap Tape 51 or approved - or utilize PVC Coated Rigid Metal Conduit. Completely wrap and tape field joints.
- B. PVC Coated Rigid Metal Conduit:
  - 1. Required in corrosive environments or as indicated on the Drawings.

- C. Rigid Non-Metallic Conduit:
1. Acceptable underground with minimum 24 inches of cover.
  2. Not acceptable for raceways extending through concrete; utilize Rigid Metal Conduit or Fiberglass (RTRC).
  3. Not acceptable for bends 45 degrees and greater unless concrete encased; utilize Rigid Metal Conduit as specified herein, PVC Coated Rigid Metal Conduit or Fiberglass (RTRC). Field bends not acceptable.
  4. Concrete encased where indicated on Contract Drawings or where required by Code or Utility.

### **3.07 HANDHOLES INSTALLATION**

- A. Install precast handholes on a solid ring of base material such as concrete around the outer edge to prevent settlement. The base material shall include openings that allow drainage from the box into the soil. Boxes must be set plumb and elevated slightly above surrounding grade to prevent them from becoming the water collection points. Conduit ends must be sealed to prevent debris from entering the raceway.

### **3.08 PRECAST VAULTS INSTALLATION**

- A. Install on a level bed of well-tamped gravel or crushed stone, well-graded from the 1-inch to 2-inch sieve.
- B. In paved areas, set top of vault plumb and flush with finished surface. In unpaved areas, set vault top slightly higher than surrounding area to prevent the vault from collecting surrounding water.
- C. Vaults with round castings/ covers shall have risers to recess the vault below landscaping, subgrades and other site finishes.
- D. Install a ground rod in each vault through the ground rod knockout in the floor.
- E. Install a No. 2 AWG copper bonding conductor along the perimeter of the interior walls and support above floor level. Bond all metallic parts within vault including channels, frames, lids, ladders, etc. with No. 6 AWG copper bonding jumper. Connect the ground rod to the bonding conductor with No. 2 AWG copper.
- F. In cases where Term-A-Ducts were not provided at conduit entries, fill the breakout windows with concrete or non-shrink grout from both sides after all ducts have been installed.
- G. Cast end bells into vault wall for conduit entries.

### **3.09 FIELD QUALITY CONTROL**

- A. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
- B. Test vault grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526.

### **3.10 Cleaning**

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of vaults and handholes, including sump. Remove any foreign material.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes isolation pads, spring isolators, restrained spring isolators, restraint cables, hanger rod stiffeners, anchorage bushings and washers, and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards: NFPA 70, National Electrical Code (NEC).
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel".

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation and seismic restraint device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to the AHJ.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
  - 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- C. Delegated-Design Submittal: For vibration isolation and seismic restraint details indicate to comply with performance requirements and design criteria, including analysis data signed and sealed by professional engineer responsible for their preparation.
  - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
    - a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors.
    - b. Comply with requirements in other Division 26 sections for equipment mounted outdoors.
  - 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
  - 3. Field fabricated supports.
  - 4. Seismic Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

- b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to structure during seismic events. Indicate association with vibration isolation devices.
  - c. Preapproval and Evaluation Documentation: By agency acceptable to AHJ, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- D. Welding Certificates.
- E. Test Reports:
- 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. General: A single supplier shall furnish isolation mounts, pads, seismic restraints, sway braces, related hardware, and fabricate isolation bases for the project unless otherwise specified.
- B. Responsibility: This supplier shall be responsible for selection and installation supervision of vibration isolators. Prepare engineering drawings and details and submit to the A/E. Perform installation supervision and provide adjustment instructions.
- C. Seismic Restraints:
- 1. Design and select restraint devices for ducts, pipes, and equipment to meet seismic requirements defined in IBC and ASCE 7-05. Prepare calculations based on coefficients included on the structural drawings. Refer to the structural drawings for allowable methods and loads.
  - 2. Retain an engineer, specialty consultant, or seismic restraint device manufacturer to design and develop seismic restraint systems and perform calculations based on actual equipment data.
  - 3. Engineer, specialty consultant, or seismic restraint device manufacturer shall coordinate attachments to structure to verify that attachment points on equipment and structure can accept seismic, weight, and other loads imposed. Pay any additional structural engineering services fee.
  - 4. Shop Drawings, details, and calculations shall be stamped and signed by a professional engineer licensed in engineering in the state in which the Work is performed.

### **PART 2 PRODUCTS**

#### **2.01 VIBRATION ISOLATORS**

- A. Manufacturers: Amber/Booth, California Dynamics Corporation, Kinetics Noise Control, Mason Industries, Vibro-Acoustics, Vibration Mountings & Controls, or approved.
- B. Isolation Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
- 1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
  - 2. Minimum Additional Travel: 50 percent of required deflection at rated load.
  - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4 inch thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
  6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed. Factory-drilled baseplate bonded to 1/4 inch thick neoprene or rubber isolator pad attached to baseplate underside. Adjustable equipment mounting and leveling bolt that acts as blocking during installation.
  2. Restraint: Seismic or limit-stop as required for equipment and AHJ.
  3. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
  4. Minimum Additional Travel: 50 percent of required deflection at rated load.
  5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.02 SEISMIC RESTRAINT DEVICES

- A. Manufacturers: Amber/Booth, California Dynamics Corporation, Cooper B-Line, Hilti, Mason Industries, TOLCO, Unistrut, or approved.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements as defined in reports by an agency acceptable to AHJ.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components minimum 4 times maximum seismic forces to which they will be subjected.
- C. Restraint Cables: ASTM A 492 stainless steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service. Include minimum 2 clamping bolts for cable engagement.
- D. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- E. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchors and studs.
- F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices.
- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene with a flat washer face.
- H. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of 8 times diameter.
- I. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

#### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

#### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

#### **3.04 APPLICATIONS**

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to the AHJ.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces. Welding stiffeners to rods not acceptable.
- C. Strength of Support and Seismic Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

#### **3.05 SEISMIC RESTRAINT DEVICE INSTALLATION**

- A. Equipment and Hanger Restraints:
  - 1. Install restrained isolators on electrical equipment.
  - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
  - 3. Install seismic restraint devices using methods approved by agency acceptable to AHJ providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated on the Drawings, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, and at concrete members.
- D. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the A/E if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, and grout has achieved full design strength.

3. Mechanical Anchors: Protect threads from damage during anchor installation. Install sleeve anchors with sleeve fully engaged in structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from bottom of hole and progressing toward surface in such a manner as to avoid introduction of air pockets in adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.

### **3.06 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION**

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections and branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### **3.07 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  1. Obtain the A/E's approval before transmitting test loads to structure. Install temporary load-spreading members.
  2. Test at least 4 of each type and size of installed anchors and fasteners selected by the A/E.
  3. Test to 90 percent of rated proof load of device.
  4. Measure isolator restraint clearance.
  5. Measure isolator deflection.
  6. Verify snubber minimum clearances.
  7. If a device fails test, modify installations of same type and retest until satisfactory results are achieved.
- B. Remove and replace malfunctioning units, provide new, and retest as specified above.
- C. Prepare test and inspection reports. Include copy of reports in the Operation and Maintenance Manual.

### **3.08 ADJUSTING**

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes nameplates, wire and cable markers, conduit color coding, buried duct marking tape, and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards: NFPA 70, National Electrical Code (NEC).

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Nameplate schedule.

## **PART 2 PRODUCTS**

### **2.01 IDENTIFICATION MATERIAL**

- A. Nameplates:
  - 1. Engraved three-layer laminated plastic.
    - a. Normal Power: White letters on black background.
  - 2. Panelboards and Switchboards: 1/2 inch high letters to identify equipment designation. 1/4 inch high letters to identify voltage rating and source.
  - 3. Control Panels and Equipment (Lighting and Receptacle Control): 1/2 inch high letters to identify equipment designation. 1/4 inch high letters to identify source, control panel name and space and zone controlled as designated on the Drawings..
  - 4. Enclosed Circuit Breakers, Disconnect Switches, Motor Starters: 1/4 inch high letters to identify load served and source.
  - 5. Power Monitoring: 1/2 inch high letters to identify meter designation. 1/4 inch high letters to identify metering category.
  - 6. Service Entrance Equipment: 1/2 inch high letters to identify available fault current.
  - 7. Digital Control Switches: 1/4 inch engraved letters on push button or cover to identify control zone.
  - 8. Feeders: 1/4 inch high letters to identify feeder ampacity, phase conductor size and quantity.
- B. Adhesive Printed Labels:
  - 1. Laminated tape – Brother TZe Series 12 mm width tape or equivalent with adhesive back suitable for exterior locations.
    - a. Normal Power: Black letters on clear background.
  - 2. Switches: 1/4 inch letters to identify load controlled.
  - 3. Receptacles: 1/4 inch letters to identify panelboard, circuit number and where identified as Dedicated, identify equipment designation as shown on panel schedule
  - 4. Lighting control devices: 1/4 inch letters to identify lighting control device designation as shown on shop drawings and lighting control program
- C. Outlet boxes, junction boxes and pull boxes for emergency system devices and circuits orange in color, both inside and outside.

- D. Outlet boxes, junction boxes and pull boxes for fire alarm system devices and conductors: red in color, both inside and outside.
- E. Permanent felt marker for junction and pull box.
  - 1. Normal/Standby/Emergency Power: Black letters indicating circuit notation.
  - 2. Lighting controls: Black letters indicating "Lighting Control Device" and relays
- F. Wire and Cable Markers:
  - 1. Split sleeve or tubing type. Vinyl impregnated cloth, vinyl, and mylar self-adhesive types not acceptable.
  - 2. Color code wire in accordance with the coding shown in Decal Detail below. Conductors of power systems in this building (plant) are identified as follows:

|                                |               |
|--------------------------------|---------------|
| Conductor                      | 208Y/120 Volt |
| A Phase (Left Bus In Panel):   | Black         |
| B Phase (Center Bus In Panel): | Red           |
| C Phase (Right Bus In Panel):  | Blue          |
| Neutral:                       | White         |
| Equipment Ground:              | Green         |

- 3. Where dedicated neutral conductors are provided for single phase circuits, neutral conductor shall have a colored stripe to match the color of the corresponding phase conductor.
- G. Phase Identification: Vinyl colored electrical tape.
- H. Detectable Buried Duct Marking Tape:
  - 1. Electrical (Power) Ducts: Six inch wide red tape with words "CAUTION - ELECTRIC LINE BURIED BELOW". 3M Scotch #408 or approved.
  - 2. Communications/Telephone Ducts: Six inch wide orange tape with the words "CAUTION - TELEPHONE LINE BURIED BELOW". 3M Scotch #411 or approved.
- I. Electrical Hazard Marking Tape: Black and yellow striped vinyl 2 inch wide hazard tape, Identi-Tape #VH2BKY or equal.
- J. Directory Cards: Directory cards shall consist of heavy cardstock, metallic mounting frames and plastic covers. Mounting frames attached to the back side of panelboard or lighting control panel doors. Directories shall contain typewritten text indicating the circuit breaker or control relay number, type of load served and room number in which each load is located. Unused circuit breakers or control relays designated with "SPARE" written in pencil. Spaces for future circuit breakers left blank. Circuit designations on directory cards shall match the installed conditions with respect to loads and physical arrangement within panelboards.
- K. Wiring Color Code Schedules: Prepared using a color printer and laminated between two layers of clear plastic. Schedules shall show color designation for each phase, neutral and ground of each system voltage. Schedule size, 130 mm by 180 mm (5" by 7").
- L. Arc Flash Hazard Safety Signs: Product safety signs in accordance with ANSI Standard Z535.4 requirements. An electrical hazard (lightning) graphic surrounded by a yellow triangle at the left of each sign. At the top of the right side of the sign, in an orange signal word block, the signal word "Warning" shall appear together with an exclamation mark surrounded by a triangle. Underneath the signal word block, include the message "Arc Flash Hazard" printed on the first line, followed by "Available Fault Current" and "Appropriate PPE Required" on the second line. The sign shall also indicate the flash protection boundary in inches and the incident energy at 460 mm (18") in cal/cm<sup>2</sup>, in accordance with the requirements of NFPA 70E.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

#### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

#### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. Description: Install, apply, erect, and perform work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, more stringent requirements govern.
- B. Nameplates:
  - 1. Degrease and clean surfaces to receive nameplates.
  - 2. Install nameplates parallel to equipment lines.
  - 3. Secure nameplates to equipment fronts using screws or rivets. Adhesives not acceptable.
- C. Wire Identification:
  - 1. Install wire markers on conductors in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
  - 2. Install solid colored jackets for wire sizes smaller than number 8 AWG. Wire sizes larger than number 10 AWG may be taped at both ends and at pull and junction boxes with appropriate colored tape. Color coding tape to completely encircle conductor at least 3 inches wide.
- D. Felt Marker Identification: Apply on front of cover in non-finished areas, such as mechanical/electrical rooms, above ceilings, and similar locations, and on back of cover in finished areas.
- E. Provide black and yellow striped vinyl 2" wide hazard tape on floor and stencil "Electrical Hazard-Keep Clear" on floor, spaced as to not exceed 4 feet on center to identify code required clearance in front of electrical equipment including switchboards, panelboards, motor control centers, transformers, transfer switches, etc. in unfinished spaces such as electrical and mechanical rooms.

#### **3.04 INSTALLATION**

- A. General:
  - 1. Provide identification for electrical equipment as specified herein.
  - 2. Attach identification in durable manner, suitable to each respective type of identification. Securely fasten nameplates to equipment with two (2) rivets. Wiring color code schedules fastened to equipment with permanent adhesive.
- B. Distribution Panelboards and Switchboards: Provide the following nameplates and schedules.
  - 1. Nameplates: Provide for each distribution panelboard and switchboard. Install nameplates on the outside of the equipment enclosures above the incoming line sections.

2. Overcurrent protective device nameplate: Install nameplates on the outside of the equipment enclosure adjacent to each device. .
  3. Wiring color code schedule: attach to the exterior of each switchboard and each distribution panelboard. Locate schedules adjacent to the main incoming line sections.
  4. Feeder nameplate: attach to the exterior of each switchboard and distribution panelboard to identify the source feeder.
- C. Panelboards: Provide the following nameplates and schedules
1. Panelboard nameplate: Provide for each panelboard. On panelboards install nameplates on the outside of panelboard enclosures above doors.
  2. Directory cards: Provide in each panelboard. Update room numbers and descriptions to match final owner approved room name/number. Place directory card in holder behind plastic cover.
  3. Provide a reduced copy of each panel schedule contained in the Contract Documents, showing actual configuration. Provided panel schedules in addition to the typewritten panelboard directories. Place schedules in directory frame.
  4. Provide a wiring color code schedule attached to each panelboard. Install schedules on the inside of panelboard doors.
  5. Provide a feeder tag nameplate attached to the exterior of each panelboard to identify the source feeder
- D. Control Panels/Equipment:
1. Nameplate: attach to the outside, front of enclosure for each relay panel, control units and control equipment. Nameplate text shall include the relay panel name or space and zone controlled as designated on the Drawings.
- E. Provide an arc flash hazard safety sign attached to equipment indicated in power studies. Locate signs so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. On panelboards located in mechanical and electrical rooms, attach the signs on the outside of panelboard enclosures. On all other panelboards, attach the signs on the dead fronts or the back side of the panel doors, so that signs are not visible when panelboard doors are closed.
- F. Power Monitoring:
1. Nameplate: attach on the outside, front of each power meter enclosure. Nameplate text shall include the meter name/number and metering category/load description as designated on the Drawings.
- G. Motor Starters:
1. Provide a nameplate on the outside, front of each starter and variable frequency drive enclosure. Nameplate text shall include the name of load served as designated on the Drawings.
- H. Signaling and Communications Systems Cabinets:
1. Provide a nameplate on the outside of each cabinet above door. Nameplate text shall include the system name as designated on the Drawings and the cabinet function.
- I. Disconnect Switches:
1. Provide a nameplate on the outside front of each disconnect switch enclosure. Nameplate text shall include the name of the load controlled as designated on the Drawings, and also the designation of the equipment that serves as the power source for the circuit that supplies the disconnect.
  2. Provide a feeder tag nameplate attached to the exterior of each disconnect that has overcurrent protection to identify the source feeder

J. Relays and Time Switches:

1. Provide a nameplate on the outside front of each relay and time switch enclosure. Nameplate text shall include the name of the load controlled as designated on the Drawings.

K. Contactors:

1. Provide a nameplate on the outside front of each contactor enclosure. Nameplate text shall include the contactor name as designated on the Drawings and the name of the load controlled.

L. Control Switches:

1. Provide a nameplate for each equipment control switch with a device plate as specified in Section 262726. Nameplate text shall include the name of the load controlled as designated on the Drawings.
2. Provide a nameplate or printed label on each control switch that does not have a device plate as specified in Section 262726. Verify type with Architect's Consultant. Text shall include the name of the load controlled as designated on the Drawings.

M. Wiring Devices:

1. Receptacle Labels:
  - a. Indicate panelboard and circuit number.
  - b. Where noted with equipment description on plan drawing, provide label indicating equipment to be connected as spelled out in panel schedule e.g., refrigerator, microwave, copier, printer, etc.
2. Provide an engraved printed label for each switch that controls luminaires not within sight of the switch or that controls receptacles. Engraved printed label text shall include the type and location of the load controlled.

N. Junction Boxes and Pull Boxes:

1. Provide nameplates on the outside of the front cover of junction boxes and pull boxes in finished areas and of junction boxes and pull boxes that are larger than 150 mm by 150 mm (6" by 6"). Nameplate text shall designate the system for which wiring is to be enclosed in the box. In the case of power system junction boxes or pull boxes, the nameplate text shall also include the panelboard name and circuit number.
2. Junction boxes and pull boxes 150 mm by 150 mm (6" by 6") or smaller in unfinished areas and above accessible ceilings must be color coded by spray painting the outside edges of the box and spray painting the cover with the following colors:

|                                  |           |
|----------------------------------|-----------|
| 208Y/120 VAC Power:              | Unpainted |
| Fire Alarm & Detection:          | Red       |
| Security and Video Surveillance: | Purple    |
| Telecommunications:              | Blue      |
| Intercom/Paging & Clock:         | White     |
| Television:                      | Black     |
| Audio-video:                     | Gold      |

3. After painting, mark the covers of power system junction boxes and pull boxes with the panelboard name and circuit numbers. Marking must be done with a wide-tip, permanent-ink black marker.

O. Outlet Boxes:

1. Outlet boxes for emergency power and fire alarm circuits must be color coded by spray painting the box inside and outside with the following colors:

Fire Alarm & Detection: Red

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes preparation of fault (short-circuit) calculations, protective device coordination study, and arc flash hazard analysis and labeling.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. IEEE C57.109, IEEE Guide for Transformers Through-Fault Current Duration.
  - 2. IEEE 141, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book).
  - 3. IEEE 241, IEEE Recommended Practice for Electric Power Systems in Commercial Buildings (IEEE Gray Book).
  - 4. IEEE 242, IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book).
  - 5. IEEE 1584, IEEE Guide for Performing Arc-Flash Hazard Calculations.
  - 6. NFPA 70, National Electrical Code.
  - 7. NFPA 70E, Standard for Electrical Safety in the Workplace.
  - 8. ANSI Z535.4, American National Standard for Product Safety Signs and Labels.
- C. Qualifications: Fault calculations, protective device coordination study and arc flash hazard analysis shall be prepared by electrical equipment manufacturer who furnishes incoming service equipment to building or an independent electrical engineer. In either case, calculations and study shall be stamped and signed by a professional engineer licensed in the state in which the Work is performed.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Identification of computer software program used for study.
- A. Serving Utility Information:
  - 1. Contact the utility to get all information upstream of the point of service required to perform the power study. Include the following:
    - a. Utility owned transformer:
      - 1) Utility transformer nameplate information: size, rating, overcurrent protection, impedance, X/R.
      - 2) Available fault duty on secondary side of transformer.
      - 3) Nearest upstream protective device type/size/settings.
      - 4) Conductor size/type, number of parallel runs and distance from Point of Service back to nearest upstream protective device.
- B. Submit study outline.
- C. Initial Submittals:
  - 1. One-line diagram with each bus and node having a unique number indicating that fault calculation will be made at that point.

2. Representative one-line diagram of distribution system (with bus numbers as described herein) indicating which devices will be presented in protective device coordination study.
- D. Following review and approval of the initial submittals by the A/E, submit final calculations and study in a common bound report.
- E. Closeout Submittals:
  1. Final report, in the following formats:
    - a. Hard copy, bound.
    - b. Soft copy, PDF format.
    - c. Soft copy, native file(s) in format utilized by computer software program.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this section. Manual calculations are unacceptable.
- B. The fault calculations protective device study and arc flash hazard analysis must include complete fault calculations for each proposed and ultimate source combination.
- C. Source combinations may include present and future power company supply circuits, large motors, and generators.
- D. Drawings and specifications indicate general requirements for electrical equipment being provided. Changes and additions may be suggested by results of study. Submit proposed changes and additions as a part of study.

### **2.02 FAULT (SHORT CIRCUIT) CALCULATIONS**

- A. Prepare description of calculation methods, assumptions, and base per unit quantities selected.
- B. Prepare one-line diagram(s) and source impedance data including X/R ratio and power company system characteristics.
- C. Prepare impedance diagrams, typical calculations, tabulations of calculation quantities, and results, conclusions, and recommendations.
- D. Prepare calculations of short circuit interrupting and momentary (when applicable) duties for an assumed 3 phase, bolted, fault at medium voltage switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear or switchboard lineup, motor control center, distribution panelboard, branch circuit panelboard, and other significant locations throughout system.
- E. Prepare ground fault current calculations for the same system areas including associated zero sequence impedance diagram.
- F. Prepare tabulations including fault impedance, X/R ratios, asymmetry factors, motor contributions, short circuit KVA, and symmetrical and asymmetrical fault currents.

### **2.03 PROTECTIVE DEVICE COORDINATION STUDY**

- A. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

- B. Prepare time-current coordination curves graphically indicating proposed. Include upstream and downstream devices associated with each device to illustrate coordination. Include with each curve sheet a complete title and one-line diagram with legend identifying specific portions of system covered by that particular curve sheet.
- C. Study shall incorporate all system protective device components.
- D. Include detailed description of each protective device identifying its type, function, manufacturer, AIC rating, device tap, time-dial, pick-up, instantaneous, and time-delay settings.
- E. Include on curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low voltage equipment circuit breaker and fuse characteristics, pertinent transfer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices.
- F. Include, as a minimum, devices down to largest branch circuit and largest feeder circuit breaker in each piece of electrical gear or equipment.
- G. Include recommended adjustable settings of overcurrent protective devices including but not limited to the following:
  - 1. Circuit breakers.
  - 2. Protective relays.
  - 3. Ground fault protection.
  - 4. Zone selective interlocking.
- H. Include manufacturing tolerance and damage bands in plotted fuse characteristics.
- I. Show transformer full load, 150, 400, and 600 percent current, transformer magnetizing inrush, transformer withstand parameters according to IEEE C57.109, and significant symmetrical or asymmetrical fault current to which device is exposed.
- J. Select each primary protective device required for transformer winding configuration shown so that its operating band is within transformer characteristics including point equal to 59 percent of IEEE C57.109 to withstand point for secondary line-to-ground fault protection. Where primary device is not within transformer characteristics, show transformer damage curve.
- K. Separate transformer primary protective device characteristic curves by a 16 percent current margin for coordination and protection in event of secondary line-to-line faults. Separate medium voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.
- L. Prepare complete sets of individual protective device time-current coordination characteristics on transparencies.

## **2.04 ARC FLASH HAZARD ANALYSIS AND LABELING**

- A. Perform electrical arc flash hazard analysis in accordance with the latest adopted version of NFPA 70E and IEEE 1584 to calculate arc flash protection boundary, working distance, incident energy level and personal protective equipment (PPE) requirements. Arc flash analysis and labeling shall be performed for electrical distribution system equipment including switchboards, panelboards, uninterruptible power supplies, transfer switches, industrial control panels, motor control centers, transformers, enclosed circuit breakers and disconnect switches.
- B. Provide arc flash hazard safety signs in accordance with Section 260553, Electrical Identification. Arc flash signs shall include the following information.
  - 1. Equipment name.
  - 2. Working distance.
  - 3. Incident energy level.

4. Arc flash hazard boundary.
  5. Required PPE level.
- C. Where arc flash energy reduction devices are utilized, provide second set of arc flash labels reflecting information when arc flash reduction devices are implemented. Labels shall be visibly different from standard labels for easy identification.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine project overcurrent protective device submittals for compliance with fault calculation study, electrical device coordination and arc flash hazard labeling requirements and other conditions affecting performance.
- B. Existing Condition Survey: Field investigate existing conditions to provide the information required for a complete power study from the Point of Service to all new and existing to remain equipment.
  1. Serving utility information: Contact the utility to get all information upstream of the point of service required to perform the power study.

#### **3.02 EQUIPMENT SHORT CIRCUIT CURRENT RATING**

- A. All mechanical equipment, packaged systems, control panels, motor starters, motor controllers, variable frequency drives and similar equipment shall carry a Short Circuit Current Rating (SCCR) equal to or greater than the available fault current delivered from the electrical system. Coordinate final available fault currents with the contractors providing this equipment.

#### **3.03 ADJUSTING**

- A. After review by the A/E, make revisions to protective device settings to accomplish conformance with approval fault calculations and protective device coordination study. Provide final settings of all adjustable overcurrent devices in accordance with the coordination study.

#### **3.04 LABELING**

- A. Provide arc flash hazard labels on all electrical equipment. Labels shall be located so as to be clearly visible to personnel providing examination, adjustment, servicing or maintenance of the equipment.

#### **3.05 DEMONSTRATION**

- A. Demonstrate to the A/E that correct device settings and ratings have been made. Include settings and ratings on the Record Drawings.
- B. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels. Training should include how to use arc flash energy reduction devices to reduce the available arc flash energy at switchboards.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes testing requirements for individual components, equipment, systems, and integration to ensure intended facility operation. Test equipment per manufacturer guidelines and industry standards. Test modes of operation and interlocks and alarm functions. This section presents a guideline of system testing. Provide complete, comprehensive testing in addition to minimum requirements specified in individual sections and in this section.
- B. Training: Include comprehensive Owner operation and maintenance training of individual components, equipment, and systems. Training includes normal operation and alternate modes of operations.
- C. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. ANSI/NETA ATS 2017, Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
  - 2. ANSI/NETA MTS-2015, Standard for Maintenance Testing Specifications for Electrical Power Equipment and Systems.
  - 3. NFPA 70B, Recommended Practice for Electrical Equipment Maintenance.
  - 4. NFPA 70, National Electrical Code (NEC).
- C. Testing Agency: Testing shall be accomplished by an approved testing agency. Retain services of a NETA certified firm or approved. Testing agency shall not be associated with manufacturer of equipment or systems under test.
- D. Perform testing and inspections with the assistance of a factory-authorized service representative, where indicated in individual specification sections.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Qualifications: Testing agency qualifications.
- C. Testing Plan and Schedule: Detailed plan and schedule of testing, and training for acceptance by the Owner and the A/E prior to initiation of work.
- D. Test Procedures: Test procedures and sample test forms.
- E. Test Reports: Submit detailed report of testing functions with associated results. Include date of testing and corresponding line item for system tested and individual components. Include testing checklists for each system and device tested. Record for each line item test results that comply with requirements. Record for each line item test results that do not comply with requirements, corrective actions taken to achieve compliance with requirements and retest date and confirmation.
- F. Settings of Adjustable Devices: Record as-left set points of all adjustable devices.
- G. Include copy of reports in the Operation and Maintenance Manual.
- H. Certification: Certification that tests have been completed.

## **PART 2 PRODUCTS**

Not used.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### **3.04 GENERAL**

- A. Perform acceptance tests in accordance with manufacturer's recommendations, NFPA 70 and ANSI/NETA ATS.
- B. Report any system, material, or workmanship which is found defective on basis of electrical inspections and tests to the A/E.
- C. If test reveals a fault or problem, remove and replace malfunctioning units. Repeat entire test until problem is corrected. Submit additional written test reports.
- D. Maintain written record of tests. Upon completion of project, assemble and certify final test report and include in the Operation and Maintenance Manual. Compile field test reports signed by individuals performing the tests.

### **3.05 GENERAL COMPONENT AND EQUIPMENT TESTING REQUIREMENTS**

- A. Phase Relationship Tests: Check connections to existing and new equipment for proper phase relationship. During such check, disconnect devices which could be damaged by application of voltage or reversed phase rotation.
- B. Grounding:
  - 1. Test each ground electrode system. Comply with requirements in Sections 260526 and 260527.
  - 2. Visual and Continuity Test: Perform for each of the following ground connections:
    - a. Data floor ground system distribution and ground busses.
    - b. UPS System.
    - c. PDUs.
    - d. Equipment ground connections.
    - e. Cable tray grounding.

- C. Feeders:
1. After installation and prior to energization, test cable and wire for continuity of circuitry and for short circuits, Megger circuits of 100 Amp and greater. Correct malfunctions. Submit record of megohmmeter readings to the A/E.
  2. Inspect wire and cable for physical damage and proper connection.
  3. Inspect ground conductor's installation to ensure ground terminations, jumpers, and devices have solid, mechanical connection.
  4. For circuits above 80 Amps, perform torque test for each conductor termination. Torque connections per manufacturer's recommendations and tabulate results.
- D. Overcurrent Protective Device Calibration: Perform necessary field settings and adjustments to conform to the coordination study specified in Section 260573.
- E. Overcurrent Protective Device Factory Tests: Submit documentation of factory testing of distribution circuit breakers as specified in Section 262813.
- F. Switchboards:
1. Perform overcurrent device, conductor, terminations, and thermographic testing described in this section.
  2. Inspect equipment for signs of damage.
  3. Verify installation per the Drawings.
  4. Inspect cabinets for foreign objects. Clean exterior and interior of cabinets from dirt and dust.
  5. Check control wiring connections for tightness.
  6. Check power wiring connections for tightness.
- G. Panelboards:
1. Inspect for physical damage, proper installation, supports, and grounding.
  2. Inspect cabinets for foreign objects. Clean exterior and interior of cabinets from dirt and dust.
  3. Verify neutrals are grounded only at main or separately derived service point.
  4. Check load balance of panelboards for load balance between phases and make adjustments to bring phases within 15 percent of average load.
- H. Receptacles: Test for open ground, reversed polarity, open hot, open neutral, hot and ground reversed, and hot on neutral.

### **3.06 LIGHTING CONTROLS TESTING**

- A. Test lighting controls, components and systems in accordance with local codes, manufacturer recommendations.
- B. Test each device to confirm operation per manufacturer recommendations and design requirements.
- C. Document each component, device and system tested and include "as-left" settings for all adjustable settings. Include a matrix which identifies device, type and location at a minimum.

### **3.07 REPORTS**

- A. Prepare test reports for each system, equipment and device tested. Include copy of each test report in the Operation and Maintenance Manual. Utilize test forms for systems and equipment tested. Use manufacturer's standard or other appropriate test forms commensurate with test performed. Test reports shall include the following.
1. Summary of project.
  2. Description of equipment tested.

3. Description of test.
4. Test results including retesting results.
5. Test dates.
6. Tester's name.
7. Witnesses (when required).
8. Corrective work.
9. Acceptance criteria.
10. Conclusions and recommendations.
11. Appendix including appropriate test forms.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes design, furnish, and install of lighting and plug load control system(s) required to form complete coordinated system(s) ready for operation. Contract Documents indicate minimum scope and performance criteria. It is the responsibility of the lighting controls manufacturer/vendor/contractor to provide a complete system.
- B. Digital lighting controls: Stand-alone and Networked energy saving intelligent lighting control system including lighting control panels, network interface modules, emergency lighting transfer devices, as well as digital wall switches, occupancy sensors, daylighting controls, and associated appurtenances.
- C. Analog lighting controls: Energy saving lighting control devices including wall switches, occupancy sensors with power supplies, emergency lighting transfer devices, daylighting controls, contactors and associated appurtenances.
- D. Receptacle/Plug load controls: Plug load control devices including contactors and relays.
- E. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. NEMA 410, Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts.
  - 2. NFPA 70, National Electrical Code (NEC).
  - 3. UL 508, Standard for Industrial Control Panels.
  - 4. UL 916, Standard for Energy Management Equipment.
  - 5. UL 917, Standard for Clock Operated Switches.
  - 6. UL 924, Standard for Emergency Lighting and Power Equipment.
  - 7. Washington State Energy Code
- C. Comply with NEC, NEMA, and FCC emission requirements for Class A applications.
- D. UL Approvals: Relay panels and accessory devices UL listed and labeled under UL 916. Custom relay panels UL listed and labeled under UL 508. Automatic load control relays UL listed and labeled under UL 924. Branch Circuit Emergency Lighting Transfer Switch UL listed and labeled under UL 1008.
- E. Certification: Manufacturer shall certify that products will meet product specifications and local energy codes. If any additional equipment is required to meet coverage patterns and local energy codes, provide additional equipment at no additional cost to the Owner.

### **1.03 DESIGN/PERFORMANCE REQUIREMENTS**

- A. Design, furnish, and install complete operable lighting control system(s) in accordance with the latest adopted editions of energy code and Owner requirements.
- B. Drawings reflect minimum Owner requirements. The Contractor's scope of work shall include but not limited to the following:
  - 1. Complete lighting control system based on the available architectural, civil, structural, mechanical and electrical drawings.

2. Wiring systems associated with lighting controls.
  3. Providing additional occupancy sensors, photo sensors, daylight sensors, low voltage switches, relays, dimming modules, UL 924 control devices, control panels, and power supplies associated with lighting controls system.
- C. Networked and Stand-Alone digital lighting controls shall accommodate the square-footage coverage requirements for each space controlled as indicated on the lighting zone control plans. Provide relays, control modules, dimming modules, occupancy sensors, switches, daylighting sensors, astronomical timeclocks, networking equipment and cabling, plug/load relays and controllers, contactors and accessories that suit the required lighting and electrical system parameters.

#### 1.04 SUBMITTALS

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data and maintenance data for each type of lighting control system and components. Include digital cable, analog cable, termination types, wire connectors, manufacturer specific back boxes/supporting equipment.
- C. Shop Drawings:
1. Floor plans showing wall occupancy sensors, light switches, relays, plug/load controllers, contactors, power supplies, dimming modules, network controllers, and mechanical control interface locations. Include typical installation and mounting diagrams for networking dimming and occupancy control devices. Above ceiling devices to be shown on the floor plans.
  2. Reflected ceiling plans showing occupancy sensors, daylighting sensor. Include typical installation and mounting diagrams for occupancy and daylighting control devices.
  3. Detailed point to point wiring diagrams.
  4. System one-line diagram showing panels, number and types of switches and sensors, and building energy management system interface.
  5. Request for engraved switch verbiage
  6. Drawings for each panel showing hardware configuration and numbering.
  7. Panel wiring schedules.
  8. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  9. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- D. Commissioning/Test Reports:
1. Field Test Reports.
  2. Commissioning Plan with Test Procedures.
- E. Closeout Submittals:
1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
  2. Operation and Maintenance Manual:
    - a. Include approved Shop Drawings and Product Data.
    - b. Engraved switch identification.
    - c. Include Sequence of Operation, identifying operation for each room/ space and accent lights.
    - d. Include manufacturer's maintenance information.

- e. Operation and Maintenance Data: Include detailed information on device programming and setup.
- f. Include startup and test reports.

#### **1.05 PROJECT CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
  - 1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
  - 2. Relative humidity: Maximum 90 percent, non-condensing.

#### **1.06 WARRANTY**

- A. Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Digital Lighting Control: Subject to compliance with requirements, Acuity n-Light, Wattstopper DLM, Osram Encelium, Intelligent Lighting Controls (ILC).
- B. Analog Lighting Control: Components with single use function, subject to compliance with requirements, Leviton, Sensor Switch, Lutron, Wattstopper, Hubbell.

#### **2.02 SYSTEM DESCRIPTION**

- A. Space Control System: Electrically operated, electrically supervised, lighting control system as described herein. Include control units, power supplies, relays, dimming output control devices, input control devices including occupancy sensors, photo sensors and control switches, wiring, cabling, conduit, fittings, and accessories required for a complete operating system.
- B. System Types (indicated in the contract documents):
  - 1. Digital control: Digital controllers for lighting zones, fixtures and/or plug loads. Provide controllers to match the lighting and plug load control requirements. System, control, and features include:
    - a. Stand-alone digital control system: Digital control within a single space to bind room loads to the connected control devices in the space. Control functions are limited to the devices connected to the stand alone digital control system.
      - 1) Self-configuring digital controller(s) with all digital parameter data programmed into non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
    - b. Networked digital control system: Digital control of devices visible through the network and capable of complete system control including scheduling, room device parameter administration, power monitoring, and reporting device status. The network will have a single user interface point to program or administer the system.
    - c. Digitally addressable control devices:
      - 1) On/Off control relays.
      - 2) Dimming control devices: 0-10V, phase dimming.
      - 3) Plug load control relays.
      - 4) Tunable control devices.

- d. Digital inputs:
  - 1) Occupancy sensors.
  - 2) Photo sensors.
  - 3) On/Off/Scene and dimming control switches.
  - 4) Partition sensors.
- e. Configuration tools: Allows complete configuration and reconfiguration of the Space. Must be able to tune system without the use of ladders.
- 2. Analog control: Single function analog devices to control lighting fixture and/or plug loads. Provide devices to match the lighting and plug load control requirements indicated in contract documents.
  - a. Analog control devices:
    - 1) Line voltage control devices receive input from analog low voltage control devices and include the following:
      - a) On/Off universal voltage power pack.
      - b) Plug load control on/off universal voltage power pack.
    - 2) Low voltage control devices provide inputs to line voltage control devices or directly to light fixtures and include:
      - a) Occupancy sensors.
      - b) Photo sensors.
      - c) Momentary contact On/Off Switches.
      - d) Occupancy sensor control switches W/ 0-10V dimming control where indicated.
- C. Comply with requirements in Section 260533 for raceways, Section 260519 for conductors and wiring, Section 260534 for outlet boxes, and Section 260529 for supports. System cabling requirements shall meet manufacturer standards.
- D. Open cabling methods may be utilized above accessible ceilings. All cabling in exposed areas, above inaccessible ceilings and in walls shall be installed in raceway.
- E. Control: The system shall have control devices to perform automatic and/or manual control functions indicated on the drawings and defined below. The control devices shall be capable of being controlled by any system input device type as well as by building control system DDC/BMS. The system shall also be capable of providing sequence of operations functions indicated on the drawings.
  - 1. Occupancy Sensor Control: Provide occupancy sensors for on/off control with manual dimming of light fixtures in as indicated on drawings. Control shall function as vacancy sensors with Manual-ON functionality or occupancy sensors with Automatic-ON functionality.
  - 2. Dimming Control Requirements: Provide automatic dimming for each light fixture in daylight areas and manual dimming zones as indicated on lighting zone control drawings.
  - 3. Manual On/Off Control: Provide control devices to turn on/off all light fixtures within manual control zones as indicated in the drawings.
  - 4. Daylighting Control Requirements: Provide daylight-responsive automatic control in all spaces where daylight contribution is available as defined by relevant local building energy code. See lighting control zone drawings for additional information:
    - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylighting zones.
    - b. Daytime set points for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with drawings and specifications.

- c. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system shall be designed to turn off electric lighting when daylight is at or above required lighting levels. Daylighting control system shall turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
- 5. Timeclock Control Requirements: Provide astronomical timeclock for on/off control based on time of day as indicated in drawings.
- 6. Plug Load control requirements: Provide control devices to energize/de-energize controlled receptacles as indicated in the drawings. Controlled receptacles are non-essential plug loads in spaces as required by the applicable energy code.

### 2.03 SYSTEM OPERATION

- A. Digital Control System shall include the following features:
  - 1. Occupancy Sensors: Digital wall/ceiling device or digital wall switch.
    - a. Calibration and configuration for the following variables:
      - 1) Sensitivity: 0-100 percent in 10 percent increments.
      - 2) Time delay: 1-30 minutes in 1 minute increments.
      - 3) Test mode: Five second time delay.
      - 4) Detection technology: PIR, Dual Technology activation and/or re-activation.
      - 5) Walk-through mode.
    - b. Programmable control functionality including:
      - 1) Each sensor may be programmed to control specific loads within a local network.
      - 2) Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
      - 3) On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use one of both technologies. Technologies include:
        - a) Ultrasonic or Microphonic.
        - b) Passive Infrared.
    - c. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal Hours (NH) and After Hours (AH) time periods.
    - d. Cable or wiring connections as required by the lighting controls systems.
    - e. Device Status LEDs including:
      - 1) PIR detection.
      - 2) Ultrasonic or Microphonic detection.
      - 3) Configuration mode.
    - f. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
    - g. Manual override of controlled loads.
  - 2. Dimming Control:
    - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

- b. The following dimming attributes may be changed or selected using a network interface or wireless configuration tool:
    - 1) Establish preset level for each load from 0-100 percent.
    - 2) Set high and low trim for each load.
    - 3) Normalize dimming curve for main ambient light fixtures of each space so they dim at the same rate.
  - c. Override button(s) for each load provides the following functions:
    - 1) Press and hold for dimming control (Dim Up).
    - 2) Press and hold for dimming control (Dim Down).
  - d. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
3. Daylight sensors:
- a. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
    - 1) Closed loop sensors measure the ambient light in the space and control a single lighting zone.
    - 2) Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
    - 3) Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
4. Plug Load Control:
- a. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
  - b. Default operation is Auto-on/Auto-off, based on timeclock signal for building hours of occupancy or local occupancy sensor.
5. Digital Push Button Switches:
- a. Programmable control functionality including:
    - 1) Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
    - 2) Individual button function may be configured to Toggle, On only or Off only.
    - 3) Individual scenes may be locked to prevent unauthorized change.
    - 4) Ramp rate may be adjusted for each dimmer switch.
    - 5) Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
    - 6) Button priority may be configured to any priority level corresponding to system operation allowing local actions to utilize life safety priority.
    - 7) Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
6. Digital Partition Control:
- a. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.

7. Device Status LEDs to indicate:
    - a. Data transmission.
    - b. Device has power.
    - c. Status for each load.
    - d. Configuration status.
  8. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
    - a. Turn on to 100 percent.
    - b. Turn off.
    - c. Turn on to last level.
  9. Each load be configurable to operate in the following sequences based on occupancy:
    - a. Auto-on/Auto-off.
    - b. 50% Auto-on/50%Manual-on/Auto-off.
    - c. Manual-on/Auto-off.
- B. Analog Control Devices shall include the following features:
1. Wall Occupancy Switch:
    - a. Manual On/Manual Off push button.
    - b. Dimmable push buttons with 0-10V dimming where indicated.
    - c. The following sequence:
      - 1) Time delay: 1-30 minutes in 1 minute increments.
      - 2) Test mode: Five second time delay.
      - 3) Detection technology: PIR, Dual Technology activation and/or re-activation.
  2. Wall Switch with ceiling occupancy sensor and power packs:
    - a. Manufacturers: Sensor Switch, Watt Stopper, Leviton, Hubbell, or approved.
    - b. Manual On/Manual Off momentary contact push button.
    - c. Dimmable push buttons with 0-10V dimming where indicated.
    - d. Sensors capable of operating normally with electronic ballasts/drivers, PL lamp systems, and rated motor loads.
    - e. Sensors dual technology which use passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound not acceptable.
    - f. Coverage of sensors remains constant after sensitivity control has been set. Automatic reduction shall not occur in coverage due to cycling of air conditioner or heating fans.
    - g. Sensors readily accessible with user adjustable settings for time delay and sensitivity.
    - h. Include bypass manual override on each sensor in event of failure. When bypass is utilized, lighting shall remain on constantly or control shall divert to wall switch until sensor is replaced. Control recessed to prevent tampering.
    - i. Include LED as continuous visual means of indication to verify that motion is being detected during both testing and normal operation.
    - j. Include internal additional isolated relay with NORMALLY OPEN, NORMALLY CLOSED, and COMMON outputs for use with HVAC control, data logging, and other control options.
    - k. The following sequence:
      - 1) Time delay: 1-30 minutes in 1 minute increments.
      - 2) Test mode: Five second time delay.
      - 3) Detection technology: PIR, Dual Technology activation and/or re-activation.

- I. Control wiring between sensors and control units shall be Class 2, No. 18 through No. 20 AWG, stranded, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

## 2.04 POWER REQUIREMENTS

- A. Include 120 VAC power for each controller and power supply.

## 2.05 EQUIPMENT

- A. Control Panels: Include power supply, relays, network equipment, dry contact inputs, dry contact outputs, 0-10V dimming modules pre-wired in a single NEMA 1 enclosure.
- B. Room Controllers (controls 8 or fewer outputs in a single enclosure): Include power supply, relays, network equipment, dry contact inputs, dry contact outputs, 0-10V dimming modules pre-wired in a single NEMA 1 enclosure. If multiple controllers/devices or pieces of equipment are located in a single space/room, provide custom enclosure with voltage barriers to enclose all of the devices and equipment.
- C. On/Off Control Relays: Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load mounted in lighting control panel.
- D. 0-10V Dimming Controller: The 0-10 V output controller compatible with 0-10V dimming driver/ballast and mounted in lighting control panel. 0-10V output shall automatically open upon loss of power to the Controller to assure full light output from the controlled lighting.
- E. On/Off/0-10V Dimming Control Module: On/Off and dimming to control one output or load.
  - 1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load.
  - 2. Dual Voltage (120/277 VAC, 60 Hz) capable rated for 3A total load used for single light fixture control.
- F. Phase Dimming Controllers: Forward phase 120V dimming modules with network communication functionality.
- G. Ceiling/Wall Occupancy Sensors: Features include the following:
  - 1. Finish White. Provide compatible wall plates with decorator opening.
  - 2. Sensors capable of operating normally with electronic ballasts/drivers, PL lamp systems, and rated motor loads.
  - 3. Detection technology: Dual Technology activation and/or re-activation.
  - 4. Time delay: 1-30 minutes in 1 minute increments.
  - 5. Test mode: Five second time delay.
  - 6. Coverage of sensors remain constant after sensitivity control has been set. Automatic reduction shall not occur in coverage due to cycling of air conditioner or heating fans.
  - 7. Sensors readily accessible with user adjustable settings for time delay and sensitivity.
  - 8. Include bypass manual override on each sensor in event of failure. When bypass is utilized, lighting shall remain on constantly or control shall divert to wall switch until sensor is replaced. Control recessed to prevent tampering.
  - 9. Include LED as continuous visual means of indication to verify that motion is being detected during both testing and normal operation.
  - 10. Include internal additional isolated relay with NORMALLY OPEN, NORMALLY CLOSED, and COMMON outputs for use with HVAC control, data logging, and other control options. Include additional auxiliary module if sensor doesn't have auxiliary contact.
  - 11. Provide additional detection devices as required for the space.

12. Provide sensors that can function at the same mounting height as the light fixtures including but not limited to the following areas:
    - a. Ceiling heights less than 12 feet.
    - b. Open ceiling areas of two or more stories.
    - c. High-bay areas.
    - d. Medium-bay areas.
  13. Analog Devices with Power Packs shall use power packs capable of automatic on or manual on.
- H. Wall Switch Occupancy Sensors:
1. Finish White. Provide compatible wall plates with decorator opening.
  2. Capable of operating normally with electronic ballasts/drivers, PL lamp systems, and rated motor loads.
  3. Detection technology: Dual Technology activation and/or re-activation.
  4. Time delay: 1-30 minutes in 1 minute increments.
  5. Test mode: Five second time delay.
  6. Coverage of sensors remains constant after sensitivity control has been set. Automatic reduction shall not occur in coverage due to cycling of air conditioner or heating fans.
  7. On/Off push button.
  8. Dim up/Dim down push button with 0-10V Dimming.
- I. Photo Sensors:
1. Finish: White. Provide compatible wall plates or ceiling plates with decorator opening.
  2. Sensor's internal photodiode shall only measure light waves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers. Sensor light level range shall be from 1-6,553 foot-candles (fc).
  3. Closed loop digital photo sensors shall include the following additional features:
    - a. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
    - b. Automatic self-calibration, initiated from the photo sensor, a wireless configuration tool or a PC with appropriate software.
    - c. Automatically establishes application-specific set points following self-calibration. For dimming operation, a sliding set point control algorithm with separate Day and Night set points shall prevent abrupt ramping of loads.
  4. Open loop digital photo sensors shall include the following additional features:
    - a. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
    - b. Automatically establishes application-specific set points following manual calibration using a wireless configuration tool or a PC with appropriate software. For dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
- J. Digital Control Switches:
1. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration.
  2. Finish: White. Provide compatible wall plates with decorator opening.
- K. Plug Load Control: 120 VAC, 60 Hz rated for 20A total load.
1. Automatic Load Control Relay: UL 20 rating for receptacle control.

- a. Digital relay connected to lighting control system provides ON/OFF control of plug loads within a space/zone via a programmable control relay.
- L. Timeclocks:
1. Manufacturer: Compatible with Control Panel, Intermatic ET2800C Series Time Switch or equivalent by Tork, Paragon, or approved.
  2. Description: Electronic, solid-state programmable type with alphanumeric display, astronomic feature, automatic daylight savings time reset, 100 hour capacity, carry over, two channel unless indicated otherwise, 24 hour and 365 day calendar, skip-a-day, manual HOA override. Appropriate enclosure suitable for installation.
  3. Contact Rating: 20 Amp resistive/general purpose, 10 Amp electronic ballast (LED) unless indicated otherwise.
- M. Exterior Photo Cell:
1. Manufacturers: Compatible with Lighting Control Panel Long Life EK4136S Series or equivalent by Tork, Intermatic or approved.
  2. Description: Weatherproof, electronic photo diode to operate in temperature range of minus 30 F to plus 140 F. Light level range of 1.5 "on" to 6 foot-candles "off" with manually adjustable level slide for off and on levels. Time delay of 2-5 seconds minimum to minimize false operation. Conduit wired stem mounting. Manually adjustable level slide. Rating of 6 Amps electronic ballast (LED) at rated Voltage. Compatible with lighting control system.
- N. Contactors:
1. Manufacturer: Square D 8903 Series or equivalent by ASCO, Eaton/Cutler Hammer, GE, Siemens or approved.
  2. Description: Electrically operated and mechanically electrically held type of types, sizes, and ratings as indicated in the Contract Drawings, 30 Amp, 6-pole minimum. Include auxiliary devices and contacts as indicated on the Contract Drawings, two normally-open contacts minimum. Appropriate enclosure listed for installation.
  3. Short Circuit Withstand (SCCR) Rating: Equal to or exceeding the available fault current at the upstream panelboard.
  4. Comply with requirements in Section 230900 for control of receptacle and lighting system as part of building energy management system. Provide hardware interface to enable the BAS to monitor and control receptacle and lighting contactors.
    - a. Monitoring: On-off status.
    - b. Control: On-off operation.
- O. Network Communication Equipment: System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies. Hardware compatible with lighting controls systems that provides the following functions:
1. Facilitation of global network communication between different areas and control zones.
  2. Time-based control of downstream wired and wireless network devices.
  3. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
  4. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
  5. Device shall have a standard and astronomical internal time clock.
  6. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
  7. Shall be capable of connecting to the customers Local Area Network (LAN) via IEEE 802.11.x Wireless and IEEE 802.3 Wired connection.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

#### **3.02 PRE-INSTALLATION MEETINGS**

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, A/E, Commissioning Agent, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
  - 1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
  - 2. Review the specifications for low voltage control wiring and termination.
  - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
  - 4. Review interface with Division 23 Controls including list of BACnet integration points, schedules and responsibilities.
  - 5. Discuss requirements for integration with other trades.
- C. Inspect and make notes of job conditions prior to installation:
  - 1. Record minutes of the conference and provide copies to all parties present.
  - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.

#### **3.03 PRE-INSTALLATION TRAINING**

- A. Prior to installation, post submittal, the manufacturer shall provide an on-site training session for the contractor. This is a mandatory meeting for the installing contractor to attend and is to be scheduled by the contractor. Notify A/E two weeks prior to meeting date. Manufacturer to provide agenda and Contractor to provide meeting minutes and attendance list.

#### **3.04 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.
- C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

#### **3.05 INSTALLATION**

- A. Install system in accordance with the drawings, this section, Sections 260511, 260519, 260553, 262726, applicable codes and manufacturer's recommendations. Install wiring in compliance with NEC for power and non-power limited signaling circuits. Upon completion, certify in writing to the Owner and general contractor that system has been installed in compliance with NEC.

- B. Lighting Control Equipment:
1. Room Controllers/Control Panels: Install where indicated on the plans. Provide 120V power supply and circuit as indicated on the plans, if no circuit is indicated circuit with load on relay 1.
  2. On/Off/0-10V Control Modules:
    - a. Remote Modules: Install remote mounted control modules in accessible location. Where possible mount to junction box connected to first light fixture in the lighting control zone.
    - b. Centrally located Control Modules: Two or more control modules mounted in a single location, install control units in a single enclosure with voltage barriers.
  3. 0-10V Dimming Controllers: Install in room controllers/control panels where possible. Mount in NEMA 1 enclosure above entry doorway into space and in an accessible location where modules are providing control.
  4. Phase Dimming Controllers: Install in electrical rooms.
  5. Ceiling/Wall Occupancy Sensors: Install where indicated on the drawings and as required to provide complete coverage based on shop drawings layouts.
    - a. Open to structure overhead sensors mount at same height as light fixtures.
  6. Wall Switches: Mounting height to match switches in Section 260519.
  7. Photo Sensors: Mount per manufacturer recommendations in locations indicated on shop drawings.
  8. Network Communication Equipment: Install in main electrical room.
- C. Digital devices: Connect together with manufacturer approved low voltage network wiring.
1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
  2. Low voltage wiring topology must comply with manufacturer's specifications.
  3. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- D. Test conductors for ground conditions before making final wiring connections. Comply with requirements in Section 260526.
- E. Maintain wiring color code throughout installation. Include color code identification in the Operation and Maintenance Manual.
- F. Coordinate with appropriate subcontractors for installation of equipment and devices that pertain to other work in the contract.
- G. Clean dirt and debris from inside and outside of the equipment after completion of installation.
- H. All line voltage connections shall be tagged to indicate circuit and switched legs.
- I. Test all devices to ensure proper communication.
- J. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- K. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
1. Sensor parameters, time delays, sensitivities, and daylighting set points.
  2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.).
  3. Load Parameters (e.g. blink warning, etc.).
  4. Normalized dimming in lighting control system to match dimming curve of each space main ambient light fixtures.

- L. Post Start-up Tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy.
- M. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- N. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- O. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to controllers.

### **3.06 INTERIOR LIGHT LEVEL SET POINTS**

- A. Light Levels: Measurements shall be made in accordance with the methods set forth in Section 9.15 of the IES handbook, 10<sup>th</sup> Edition.
  - 1. Measure all spaces/areas identified with a light level set points.
  - 2. Set dimming level of light fixtures so the maximum light output matches the light level set point.
  - 3. Photo sensors:
    - a. Daylight Zones:
      - 1) Automatic dimming of light fixtures in primary/secondary daylight zones to maintain illumination levels indicated on Contract Drawings.
      - 2) Automatically turn off light fixtures when daylight illumination exceeds maintained illumination levels.
      - 3) Light fixture shall dim to driver/ballast lowest rated light output prior to switching off.
    - b. Non-Daylight zones:
      - 1) Automatic dimming of light fixtures in control zones to maintain light level set point indicated on Contract Drawings.

### **3.07 OCCUPANCY SENSOR SETTINGS**

- A. Ceiling and wall mount occupancy/vacancy sensor time delay settings of 20 minutes except spaces below or indicated otherwise in the drawings:
  - 1. Public/Student Restroom – Shall be adjusted to 15 minutes.
  - 2. Corridors – Shall be adjusted to 30 minutes.
  - 3. Offices/Conference Rooms – Shall be adjusted to 15 minutes.
  - 4. Work/Storage/Custodial Spaces – Shall be adjusted to 5 minutes.
  - 5. IDF/MDF Rooms – Shall be adjusted to 30 minutes.

### **3.08 EXTERIOR PHOTOCELL INSTALLATION**

- A. Mount on building roof facing north, away from spill light influence.
- B. Set for appropriate on and off foot-candle levels.

### **3.09 IDENTIFICATION**

- A. Identify components, power and control wiring according to Division 26 Section "Electrical Identification".
- B. Identify controlled circuits in Directory Cards.
- C. Provide engraved nameplate to identify time switches and contactors with a unique designation.

- D. Provide engraved push buttons on digital switches, confirm switch labels with owner.
- E. Provide printed labels on ceiling tiles or grid runners below all above ceiling mounted control devices.
- F. Provide printed labels on Control Relays and modules to indicate controlled loads.

### **3.10 CONTRACTOR COMMISSIONING**

- A. Upon completion of initial contractor self-commissioning, the contractor shall coordinate system commissioning by the manufacturer's factory authorized representative who shall verify the system is complete and fully functional.
- B. Provide computer generated documentation on the commissioning of the system with room by room description including:
  - 1. Sensor parameters, time delays, sensitivities, daylighting set points.
  - 2. Sequence of operations (e.g. Manual On, Auto OFF, etc.).
  - 3. Load Parameters (e.g. blink warning, etc.).
  - 4. Re-commissioning – After 30 days from occupancy, recalibrate occupancy/vacancy sensor time delay settings, occupancy/vacancy sensor sensitivity settings and photo sensor light level settings. Provide detailed report to A/E for review.

### **3.11 COMMISSIONING SUPPORT**

- A. Factory technician shall be on-site to support the enhanced commissioning process.

### **3.12 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
  - 1. Verify Class I and II wiring connections are terminated properly by validating system performance.
  - 2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
  - 3. Verify/complete task programming for all switches, dimmers, time clocks, and sensors.
  - 4. Verify that the control of each space complies with the Sequence of Operation.
  - 5. Correct any system issues and retest.
- C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
  - 1. Date of test or inspection.
  - 2. Loads per space, or Fixture Address identification.
  - 3. Quantity and Type of each device installed.
  - 4. Reports providing each device's settings.

**3.13 DEMONSTRATION AND TRAINING**

- A. Before Substantial Completion, arrange and provide a one-day (8 hour) Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instructions includes:
  - 1. Confirmation of entire system operation and communication to each device.
  - 2. Confirmation of operation of individual relays, switches, and sensors.
  - 3. Confirmation of system Programming, photocell settings, override settings, etc.
  - 4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.
- B. Provide additional one-day (8 hour) site visit for on additional training and site tuning 60-90 days after occupancy.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes switchboards, disconnect switches, transformers, panelboards, and associated appurtenances used for service entrance equipment as specified in applicable Division 26 sections and are included as work of this section. Extent of service entrance work is indicated on the Drawings and schedules.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.
- C. Consult local utility company relative to costs for line extensions, connections, and similar requirements and include those costs for bringing service to facility in base bid. Confirm location of point of service before bidding.
- D. Include labor and materials required to accomplish local utility company metering in accordance with power company standards and requirements.
- E. Include concrete pads of size and type required for service transformers. Verify location, size, openings, reinforcing requirements with local utility company before beginning work. Comply with local utility company clearance requirements.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Comply with NEC and NEMA standards as applicable to construction and installation of service entrance equipment and accessories. Provide service entrance equipment and accessories which are UL listed and labeled, and equipment marked, "Suitable for use as Service Equipment".

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for service entrance equipment and appurtenances.
- C. Shop Drawings: Submit dimensioned layouts of service entrance equipment and spatial relationships to proximate equipment.
- D. Test Reports:
  - 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

## **PART 2 PRODUCTS**

### **2.01 SERVICE ENTRANCE EQUIPMENT**

- A. General: Include service entrance equipment and accessories, of type, sizes, ratings, and electrical characteristics indicated on the Drawings, which comply with manufacturer's standard materials, design, and construction in accordance with published product information, as required for complete installation, and as specified in this section.

### **2.02 OVERCURRENT PROTECTIVE DEVICES**

- A. Overcurrent Protective Devices: Comply with requirements in Section 262813 and as indicated on the Drawings.

- B. Meter Sockets: Include remote meter sockets which comply with requirements of local utility company supplying electrical power to service entrance equipment of building project. Coordinate exact location of remote meter prior to bid and include costs in base bid.

### **2.03 RACEWAYS, WIRES, AND CABLES**

- A. Raceways: Comply with requirements in Section 260533.
- B. Wires and Cables: Comply with requirements in Section 260519.
- C. Wall and Floor Seals: Comply with requirements in Section 260533.

### **2.04 METER PEDESTAL CONTROL CENTER**

- A. Manufacturer: Milbank or approved equal
- B. Meter Sockets: 1 ring type socket with test bypass facility
- C. Voltage: 120/240V, 1 Phase, 3 Wire
- D. Distribution:
  - 1. (1) Main circuit breaker
  - 2. (2) 16 circuit load centers
- E. Enclosure: CP3B – 16"W x 17"D x 48"H (Single), NEMA 3R
- F. Options:
  - 1. Provide with integral time clock and photocell for lighting control.

### **2.05 SWITCHBOARDS**

- A. Comply with requirements in Section 262413.

### **2.06 DISCONNECT SWITCHES**

- A. Comply with requirements in Section 262816.

### **2.07 PANELBOARDS**

- A. Comply with requirements in Section 262416.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

**3.04 SERVICE ENTRANCE EQUIPMENT INSTALLATION**

- A. Install service entrance equipment as indicated on the Drawings, in accordance with manufacturer's written instructions, and with recognized industry practices to ensure that service entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.
- B. Coordination with other work, including local utility company wiring necessary to interface installation of service entrance equipment work with other work.
- C. Install floor standing service equipment on 4 inch high concrete pad. Comply with requirements in Section 260510.

**3.05 GROUNDING**

- A. Install grounding and bonding connections for service entrance equipment and conductors. Comply with requirements in Section 260526.

**3.06 ADJUST AND CLEAN**

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred enclosure surfaces to match original finishes.

**3.07 FIELD QUALITY CONTROL**

- A. Upon completion of installation of service entrance equipment and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Repair malfunctioning units on site, then retest to demonstrate compliance. If not possible to repair on site, remove and provide new units and retest. Include copy of field test reports in the Operation and Maintenance Manual.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes panelboards for lighting and appliances, distribution circuits, and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. NEMA PB-1, Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
  - 2. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 3. NEMA FU 1 – Low Voltage Cartridge Fuses.
  - 4. NFPA 70, National Electrical Code (NEC).
  - 5. UL 90 – Enclosed and Dead-front Switches.
  - 6. UL 248 – Low Voltage Fuses.
- C. Units UL listed and labeled. Comply with NEC as applicable to panelboards and cabinets. Comply with requirements in NEMA 1 and NEMA 250.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data:
  - 1. Submit manufacturer's technical product data, installation instructions, maintenance data, and general recommendations for each type of panelboard and appurtenance.
  - 2. Include dimensioned drawings of panelboards and enclosures showing scaled layouts of enclosures and required individual panelboard devices, including circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, accessories, and similar items.
- C. Test Reports:
  - 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

### **1.04 SPARE MATERIALS**

- A. Deliver 6 keys for panelboard enclosures to the Owner.

## **PART 2 PRODUCTS**

### **2.01 PANELBOARDS**

- A. Manufacturers: Square D, Eaton/Cutler Hammer, or approved.
- B. General:
  - 1. Except as otherwise indicated on the Drawings, panelboards, enclosures and ancillary components of types, sizes, and ratings indicated. Include number of unit panelboard devices for complete installation. Include "spaces" with hardware to receive breaker or switch of size indicated. Include CU/AL rated lugs of size to accommodate conductors shown on the Drawings and specified in Section 260519.

2. Include separate ground busbar for panels supplying isolated ground circuits.
  3. Include feed through or double lugs with amperage equal to incoming feeder amperage unless indicated larger on the Drawings.
- C. Short Circuit Interrupting Rating: Fully-rated for available fault current indicated on Contract Drawings. Refer to Section 262813 for additional requirements.
- D. Lighting and Appliance Panelboards: Dead-front safety type with switching and protective devices in quantities, ratings, types, and arrangement indicated on the Drawings. Include bolt-on thermal magnetic type branch breakers. For multiple breakers, include common trip handle. Include copper bus bars, full-sized neutral bus, ground bus, and isolated ground bus as required.
- E. Service and Power Distribution Panelboards: Dead-front safety type with switching and protective devices in quantities, ratings, types and with arrangement indicated on the Drawings. Include copper bus bars, full-sized neutral bus, and ground bus. Include fusible or circuit breaker branch and main devices indicated on the Drawings. Comply with requirements in Section 262813 for overcurrent protective devices.
- F. Panelboard Enclosures:
1. Flush or surface as indicated on the Drawings. Tight closing doors without play when latched. Where 2 cabinets are located adjacent to each other in finished areas, include matching trim of same height.
  2. Include lock for each cabinet door. Electrical distribution equipment locks common keyed.
  3. Door within door – Fasten panelboard front with machine screws. Provide continuous piano hinge on right side of outer door with door latches/locks on left side. Provide second door over dead front with continuous piano hinge on right side with door latches/locks on left side.
  4. Factory prime coat finish for cabinets located in finished areas. Where cabinets are located in unfinished areas, standard lacquer or enamel finish, gray or blue-gray color acceptable for factory finish coat.
- G. Identification: Comply with requirements in Section 260553.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

#### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

#### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### **3.04 PANELBOARD INSTALLATION**

- A. Install panelboards and enclosures where indicated on the Drawings in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure products fulfill requirements.
- B. Secure in place with top of cabinet at 6'-0", unless otherwise noted on the Drawings. Top of cabinet and trim level. Anchor cabinets directly or with concealed bracing to building structure. When panels are not located in or directly on a wall, provide support frame of formed steel channel anchored to floor and ceiling structure. Interior components not installed until structure is totally enclosed. Where panels are mounted adjacent to each other, top edges at same height.
- C. Bolt floor standing distribution panelboards to concrete base. Comply with requirements in Section 260510 for concrete bases and Section 260548 for seismic restraints.

### **3.05 CIRCUIT INDEX**

- A. For each branch circuit panelboard, prepare typewritten index listing each circuit in panelboard by number with load designation. Install within a transparent protective cover inside cabinet door. Listing shall match circuit breaker arrangements, typically with odd numbers on left and even numbers on right. Room numbers used shall be final room numbers used in building as verified with the Owner and not room numbers indicated on the Drawings.

### **3.06 FIELD QUALITY CONTROL**

- A. Comply with requirements in Section 260810. Include copy of field test reports in the Operation and Maintenance Manual.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes wall switches, receptacles, device plates, box covers, and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. Federal Specification W-C-596, Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
  - 2. Federal Specification W-S-896, Switch, Toggle.
  - 3. NEMA WD 1, General Color Requirements for Wiring Devices.
  - 4. NFPA 70, National Electrical Code (NEC).
  - 5. UL 498, Standard for Attachment Plugs and Receptacles.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data for each type of wiring device and appurtenance.
- C. Test Reports:
  - 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

## **PART 2 PRODUCTS**

### **2.01 WALL SWITCHES**

- A. Manufacturers: Leviton, Bryant Electric, Hubbell, Pass and Seymour, or approved. Leviton model numbers are listed.
- B. Finish: White.
- C. Wall Switches for Lighting Circuits: NEMA WD 1. General use snap switch with colored toggle handle rated 20 Amps and 120/277 Volts AC. Switch with back and side wired screw type terminals. Units specification grade.
  - 1. Single-Pole Toggle Switch: Leviton Model 1221-2.
  - 2. Double-Pole Toggle Switch: Leviton Model 1222-2.
  - 3. Three-Way Toggle Switch: Leviton Model 1223-2.
  - 4. Four-Way Toggle Switch: Leviton Model 1224-2.
- D. Pilot Light Type: Red pilot handle. Handle lighted when switch is ON. Rating same as for wall switches. Leviton Model 1221-PLR (120V)/1221-7PR (277V).
- E. Lighted Handle Type: White pilot handle. Handle illuminated when switch is OFF. Rating same as for wall switches. Leviton Model 1221-LHW (120V)/1221-7LW (277V).

- F. Momentary Contact Line Voltage Switches: Single pole, double throw, 3-wire, normally open. Rating same as for wall switches. Leviton Model 1257.
- G. Weatherproof: Switches mounted in a cast metal box with gasketed, weatherproof device plate.
- H. Multipurpose Push Button Switches: Molded Polycarbonate housing with stainless steel back plate. ADA compliant. Safety Technology International, Inc. or approved.
  - 1. Emergency Power Off – Yellow shell, Stopper Station Shield, Push button off/Twist to reset, Raised molded message to read “EMERGENCY POWER OFF” - STI #SS-2221PO.
  - 2. Emergency Gas Shut-off – Yellow shell, Stopper Station Shield, Push button off/Twist to reset, Raised molded message to read “EMERGENCY GAS SHUT-OFF” - STI #SS-2221 Custom Text.

## **2.02 LED WALL DIMMERS**

- A. Manufacturers: Leviton, Lutron, Bryant Electric, Hubbell, Pass and Seymour, or approved. Leviton model numbers are listed.
  - 1. Architectural Slide Dimmers:
    - a. Leviton Model IP710-LF
- B. Finish: White.
- C. Voltage: 120 Volts.
- D. Power Rating: Match load shown on the Drawings. 1200 Watts @ 120V and 1500 Watts @ 277V minimum.
- E. Accessory Wall Switch: Match dimmer appearance.

## **2.03 LOW VOLTAGE CONTROL**

- A. Manufacturer: General Electric, Square-D, Cutler Hammer, Siemens, or approved.
  - 1. Relays: General Electric Type RR-7.
  - 2. Switches: General Electric Type RTS-5.
  - 3. Transformers: General Electric Type RT1 and RT2.
  - 4. Rectifiers: General Electric Type RA16.
  - 5. Device Plates: As specified in Article “Device Plates”.
  - 6. Finish: White.
- B. Wire: Copper conductor for low voltage control purpose furnished by supplier of low voltage relays and switches.

## **2.04 RECEPTACLES**

- A. Manufacturers: Leviton, Bryant Electric, Crouse Hinds, Hubbell, Pass and Seymour, or approved. Leviton model numbers are listed.
- B. Finish: White.
- C. Convenience and Straight-Blade Receptacles: NEMA WD 1. Units specification grade.
- D. Convenience Receptacle Configuration: (20A-125V NEMA 5-20R) straight blade with grounding type with, back and side wired screw type terminals.
  - 1. Duplex Receptacle: Leviton Model 5362.
  - 2. GFCI Receptacles: Duplex convenience receptacle with integral ground fault circuit interrupter. Units feed-through type for downstream device protection. Leviton Model GFNT2.

- E. Controlled Receptacle:
  - 1. Finish: Green
  - 2. Leviton Model 5362-S2N.
  - 3. Split Wire: Leviton Model 5362-S1N
  - 4. GFCI: Leviton Model 308-G5362-2TN
- F. Weather Resistant Receptacles: Receptacles mounted in a cast steel box with gasketed, weatherproof device plate. Leviton GFWT2.
- G. Specific Receptacle Configuration: NEMA WD 1. Type as indicated on the Drawings, with black plastic face.
- H. Note: Designer to coordinate specific rating requirements and manufacturer options

## **2.05 DEVICE PLATES**

- A. Manufacturers: Bryant Electric, Hubbell, Leviton, Pass and Seymour, or approved. Bryant Electric and Leviton model numbers are listed.
- B. Plates in Finished Areas: Type 302 non-magnetic stainless steel except as noted below:
  - 1. Wall plates for isolated ground receptacles to be with 1/4 inch specially engraved black letters "COMPUTER ONLY".
  - 2. Wall plates for dedicated receptacles with 1/4 inch specially engraved black letters "DEDICATED".
  - 3. Wall plates for receptacles protected by a GFCI circuit breaker or feed through GFCI receptacle with 1/4 inch specially engraved black letters "GFCI PROTECTED". Leviton 84003-G40.
  - 4. Wall plates for receptacles other than NEMA 5-20R with 1/4 inch specially engraved black letters which show ampere rating, voltage, and phase.
- C. Plates on Surface Mounted Boxes: Sized to fit box without extending over sides of box.
- D. Cast Metal Plates: Cast metal box. Steel plates with steel boxes and copper-free aluminum with aluminum boxes. Stainless steel screws.
- E. Raised Sheet Steel Plates: 1/2 inch high zinc or cad-plated covers with surface mounted sheet steel boxes.
- F. Weather Resistant Cover Plate:
  - 1. While In-Use Cover: Cast metal with hinged gasketed device covers. Leviton IUM1V-GY unless otherwise noted.
  - 2. Not In-Use Cover: Cast metal with hinged gasketed device covers. Leviton WM1V-GY, only where noted on contract drawings.
- G. Finish of Attachment Screws: Match that of its respective device plate.

## **PART 3 EXECUTION**

### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.

- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

### **3.04 WIRING DEVICE INSTALLATION**

- A. Install wiring devices in clean electrical boxes, free from excess building materials, dirt, and debris.
- B. Install jumbo size plates for outlets in masonry walls.
- C. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- D. Install devices and wall plates flush and level.
- E. Fasten each device to outlet box at wall surface to bring receptacle flush with plate or for switch handle the proper distance through plate.

### **3.05 ORIENTATION**

- A. Install switches vertical with handle operating vertically, up position "ON". Install center at 44 inches above finished floor unless noted otherwise on the Drawings.
- B. Install receptacles vertical with ground slot up centered at 18 inches above finished floor and 6 inches above counters.
- C. Install exterior receptacles vertical with ground slot up centered at 18 inches above finished grade.

### **3.06 RECEPTACLE GROUNDING**

- A. Install bare bonding wire between receptacle grounding terminal and box. Plaster ear screws connecting frame to box not acceptable for grounding.

### **3.07 HANDICAPPED ACCESS**

- A. Comply with requirements of Washington State Handicapped Access Code.

### **3.08 FIELD QUALITY CONTROL**

- A. Comply with requirements in Section 260810. Include copy of field test reports in the Operation and Maintenance Manual.
- B. Prior to energizing circuitry, test wiring devices for electrical continuity and polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

**END OF SECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description: Work includes overcurrent protective devices for operation at 600 Volts and below, including circuit breakers and fuses as individual components in separate enclosures and for installation as integral components of switchboards and panelboards and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

**1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards: NFPA 70, National Electrical Code (NEC).
- C. Comply with NEMA and ANSI standards as applicable to construction and installation of overcurrent protective devices.

**1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.
- C. Shop Drawings: Include layouts of circuit breakers with spatial relationships to proximate equipment.
- D. Closeout Submittals:
  - 1. Written confirmation that all circuit breaker settings were adjusted to match the power studies final report.
- E. Test Reports:
  - 1. Field test reports.
  - 2. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

**1.04 EXTRA MATERIALS**

- A. Fuses: For each type and rating, furnish additional fuses amounting to 1 unit for every 5 units installed, but not less than 2 units of each size and type.
- B. Spare Fuse Cabinet: Provide one, sized to house spare fuses provided under this contract plus 25% additional space for future.
- C. Electronic Trip Unit Test Set: Furnish one set, including associated software, capable of testing each circuit breaker type.

**PART 2 PRODUCTS**

**2.01 MANUFACTURER**

- A. Circuit Breakers: Square D, Eaton/Cutler Hammer, General Electric, Siemens or approved. Circuit breaker manufacturer shall be same as panelboard and switchboard manufacturer when installed therein.
- B. Fusible Circuit Breakers: Bussmann Mfg. Co.

- C. Fuses: Bussmann Mfg. Co. or Mersen Electrical Power. No substitutions. Fuses shall be by one manufacturer.

## 2.02 CIRCUIT BREAKERS

A. General:

1. UL 489 fixed mounted molded case type with unless indicated otherwise.
2. Overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication.
3. Common trip for two and three pole circuit breakers. Handle ties, manufactured by circuit breaker manufacturer, permitted for multi-wire branch circuits on approval of samples.
4. Trip ratings imprinted on handle or visible through deadfront cover.
5. Constructed for mounting and operating in any physical position and calibrated for operation in ambient temperature up to 40 C.
6. Mechanical screw type removable connector lugs, AL/CU rated, to accommodate conductors specified. Rated for 75 C conductors for 60 Amp and larger circuit breakers.
7. Amperage and Voltage as indicated.
8. Short circuit rating: RMS interrupting rating as indicated. Minimum 10,000 AIC rating at 120, 208 and 240 Volts. Minimum 14,000 AIC rating at 277 and 480 Volts.
9. Ground Fault Interrupter (GFI) circuit breakers: Equipped with integral ground fault interrupter set to trip on ground fault of thirty milliamps or greater.
10. Ground Fault Circuit Interrupter (GFCI) circuit breakers: Equipped with integral Class A ground fault circuit interrupter set to trip on ground fault of six milliamps or greater.
11. Arc Fault Circuit Interrupter (AFCI) where indicated.
12. Switching rated for 120 Volt and 277 Volt lighting branch circuits.
13. HACR rating where serving air conditioning and refrigeration equipment.
14. Current limiting, utilizing non-fuse type current limiting, where indicated.
15. Tandem-mounted circuit breakers not acceptable.
16. Minimum Frame Size: To match trip rating, unless indicated otherwise.
17. Keyed Interlocks: Externally-mounted and arranged to prohibit interlocked circuit breaker operation, except in a specified sequence. Include mountings and hardware. Provide nameplates at each keyed interlock indicating interlocked circuit breaker and sequence of operation.
18. Zone-Selective Interlocking: Integral with ground fault trip unit for interlocking ground fault protection function.
19. Arc Energy Reduction: Provide energy-reducing maintenance switch with local status indicator for use as a temporary arc-flash incident energy-reduction device during maintenance activities. Provide for each circuit breaker with a frame size 1200 Amps and larger and as indicated.
  - a. Provide a manual switch on the compartment door to switch the circuit-breaker short-time tripping characteristics to instantaneous with minimum pickup setting, to reduce the danger from potential arc-flash at downstream equipment.
  - b. Provide a lock feature for the switch so that it may be locked in either the off or on maintenance-mode position.
  - c. Provide a blue LED indicating light to indicate that the switch is in maintenance mode.
  - d. Provide dry relay contacts on each switch for annunciation of the switch position.

## 2.03 TRIP UNITS

- A. General:
  - 1. Thermal magnetic unless indicated otherwise.
  - 2. Electronic Trip Unit: Required for circuit breakers:
    - a. Sized 400 Amps and larger on 480 Volt systems.
    - b. Sized 800 Amps and larger on systems 250 Volts and lower.
    - c. Sized 100 Amps and larger serving emergency and legally-required standby systems and equipment.
    - d. Power circuit breakers.
    - e. Insulated case circuit breakers.
    - f. Where indicated or specified.
    - g. Where required by the Selective Coordination Study.
- B. Thermal Magnetic Trip Unit: Adjustable magnetic trip setting for sizes 250 Amps and larger.
- C. Electronic Trip Unit: Field-replaceable rating plug. RMS sensing Microprocessor-based, programmable, time-current shaping adjustments; complete with current transformers and sensors and the following features:
  - 1. Programmable functions independent of each other in both action and adjustment.
  - 2. Adjustable settings:
    - a. Instantaneous trip; long and short-time time adjustments; long and short-time pickup adjustments.
    - b. Where ground fault protection indicated, ground fault pickup level, time delay and I<sup>2</sup>t response.
    - c. Built-in test points for testing the long time, short time, delay, instantaneous, and ground fault functions of the circuit breaker.
  - 3. Trip Indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.

## 2.04 FUSES

- A. General:
  - 1. Fuses of type, sizes, ratings, and electrical characteristics of single manufacturer.
  - 2. Fuses labeled UL Class L, UL Class R, current limiting, rated for up to 200,000 Amps.
- B. Where fuses are shown on the Drawings feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing. Adjust fuse size and type to comply with manufacturer's recommendation.
- C. Main Service, Feeder and Branch Circuit Fuses:
  - 1. For fuse ratings over 600 Amps: UL Class L (KRP-C or A4BY).
  - 2. For fuse ratings up to 600 Amps: UL Class RK1 (KTN-R, KTS-R or A2K-R, A6K-R).
  - 3. Feeder or branch circuit directly feeding motors, transformers, and other inductive load: UL RK5 time delay (FRN-R, FRS-R or TR-R or TRS-R).
  - 4. Other Branch Circuits: UL Class RK1, (KTN-R, KTS-R or A2K-R, A6K-R).

## **PART 3 EXECUTION**

### 3.01 INSPECTION

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

**3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

**3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

**3.04 CIRCUIT BREAKERS**

- A. Install in panelboards, switchboards and enclosures, in accordance with the manufacturer's recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards.
- B. Install handle ties for multiwire branch circuits per Section 260519.
- C. Device Settings: Adjust in accordance with the Electrical Power Studies report from Section 260573, including but not limited to the following:
  - 1. Circuit Breakers.
  - 2. Zone selective interlocking.

**3.05 FUSES**

- A. Install fuses in switches, panelboards, switchboards and enclosures. Install fuses so current rating is visible from front when cover is open.
- B. Do not install until equipment is ready to be energized.
- C. Coordinate with equipment furnished by others for proper fuse type and size.
- D. For motor and equipment circuits, fuse sizes shown on the Contract Drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) for nuisance free tripping. Adjust fuse size for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times.

**3.06 FIELD QUALITY CONTROL**

- A. Test circuit breakers as specified in Section 260810.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- A. Description: Work includes disconnect switches, enclosed circuit breakers and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to Work in this section.

### **1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards:
  - 1. NFPA 70, National Electrical Code (NEC).
  - 2. UL 98, Enclosed and Dead-Front Switches.

### **1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data and maintenance data for each type of equipment and appurtenance. Include equipment characteristics such as ratings, enclosure type, dimensions and weight.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURER**

- A. Disconnect Switches and Enclosed Circuit Breakers: Square D, Eaton/Cutler Hammer, General Electric, Siemens, or approved.

### **2.02 GENERAL**

- A. Ratings: Voltage, Amperage and horsepower rating suitable for circuit and equipment controlled. Service entrance rated where indicated or required.
- B. Enclosures: Surface-mounted.
  - 1. NEMA Type 1, in general.
  - 2. NEMA Type 3R where exposed to moisture and where shown on the Drawings.
- C. Accessories:
  - 1. Padlockable in "OFF" position.
  - 2. Labeled "ON"/"OFF" position.
  - 3. Ground lug.
  - 4. Neutral lug where applicable.
  - 5. Other accessories as indicated.
- D. Nameplates: Per Section 260553.

### **2.03 DISCONNECT SWITCHES**

- A. General: Heavy duty, UL 98, horsepower rated with external handle.
- B. Interlock: Defeatable door interlock that prevent door from opening when operating handle is in "ON" position.
- C. Fusible or non-fusible as indicated. Fuse rejection clips where Class R fuses are specified.

- D. Quick-make, quick-break mechanism. Visible blades.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

#### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

#### **3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE**

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Comply with applicable requirements of NEC, NEMA and NECA standards, and with recognized industry practice. Where these may be in conflict, the more stringent requirements govern.
- B. Install where indicated on the Contract Drawings and where required. Mount independent of equipment served; do not attach to equipment served.
- C. Coordinate installation work with electrical raceway, wire, and cable work as necessary for proper interface. Comply with requirements in Section 260533.
- D. Install within sight of equipment or controller served.
- E. Where locations are not shown on Contract Drawings, locate on wall adjacent to equipment being served or on formed steel channel frame at face of equipment. Coordinate location to maintain equipment clearances.

#### **3.04 FIELD QUALITY CONTROL**

- A. Comply with requirements in Section 260810. Include copy of field test reports in the Operation and Maintenance Manual.

**END OF SECTION**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Description: Work includes packaged diesel engine-generator sets for emergency or standby power supply as indicated on the Drawings with unit mounted cooling system, unit mounted control and monitoring, outdoor enclosure and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 sections apply to work in this section.

1.2 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable city, county and state codes and ordinances.
- B. Codes and Standards:
  - 1. ASCE 7, Minimum Design Loads for Buildings and Other Structures.
  - 2. ASME B15.1, Safety Standard for Mechanical Power Transmission Apparatus.
  - 3. NEMA AB1, Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.
  - 4. NEMA ICS 6, Industrial Controls and System Enclosures.
  - 5. NEMA MG-1, Motors and Generators.
  - 6. NEMA 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
  - 7. NFPA 30, Flammable and Combustible Liquids Code.
  - 8. NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
  - 9. NFPA 70, National Electrical Code (NEC).
  - 10. NFPA 99, Standard for Health Care Facilities.
  - 11. NFPA 110, Standard for Emergency and Power Standby Systems.
  - 12. UL 142, Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids.
  - 13. UL 489, Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.
  - 14. UL 1236, Standard for Battery Chargers for Charging Engine-Starter Batteries.
  - 15. UL 2200, Standard for Safety Stationary Engine Generator Assemblies.
- C. Manufacturer and/or Supplier Qualifications:
  - 1. Authorized primary distributor with minimum of 5 years in business of distributing, installing and maintaining specific type of generation equipment under present firm name. Second tier dealers are not acceptable.
  - 2. Capable of dispatching maintenance and repair truck with qualified factory trained repairman and spare parts to the job site within 1 hour of request for service on equipment.
  - 3. Equipment manufacturer with minimum of 5 years' experience to regularly assembled and manufactured such equipment.
  - 4. Distributor with local office within 50 miles of project site, with factory trained representatives employed for minimum of 1 year.
  - 5. Distributor shall maintain spare parts stock to minimize down time in case of equipment failure.

- 6. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those included for this Project. Comply with requirements in Section 260548.
- D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a testing agency acceptable to the AHJ and marked for intended use.
- F. Engine Exhaust Emissions: EPA Certified or as required to comply with applicable state and local government requirements.
- G. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

### 1.3 SUBMITTALS

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data and for each component and appurtenance. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include the following:
  - 1. Thermal damage curve for generator.
  - 2. Time current characteristic curves for generator protective device.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Include the following:
  - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
  - 2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights. Comply with requirements in Section 260548.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
- D. Certification: Manufacturer seismic qualification certification that fuel tank, engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces. Comply with requirements in Section 260548.
  - 1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Test Reports:
  - 1. Factory start-up and test reports.
  - 2. Field start-up and test reports.
  - 3. Report of exhaust emissions showing compliance with applicable regulations.

4. Certified Torsional Vibration Compatibility: Comply with requirements in NFPA 110.
5. Submit completed copy of reports and include copy in the Operation and Maintenance Manual.

#### 1.4 OPERATION AND MAINTENANCE MANUALS

- A. Comply with requirements in Division 01 and Section 260500.
- B. Include step by step instructions for startup and shutdown.
- C. Include copies of test forms, service forms, and maintenance data, including test and servicing intervals, fluid levels, lubrication requirements, filters, antifreeze, and recommended lubricants.

#### 1.5 WARRANTY

- A. Packaged Engine Generator: Two years from date of acceptable on site start up and testing.
- B. Warranty shall cover material, labor and travel time for the entire system. Replacement parts shall be available within 48 hours of initial notification.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Packaged Engine Generator:
  1. Cummins Power Generation as supplied by Cummins Northwest.
  2. Kohler Co. as supplied by Power Systems West.
  3. MTU/Detroit Diesel as supplied by Pacific Power Products.
  4. Caterpillar as supplied by NC Machinery.
  5. No Substitutions.

#### 2.2 ENGINE-GENERATOR SET

- A. Factory assembled and tested, engine generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation. Include lifting attachments.
- C. Capacities and Characteristics:
  1. Power Output Ratings: Nominal ratings as indicated on the Drawings.
  2. Output Connections: Three-phase, four wire.
  3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator Set Performance for Sensitive Loads:
  1. Oversizing generator compared with rated power output of engine acceptable to meet specified performance.
    - a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

2. Steady State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Maximum 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within steady-state operating band within 0.5 second.
4. Steady State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady State Frequency Stability: No random speed variations outside the steady state operational band and no hunting or surging of speed when system is operating at any constant load within rated load.
6. Transient Frequency Performance: Less than 2 Hz variation for 50 percent step load increase or decrease. Frequency shall recover and remain within the steady state operating band within 3 seconds.
7. Output Waveform: At no load, harmonic content measured line to neutral not to exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, not to exceed 50 percent.
8. Sustained Short Circuit Current: For 3 phase, bolted short circuit at system output terminals, system shall supply minimum 300 percent of rated full load current for not less than 10 seconds and then clear fault automatically without damage to winding insulation or other generator system components.
9. Excitation System: Performance unaffected by voltage distortion caused by nonlinear load.
  - a. Include permanent magnet excitation for power source to voltage regulator.
10. Start Time: Comply with NFPA 110 for Type 10 system requirements.

## 2.3 ENGINE

- A. Fuel: Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1,800 rpm.
- C. Lubrication System: Include the following items mounted on engine or skid:
  1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit capable of full flow and designed to be fail safe.
  3. Crankcase Drain: Arranged for complete gravity drainage to removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Engine Fuel System:
  1. Main Fuel Pump: Mounted on engine to ensure adequate primary fuel flow under starting and load conditions.
  2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with requirements in NFPA 110 for Level 1 equipment for heater capacity. Heater voltage 120V.

- F. Governor: Control engine speed within plus or minus 3 Hz at 60 Hz (speed regulation 5 percent) from no load to full load generator output. Maintain steady state frequency at any constant load, including no load, within band of plus or minus 0.25 Hz rated frequency. Governor not to permit frequency modulation, defined as number of times per second that frequency varies from average frequency in cyclic manner, in excess 1 Hz per second.
- G. Cooling System: Closed loop, liquid cooled with radiator factory mounted on engine generator set mounting frame, engine driven fan, and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene glycol based antifreeze and 50 percent water with anticorrosion additives as recommended by engine manufacturer.
  2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed loop coolant system pressure for engine used. Include gage glass and petcock.
  4. Temperature Control: Self-contained, thermostatic control valve that modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging, ultraviolet, and abrasion resistant fabric.
    - a. Rating: 50 psig maximum working pressure with coolant at 180 F and non-collapsible under vacuum.
    - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- H. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system not to exceed engine manufacturer's engine backpressure requirements.
1. Sound Attenuation: Minimum 25 dB at 500 Hz.
  2. Maximum 85 dBA sound level measured at distance of 10 feet from exhaust discharge.
  3. Sound level may be superseded by dBA requirements, under Section 2.9 Outdoor Generator Set Enclosure.
- I. Engine Exhaust Flexible Connectors: Sized to match engine exhaust outlet connection and as recommended by engine manufacturer.
- J. Air-Intake Filter: Heavy duty, engine mounted air cleaner with replaceable dry filter element and "blocked filter" indicator.
- K. Starting System:
1. Components: Sized not to be damaged during full engine cranking cycle at maximum ambient temperature.
  2. Cranking Motor: Heavy duty unit that automatically engages and releases from engine flywheel without binding.
  3. Cranking Cycle: Minimum 60 seconds.
  4. Battery: Capacity within ambient temperature range for specified cranking cycle at least twice without recharging.
  5. Battery Cable: Size as recommended by engine manufacturer. Include required interconnecting conductors and connection accessories.
  6. Battery Charging Alternator: Factory mounted on engine with solid state voltage regulation and 35-A minimum continuous rating.

7. Battery Charger: Current limiting, automatic equalizing and float charging type. Comply with UL 1236. Include the following features:
  - a. Operation: Equalizing charging rate of 10 Amps initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 C to plus 60 C to prevent overcharging at high temperatures and undercharging at low temperatures.
  - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
  - d. Ammeter and Voltmeter: Flush mounted in door to indicate charging rates.
  - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of AC input or DC output of battery charger. Either condition shall close contacts that provide a battery charger malfunction indication at system control and monitoring panel.
  - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
  - g. Battery charger voltage: 120V

#### 2.4 FUEL OIL STORAGE

- A. Comply with requirements in NFPA 30.
- B. Base Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Include the following features:
  1. Containment: Integral rupture basin with a capacity of 110 percent of nominal capacity of day tank. Include leak detector in rupture basin and connect for audible and visual alarms in event of day tank leak.
  2. Tank level indicator.
  3. Capacity: 72 hours full rated load.
  4. Vandal resistant fill cap.
  5. Five gallon spill fill containment to comply with requirements of the AHJs.
  6. Low Level Alarm Sensor: Liquid level device operates alarm contacts at 25 percent of normal fuel level.
  7. High Level Alarm Sensor: Liquid level device operates alarm and redundant fuel shutoff contacts at midpoint between overflow level and 100 percent of normal fuel level.
  8. Secondary containment leak alarm sensor.
  9. High level alarm sensor.
  10. 12 ft. normal vent pipe extension if required by AHJ.
  11. Emergency vents shall terminate outside of weather housing.
  12. UL listed flame arrester on normal vent if required by AHJ.

## 2.5 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode selector switch on control and monitoring panel is in "AUTO" position, remote control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode selector switch is switched to "ON" position, generator set starts. "OFF" position of same switch initiates generator set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of remote emergency stop switch also shuts down generator set.
- B. Include the Following Indicating and Protective Devices and Controls:
1. AC voltmeter.
  2. AC ammeter.
  3. AC frequency meter.
  4. DC voltmeter (alternator battery charging).
  5. Engine coolant temperature gage.
  6. Engine lubricating oil pressure gage.
  7. Running time meter.
  8. Ammeter and voltmeter and phase-selector switch(es).
  9. Generator voltage adjusting rheostat.
  10. Start/stop switch.
  11. Overspeed shutdown device.
  12. Coolant high temperature shutdown device.
  13. Coolant low level shutdown device.
  14. Oil low pressure shutdown device.
  15. Fuel tank low level alarm.
  16. Fuel tank high level shutdown of fuel supply alarm.
  17. Fuel tank leak alarm.
  18. Generator overload.
  19. Battery charger failure.
  20. Battery charger low and high voltage alarms.
- C. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated on the Drawings.
- D. Alarm Contacts: Include separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication for connections for data link transmission of indications to remote data terminals.
- E. Remote Alarm Annunciator: Comply with NFPA 99. LED labeled with respective alarm conditions shall identify each alarm event and common audible signal shall sound for each alarm condition. Silencing switch on face of panel shall silence signal without altering visual indication. Connect so that after alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate surface mounting type to suit mounting conditions indicated on the Drawings.
- F. Remote emergency stop shall be provided, as per NFPA 110 Table 5.6.5.2 (u).

## 2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, electronic-trip type, 100 percent rated. UL 489.

1. Tripping Characteristics: Adjustable long time and short time delay and instantaneous.
  2. Trip Settings: Selected to coordinate with generator thermal damage curve.
  3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Ground Fault Indication: Comply with requirements in NFPA 70 for emergency system signals for ground fault. Integrate ground fault alarm indication with other generator set alarm indications.

## 2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with requirements in NEMA MG 1.
- B. Drive: Generator shaft directly connected to engine shaft. Exciter rotated integrally with generator rotor, 2/3 pitch winding.
- C. Electrical Insulation: Class H or Class F.
- D. Stator Winding Leads: Terminate at terminal box to permit future reconnection for other voltages.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Voltage Regulator: Solid state type, separate from exciter, for performance specified in this section. Include adjustable rheostat on control and monitoring panel for plus or minus 5 percent of output-voltage operating band.

## 2.8 OUTDOOR GENERATOR SET ENCLOSURE

- A. Description: Weatherproof steel housing. Multiple panels lockable with adequate access to components requiring maintenance. Panels removable by one person without tools. Instruments and control mounted within enclosure.
1. The enclosures shall allow the generator set to operate at full load in an ambient of 40°C - 45°C with no additional derating of the electrical output.
  2. The enclosure roof shall be pitched to prevent accumulation of water.
  3. The complete exhaust system shall be internal to the enclosure.
  4. A duct between the radiator and air outlet shall be provided to prevent re-circulation of hot air.
  5. All acoustical insulation shall be fixed to the mounting surface with pressure sensitive adhesive or mechanically fastened. In addition, all acoustical insulation mounted on a horizontal plane shall be mechanically fastened. The acoustical insulation shall be flame retardant meeting UL 94 HF1 classification.
  6. The enclosures shall include an exhaust scoop to direct the cooling air in a vertical direction.
  7. Muffler Location: Within enclosure.
  8. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 72 dBA measured at any location 23 feet from the engine generator in a free field environment.

- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
  - 1. Louvers: Fixed engine, cooling air inlet and discharge. Storm proof and drainable louvers to prevent entry of rain and snow.

## 2.9 VIBRATION ISOLATION DEVICES

- A. Generator set shall be seismic certified from factory without additional elastomeric isolator pads or spring isolators.

## 2.10 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard color finish over corrosion resistant pretreatment and compatible primer.

## 2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
- B. Project Specific Equipment Tests: Before shipment, factory test engine generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
  - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  - 2. Full load run.
  - 3. Maximum power.
  - 4. Voltage regulation.
  - 5. Transient and steady-state governing.
  - 6. Single-step load pickup.
  - 7. Safety shutdown.
  - 8. Sound generation.
  - 9. Provide 14 days' advance notice of tests and opportunity for observation of tests by the Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

### 3.2 PREPARATION

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

3.3 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.

3.4 PACKAGED ENGINE GENERATOR INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access without removing connections or accessories, for periodic maintenance.
- C. Secure packaged engine generator sets to anchor bolts installed in concrete bases. Comply with requirements in Section 260510 for concrete bases and Section 260548 for seismic restraints.
- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.5 CONNECTIONS

- A. Piping installation requirements are specified in Division 26 Sections.
- B. Connect fuel, cooling system, and exhaust system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Ground equipment according to Section 260526.
- D. Connect wiring according to Section 260519.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Comply with requirements in Section 260810.
  - 2. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  - 3. Test the complete engine generator system at manufacturer's factory:
    - a. At full load and rated power factor with a reactive load.
    - b. Tests shall include and be documented:
      - 1) Radiator.
      - 2) Engine control panel.
      - 3) Single-step load pickup.
      - 4) Transient and steady-state governing.
      - 5) Safety shutdown device testing.
      - 6) Rated power.
      - 7) Maximum power.

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4. Provide full load test utilizing portable test bank as required by NFPA 110. Simulate power failure including operation of transfer switch, and return to normal.
  5. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  6. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified in this section including, but not limited to, single step full load pickup test.
  7. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages for the following.
    - a. Measure charging voltage and voltages between available battery terminals for full charging and float charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of connectors. Perform integrity load test and capacity load test for battery.
    - c. Verify acceptance of charge for each element of battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  8. Battery Charger Tests: Verify specified rates of charge for both equalizing and float charging conditions.
  9. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  10. Exhaust System Back Pressure Test: Verify that back pressure at full rated load is within manufacturer's written allowable limits for engine.
  11. Exhaust Emissions Test: Comply with applicable government test criteria.
  12. Voltage and Frequency Transient Stability Tests: Measure voltage and frequency transients for 50 and 100 percent step load increases and decreases and verify that performance is as specified.
  13. Harmonic Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
  14. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at 4 locations on the property line, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches specified in Section 263600 and run them concurrently.
- D. Test instruments shall have been calibrated within last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- H. Repair malfunctioning unit on site with factory-authorized service technicians, or remove malfunctioning units and provide new. Retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach label or tag to each tested component indicating satisfactory completion of tests.
- K. Infrared Scanning: After date of Substantial Completion, but not more than 60 days after final acceptance, perform infrared scan of each power wiring termination and each bus connection. Remove access panels so terminations and connections are accessible to portable scanner.
  - 1. Follow-up Infrared Scanning: Perform additional follow-up infrared scan 11 months after date of Substantial Completion.
  - 2. Instrument: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- L. Include copy of test reports in the Operation and Maintenance Manual.

### 3.7 DEMONSTRATION

- A. Demonstrate proper system operation to the A/E and Owner utilizing factory-trained field service personnel.

### 3.8 TRAINING

- A. Conduct one 2 hour training session for Owner's representatives at project site. Include training on installed equipment, system operation, emergency procedures, and maintenance. Training conducted by factory-trained service personnel.

### 3.9 FUEL FILL

- A. Fill fuel storage system(s), including remote bulk storage tank(s), with fuel after tests and demonstrations have been completed.

END OF SECTION 263213

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description: Work includes interior and exterior luminaires, lamps, ballasts/drivers and associated appurtenances.
- B. General Requirements: Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Sections 260500, and 260510 apply to Work in this section.lu
- C. Comply with requirements in other specification sections for concrete used for embedding poles, pole foundations, and footings for exterior area luminaire poles, standards, and foundations. Pole bases included in this section.
- D. Where conflict occurs, the Luminaire (Light Fixture) Schedule shall take precedence.

**1.02 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable city, county, and state codes and ordinances.
- B. Codes and Standards: NFPA 70, National Electrical Code (NEC), including local amendments, as applicable.
- C. Comply with NEC and NEMA for installation and construction of luminaires. Components, Devices and Accessories shall be listed and labeled for intended use as defined in NEC, by a qualified testing agency and acceptable to the AHJ. Luminaires shall be UL listed and be labeled.
- D. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- E. Each lamp type shall be of the same manufacturer.
- F. Each ballast type shall be of the same manufacturer.
- G. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- H. Luminaires in damp or wet locations shall be listed for such use and labeled as either "Suitable for Damp Locations" or "Suitable for Wet Locations".

**1.03 SUBMITTALS**

- A. Comply with requirements in Division 01 and Section 260500.
- B. Product Data: Submit manufacturer's technical product data and maintenance data for each type of luminaire and appurtenance.
  - 1. Submit product data for associated lamp, ballast (or driver) for each luminaire type.
  - 2. Create a matrix encompassing all luminaire types with ballast and lamp type, including manufacturer name and part number(s).
  - 3. Submit copy of individual and/or tandem warranties for luminaire, lamp and ballast (or driver), as applicable.
  - 4. For solid state lamps:
    - a. Provide IES LM-79 report.
    - b. Provide IES TM-21 report.

- c. Provide Bin Coding System Chart, with appropriate target CCT reference line, identifying which bin corresponds to the lamps supplied to each luminaire. For luminaires with multiple solid state lamps, identify which bins shall be included for color mixing.
- C. Qualifications: Indicate manufacturer qualifications as identified in Part 2.
- D. Shop Drawings:
  - 1. Submit dimensioned drawings of each type of luminaire. Submit in booklet form with separate sheet for each luminaire, assembled by luminaire "type" in alphabetical order with proposed luminaire and appurtenances clearly indicated on each sheet.
  - 2. Submit support and hanging details for luminaires weighing more than 56 pounds and pendant hung luminaires requiring support design approved by the AHJ.
  - 3. Submit copy of manufacturer installation instructions for each luminaire type.
- E. Test Reports:
  - 1. Comply with commissioning requirements in Section 260810.
  - 2. Perform field test reports.
  - 3. Submit completed copy of reports at the time of substantial completion. Include copy in the Operation and Maintenance Manual.

#### **1.04 EXTRA MATERIALS**

- A. Turn over to the Owner and obtain signed receipt.
- B. Include copy of transmittal(s) and receipt(s) in Operation and Maintenance Manual.
- C. Lamps:
  - 1. Furnish five percent (but not less than one solid state lamp) of solid state lamps for each type used on the project that has replaceable components.
- D. Drivers:
  - 1. Furnish two percent (but not less than one driver) of solid state drivers/power supplies for each type used on the project.
- E. Exit Signs: Furnish and install ten percent (but not less than one exit sign) of each type used on the project. For each exit sign, include rough-in and fifty feet of branch circuit raceway and wiring connected to a local (non-emergency or emergency) circuit, as appropriate or indicated by AHJ. Location of spare exit signs as required/directed by AHJ.

#### **1.05 DEFINITIONS**

- A. CU: Coefficient of utilization.
- B. HID: High-intensity discharge.
- C. HO: High output.
- D. IC: Insulation contact.
- E. Lamp: The complete light source package, including all associated components (base, pins, filament, outer bulb, solid state components, etc.) that make up a single unit.
- F. Light: Radiant energy sensed or seen.
- G. Light Fixture: Luminaire.
- H. Lumens: Measured light output of lamp (or luminaire if using solid state lamping).

- I. Luminaire: A complete lighting unit consisting of a lamp, ballast (or driver) as required together with the parts designed to distribute the light and to position and protect the lamp, as well as the electrical parts required to generate the light. This may include the means to connect to a power supply.
- J. Rated Lamp Life:
  - 1. Solid State lamps: L-70, the time after which 70% of the initial lumen output is maintained out of the respective luminaire.

#### **1.06 COORDINATION**

- A. Review luminaire types with respective ceiling type prior to ordering. Initiate a meeting with the ceiling installer and issue meeting minutes to the A/E. Inform A/E where mounting method conflict occurs.
- B. Review luminaire types with location of building insulation prior to ordering. Initiate a meeting with the insulation installer and issue meeting minutes to the A/E. Inform A/E where non-IC rated luminaires are in conflict with the building insulation.
- C. Review luminaire types with final millwork shop drawings. Initiate a meeting with the casework installer and issue meeting minutes to the A/E. Verify luminaires will fit where specified in or adjacent millwork prior to rough-in.
- D. Coordinate layout and installation of luminaires and associated support methods with all trades.
- E. Facilitate coordination meetings once a month (throughout construction) with the general contractor, ceiling installer, sprinkler installer, HVAC installer, plumber, telecommunications installer and all other applicable trades. Shop drawings shall be adjusted accordingly and resubmitted for A/E review and approval. Log shall be kept on site with meeting dates and meeting minutes.
- F. Develop 3D shop drawings for coordination with other trades. Combine model with other trades for use during coordination meetings.
  - 1. Meet the requirements indicated in Division 01.

#### **1.07 WARRANTY**

- A. Comply with requirements in Division 01 and Section 260500 – Warranty.
- B. Warranty period as indicated in Section 260500 shall establish minimum requirement, unless otherwise noted.
- C. Occupancy-Vacancy Sensors: 5 years.
- D. Solid State Lamps and Drivers: 5 years.
- E. Batteries (in luminaires or unit equipment): Manufacturer's standard form in which manufacturer shall repair or replace components of rechargeable batteries that do not comply with minimum Code required life, within 5 years.

### **PART 2 PRODUCTS**

#### **2.01 LUMINAIRES**

- A. Housing: Metal parts shall be free from burrs, sharp corners and edges. Sheet metal components shall be formed and shall not warp or sag. Luminaires shall be free of light leaks while also providing the required ventilation so as not to degrade the rated photometric performance and rated life of lamps and/or ballasts. Adjustable luminaires shall utilize positive locking devices to set aiming angle; luminaire shall be able to be relamped without affecting aiming angle.

- B. Lenses: Where utilized, acrylic plastic shall be 100% virgin acrylic, highly resistant to yellowing and other changes due to aging, exposure to heat and ultraviolet radiation. Minimum thickness of 0.125 inches.
- C. Hardware: Finish ferrous mounting hardware and accessories to prevent corrosion and/or discoloration to any and all adjacent materials. Hardware for steel or aluminum luminaires shall be cadmium, or approved, plated. Hardware for stainless steel luminaires shall be stainless steel. Hardware for bronze luminaires shall be stainless steel or bronze.
- D. Sockets: Linear fluorescent lamp sockets shall be 4-position positive stop lamp-lock style with knife-edge contacts. HID sockets shall be porcelain for mogul or medium base lamps, pulse rated as required; sockets shall be keyed for all position oriented lamps.
- E. Reflecting Surfaces: The following minimum reflectance values shall be met:
  - 1. White Surfaces: 85%.
  - 2. Specular Surfaces: 90%.
  - 3. Anodized Aluminum Surfaces: 93%.
- F. Latches: Latches for luminaire doors/louvers, where applicable, shall be spring type and shall operate freely and easily without excessive force.
- G. Wiring
  - 1. Cords/cables between luminaire components shall have a minimum temperature rating of 105°C.
  - 2. Cords/cables shall be fitted with appropriate strain relief connectors and/or weathertight entries, where required by application.
  - 3. No internal wiring shall be visible from normal viewing angles.
  - 4. Cords/cables to pendant luminaires shall match color of respective canopy.
  - 5. Internal and/or factory wiring shall be a minimum size of 18 AWG.
- H. Installed Where Subject to Damage: Where luminaires are installed subject to physical damage and contain metal halide lamping, the luminaires shall consist of means of protection where the lamp is completely enclosed by glass or plastic/acrylic. If the lamp breaks, the glass shards shall not escape the luminaire and the lamp shall not emit ultraviolet light outside the luminaire.
- I. Solid State LED luminaires shall be on at least one of the following (or be pre-approved by the A/E):
  - 1. U.S. Department of Energy Energy Star Qualified Luminaires Product List.
  - 2. Designlights Consortium Qualified Products List (where applicable category exists) or Lighting Design Lab LED Qualified Luminaire and Tubular LED Lamp List.

## 2.02 LAMPS

- A. Refer to Luminaire (Light Fixture) Schedule for additional information.
- B. Notify and send A/E manufacturer's recommendations for lamp/ballast combination if different from products specified.
- C. Solid State:
  - 1. LED:
    - a. Manufacturers:
      - 1) Minimum of 5 year history of producing and/or installing LEDs in North America.
      - 2) Philips/Lumileds, Osram/Sylvania, General Electric, Cree, Nichia, Samsung, or approved.

- b. Must be on U.S. Department of Energy Energy Star Qualified Lamps Product List.
  - c. Must be on the Lighting Design Lab's LED Qualified Lamp List.
  - d. Replaceable modules shall be designed to Zhaga Consortium standards.
  - e. 4,000K CCT, unless otherwise noted.
  - f. Minimum CRI of 85.
  - g. Lamps shall not use any energy when 'off'.
  - h. CCT throughout life of lamp shall be within +/- 200 K of respective specified value.
2. Organic LED lamps are not allowed.

### 2.03 DRIVERS

- A. Refer to Luminaire (Light Fixture) Schedule for additional information.
- B. Notify and send A/E manufacturer's recommendations for lamp/ballast combination if different from products specified.
- C. Quantities: For continuous linear light fixtures provide quantity of ballasts/drivers required to support the circuiting and control shown on the contract documents.
  - 1. Daylight zones: Provide drivers for control within daylight zones for linear fixtures that are mounted in any portion of a daylight zone. If 50% or more of a control length is in a daylight zone it shall be controlled within that zone.
  - 2. For linear lengths that cross primary/secondary zones control with the more stringent daylight zone.
  - 3. Control Length: Maximum eight foot, minimum four foot.
- D. Solid State Drivers/Power Supplies:
  - 1. Manufacturers:
    - a. Minimum of 5-year history of producing and/or installing drivers in North America.
    - b. Philips/Advance, Osram Sylvania, General Electric, Universal, Thomas Research, or approved.
  - 2. When not in the luminaire, the housing shall be plenum rated.
  - 3. Poke-in wire trap connectors or integral leads color coded per ANSI C82.11.
  - 4. Withstand +/- 10% voltage fluctuation with no compromise of performance or life cycle.
  - 5. +/- 5% output across published load range.
  - 6. 120-277 Volt rating.
  - 7. PF greater than 0.9, at specified voltage.
  - 8. Minimum efficiency of 70% at rated full load.
  - 9. Maximum case temperature rating of 70°C.
  - 10. THD less than 20%.
  - 11. Class A sound rating.
  - 12. Minimum operating temperature of -20°F.
  - 13. Shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external overcurrent protection.
  - 14. No PCB allowed.
  - 15. Comply with ANSI/IEEE C62.41.1 & C62.41.2, Category A for transient protection.
  - 16. Dimmable, as specified in the Luminaire (Light Fixture) Schedule.

### 2.04 EGRESS

- A. UL 924 Listed.

- B. Battery Packs (Emergency Ballasts) in General Luminaires:
1. Manufacturers: Philips/Bodine, Iota Engineering, or approved.
    - a. Solid State driver assemblies with integrated components are allowed.
  2. Must fit inside luminaire's ballast compartment. In case of remote ballast installation, battery pack shall be installed adjacent ballast and marked accordingly on the record drawings (as-builts).
  3. Must initiate within 3-10 seconds of power failure and allow for 90 minutes of operation.
  4. Compatible with 1-lamp, 2-lamp, 3-lamp, 4-lamp and dimming ballasts.
  5. Minimum 1,100 lumens of output for linear fluorescent lamps and 750 lumens for compact fluorescent lamps.
  6. Allow for multi-lamp operation.
  7. 120/277 Volt rating.
  8. End-of-lamp-life compatible.
  9. Damp listed.
  10. High temperature, maintenance-free nickel-cadmium sealed battery, minimum 7 years of operation.
  11. Self-testing, every 30 days, without horn. Indicator light shall flash if problem is detected.
  12. Must automatically switch back to normal power once available.
  13. Test switch, located inside the luminaire if possible; if not possible, notify A/E and locate switch and indicator light per A/E direction prior to rough-in.
- C. Unit Equipment:
1. Manufacturers: Hubbell Lighting/Dual-Lite, Cooper Lighting/Sure-Lites, Acuity Brands/Lithonia, Philips/Chloride, Philips/Lightolier, or approved.
  2. Must initiate within 3-10 seconds of power failure and allow for 90 minutes of operation.
  3. Maintenance-free lead-calcium sealed battery, minimum 7 years of operation.
  4. Must contain visual indicator status of normal power.
  5. Automatic self-diagnostic monitoring and testing of unit operation. Self-test every 28 days.
    - a. Must contain visual indicator status of service alerts for 'battery fault', 'charger fault', 'transfer fault' and 'lamp fault'.
    - b. Manual test switch.
  6. Must automatically switch 'off' once normal power is available.
  7. Automatic low voltage disconnect battery protection.
  8. Automatic normal power lockout circuit.

### **PART 3 EXECUTION**

#### **3.01 INSPECTION**

- A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory. Work that requires modification due to unsatisfactory conditions, deemed by the A/E, shall be corrected and completed to the satisfaction of the A/E at no additional cost to the contract.

#### **3.02 PREPARATION**

- A. Field Measurements: Field verify locations of new and existing work prior to commencing work of this section.
- B. Protection: Protect surrounding areas and surfaces to preclude damage from work of this section.

### 3.03 INSTALLATION, APPLICATION, ERECTION, AND PERFORMANCE

- A. General: Install, apply, erect, and perform the work in accordance with Article "Quality Assurance" provisions, specifications, and manufacturer's installation instructions and directions. Where these may be in conflict, the more stringent requirements govern.
- B. Temporary Lighting for Construction Use: Contractor shall provide lighting used during the construction period for construction tasks. Permanent luminaires that are part of the project may not be utilized for this use.
- C. Temporary Lighting required as part of Project Phasing: As approved by A/E, permanent luminaires may be used for temporary lighting means. Install and energize the minimum number of luminaires necessary for the task. When construction is sufficiently complete, remove the temporarily installed luminaires in a neat and workmanlike manner, disassemble, clean thoroughly, replace lamp(s) and ballast(s) and install in permanent location per the contract documents. Permanently installed luminaires deemed by the A/E to be damaged shall be replaced at no additional cost.
- D. Remote Mounting of Ballasts (where indicated on the drawings and/or approved by the A/E): Distance between the remote ballast and respective luminaire shall not exceed distance recommended by the ballast manufacturer. If recommended distance conflicts with the drawings, notify the A/E prior to rough-in.

### 3.04 INTERIOR LUMINAIRE INSTALLATION

- A. Install luminaires at locations and heights as indicated on the Drawings, in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NESC, NECA's "Standards of Installation", NEMA standards, and recognized industry practices to ensure that luminaires fulfill requirements. Luminaires shall be installed exactly level, secure and plumb with respective building lines. Wall mount and ceiling mount luminaires shall be securely and tightly attached to their respective mounting surface. Lay-in luminaires shall sit flush with grid ceiling system, doors shall swing completely open in the designed direction.
- B. Luminaire Supports:
  - 1. General: Comply with IBC and NEC (including all local amendments) as interpreted by AHJ for luminaires mounted in suspended ceilings. Lay-in and pendant luminaires shall not be supported by lay-in suspended grid ceiling system and must be attached to structure.
  - 2. Support Requirements:
    - a. Include flexible ball joint hangers for pendant and stem hung luminaires at designated points of support.
    - b. Equip hooks used to hang luminaires with safety latches. Include supports, brackets, clips, screws and miscellaneous items for mounting luminaires.
    - c. Include locking catches, screws, safety chain(s) or safety cable(s) for detachable luminaire parts, luminous ceiling accessories, louvers, diffusers, lenses and reflectors.
  - 3. Seismic Restraints:
    - a. For Luminaires Weighing Less than 10 Pounds: Install (1) slack No. 12 gauge hanger wire from luminaire to structure above.
    - b. For Luminaires Weighing 10 to 56 Pounds: Install (2) independent slack No. 12 gauge hanger wires from opposite corners of luminaire to structure above.
    - c. For Luminaires Weighing More than 56 Pounds: Support directly from the structure above by hangers approved by the AHJ. Comply with requirements in Section 260548 for seismic restraints.

- d. For Pendant Hung Luminaires: Support directly from structure with No. 9 gauge hanger wire or alternate support without using ceiling suspension system for direct support approved by the AHJ. Comply with requirements in Section 260548 for seismic restraints.
- C. Fire Rated Assemblies: Provide gypsum board protection acceptable to the AHJ to ensure fire rating of ceiling or wall in which luminaires are installed. Maintain manufacturer's recommended ventilation requirements.
- D. Provide backing in wall cavity to reinforce support for wall mounted luminaires.
- E. Luminaire Contact with Building Insulation: When building insulation is installed at a location where contact with luminaires is unavoidable, IC-Rated luminaires shall be utilized. Where insulation is present and an approved IC-Rated luminaire is not available, provide a gypsum board assembly around the luminaire, maintaining all recommended ventilation requirements, to separate luminaire from adjacent insulation.
- F. Protect installed luminaires from damage during construction period through date of substantial completion. Damaged luminaires, including associated components, shall be replaced in their entirety.
- G. Installed in a Shower or Wet Location: If luminaires have exposed metal parts that are grounded, respective circuit breakers shall be GFCI. If luminaires have exposed metal parts that are not grounded, they shall not be utilized and an approved luminaire without exposed metal parts shall be provided. Inform A/E prior to ordering luminaires.
- H. Exit Signs: Verify color of lettering with AHJ prior to ordering.

### **3.05 EXTERIOR LUMINAIRE INSTALLATION**

- A. Coordinate with work of other trades as necessary to properly interface installation of exterior lighting.
- B. Install lighting poles and standards plumb on concrete pole bases as indicated on the Drawings with anchor bolts and reinforcing bars. Coordinate anchor bolt size, pattern and orientation prior to base installation. Coordinate size and location of bases prior to installation. Hand rub exposed concrete to uniform, smooth finish. Support during backfilling and anchoring to foundations. Comply with requirements in Section 260510 for excavation and backfilling. Refer to Contract Drawings for additional information.
- C. Fuses for Exterior Pole-Mount Luminaires: Include fuses in each phase conductor, sized for 1-1/2 times maximum full load ballast current served by each conductor, Bussmann KTK or approved. Do not exceed circuit overcurrent protective device rating. Include fuse holder at handhole or in base junction box with "breakaway" receptacles for conductors running to top of poles, Bussman HEB or approved. Include fuse blanks in neutral conductors.
- D. Install with sufficient space for hand access and cable entrance holes for installation of underground cabling. Make splices in pole or pole base using Scotchcast 400 resin for watertight connections.
- E. Wall Mount: Exterior building mount luminaires shall coordinate/align with building elements. Luminaires and respective mounting and rough-in means shall align in the center of building elements and shall not split unevenly across multiple elements. Notify A/E of conflicts prior to rough-in.

**3.06 FIELD QUALITY CONTROL**

- A. Upon completion of installation of luminaires and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Repair malfunctioning units on site, then retest to demonstrate compliance. If not possible to repair on site, remove and provide new units and retest. Include copy of test reports in the Operation and Maintenance Manual.
- B. Clean luminaires in their entirety of dirt and debris upon completion of installation, including but not limited to housing, lens(es), lamp(s) and louver(s) within (7) days of substantial completion.
- C. At Substantial Completion, remove and provide new lamps in interior and exterior luminaires which are observed to be noticeably dimmed due to Contractor's use and testing, as judged by the A/E.

**END OF SECTION**

**SECTION 31 20 00  
EARTH MOVING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preparing subgrades for walks, pavements.
- B. Subbase course for concrete walks.
- C. Subbase course and base course for asphalt paving.
- D. Excavating and backfilling for utility trenches.

**1.02 REFERENCE STANDARDS**

- A. Standard Specification for Road, Bridge, and Municipal Construction as amended by City of Chehalis Standards. Hence forth referred to as Standard Specifications.
- B. AASHTO M 145 - Standard Specifications for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
- D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
- E. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes - Unified Soil Classification System
- F. ASTM D 2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways

**1.03 SUBMITTALS**

- A. See Section 01 33 00, Submittal Procedures, for submittals.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on actual materials used.
- D. Compaction Density Test Reports.

**1.04 DEFINITIONS**

- A. Backfill: Soil material used to fill an excavation.
- B. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- C. Final Backfill: Backfill placed over initial backfill to fill a trench.
- D. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- E. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- F. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- G. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

- H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- I. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- J. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- K. Fill: Soil materials used to raise existing grades.
- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- M. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where permitted.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.

### **PART 2 PRODUCTS**

#### **201 FILL MATERIALS**

- A. General Fill Complying with City of Chehalis Public Works
- B. General: **Provide imported borrow soil materials**. Native soils are expected to be Unsatisfactory soils.
- C. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- D. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- E. Bedding material shall conform to section 9-03.16 of standard specification for road, bridge, and municipal construction as amended by City of Chehalis Standards.

- F. Bank run gravel for trench backfill shall conform to 9-03.19 Bank Run Gravel for Trench Backfill of standard specification for road, bridge, and municipal construction as amended by City of Chehalis Standards
- G. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- H. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- I. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

## **202 SOURCE QUALITY CONTROL**

- A. Provide materials of each type from same source throughout the Work.

## **PART 3 EXECUTION**

### **301 EXAMINATION**

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.

### **302 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate existing utilities that remain from damage.
- C. Protect benchmarks; survey control points; existing structures; fences; sidewalks, and curbs from excavating equipment and vehicular traffic.
- D. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.
- E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### **303 EXCAVATION, GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

### **304 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.05 EXCAVATION FOR UTILITY TRENCHES**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
- D. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

### **3.06 SUBGRADE INSPECTION**

- A. Proof-roll subgrade below pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### **3.07 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### **3.08 UTILITY TRENCH BACKFILL**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of [subbase material] [satisfactory soil], free of particles larger than [1 inch (25 mm)] <Insert dimension> in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- E. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

**3.09 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
- C. Under grass and planted areas, use satisfactory soil material.
- D. Under walks and pavements, use satisfactory soil material.

**3.10 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

**3.11 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 2. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 3. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

**3.12 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
  - 2. Walks: Plus or minus 1/2 inch (13 mm).
  - 3. Pavements: Plus or minus 1/2 inch (13 mm).

### **3.13 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS**

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Shape subbase course and base course to required crown elevations and cross-slope grades.
  - 2. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
  - 3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [95] <Insert number> percent of maximum dry unit weight according to [ASTM D 698] [ASTM D 1557].

### **3.14 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### **3.15 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

**END OF SECTION**

**SECTION 31 20 00  
EARTH MOVING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preparing subgrades for walks, pavements.
- B. Subbase course for concrete walks.
- C. Subbase course and base course for asphalt paving.
- D. Excavating and backfilling for utility trenches.

**1.02 REFERENCE STANDARDS**

- A. Standard Specification for Road, Bridge, and Municipal Construction as amended by City of Chehalis Standards. Hence forth referred to as Standard Specifications.
- B. AASHTO M 145 - Standard Specifications for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
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- E. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes - Unified Soil Classification System
- F. ASTM D 2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways

**1.03 SUBMITTALS**

- A. See Section 01 33 00, Submittal Procedures, for submittals.
- B. Materials Sources: Submit name of imported materials source.
- C. Fill Composition Test Reports: Results of laboratory tests on actual materials used.
- D. Compaction Density Test Reports.

**1.04 DEFINITIONS**

- A. Backfill: Soil material used to fill an excavation.
- B. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- C. Final Backfill: Backfill placed over initial backfill to fill a trench.
- D. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- E. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- F. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- G. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

- H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- I. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- J. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- K. Fill: Soil materials used to raise existing grades.
- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- M. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where permitted.
  - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
  - 2. Prevent contamination.
  - 3. Protect stockpiles from erosion and deterioration of materials.

### **PART 2 PRODUCTS**

#### **201 FILL MATERIALS**

- A. General Fill Complying with City of Chehalis Public Works
- B. General: **Provide imported borrow soil materials**. Native soils are expected to be Unsatisfactory soils.
- C. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- D. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- E. Bedding material shall conform to section 9-03.16 of standard specification for road, bridge, and municipal construction as amended by City of Chehalis Standards.

- F. Bank run gravel for trench backfill shall conform to 9-03.19 Bank Run Gravel for Trench Backfill of standard specification for road, bridge, and municipal construction as amended by City of Chehalis Standards
- G. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- H. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- I. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

## **202 SOURCE QUALITY CONTROL**

- A. Provide materials of each type from same source throughout the Work.

## **PART 3 EXECUTION**

### **301 EXAMINATION**

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.

### **302 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate existing utilities that remain from damage.
- C. Protect benchmarks; survey control points; existing structures; fences; sidewalks, and curbs from excavating equipment and vehicular traffic.
- D. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.
- E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### **303 EXCAVATION, GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

### **304 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.05 EXCAVATION FOR UTILITY TRENCHES**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
- D. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

### **3.06 SUBGRADE INSPECTION**

- A. Proof-roll subgrade below pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### **3.07 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### **3.08 UTILITY TRENCH BACKFILL**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of [subbase material] [satisfactory soil], free of particles larger than [1 inch (25 mm)] <Insert dimension> in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- E. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

**3.09 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
- C. Under grass and planted areas, use satisfactory soil material.
- D. Under walks and pavements, use satisfactory soil material.

**3.10 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

**3.11 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 2. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 3. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

**3.12 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
  - 2. Walks: Plus or minus 1/2 inch (13 mm).
  - 3. Pavements: Plus or minus 1/2 inch (13 mm).

### **3.13 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS**

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Shape subbase course and base course to required crown elevations and cross-slope grades.
  - 2. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
  - 3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [95] <Insert number> percent of maximum dry unit weight according to [ASTM D 698] [ASTM D 1557].

### **3.14 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### **3.15 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

**END OF SECTION**

**SECTION 32 12 16  
ASPHALT PAVING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES:**

- A. Cold milling of existing asphalt pavement.
- B. Hot-mix asphalt patching.
- C. Hot-mix asphalt paving.
- D. Hot-mix asphalt overlay.

**1.02 RELATED REQUIREMENTS:**

- A. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

**1.03 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.04 INFORMATIONAL SUBMITTALS**

- A. Material Certificates: For each paving material.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by WSDOT.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Standard Specifications for road asphalt paving work.

**PART 2 PRODUCTS**

**2.01 PRODUCTS AGGREGATES**

- A. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242/D 242M rock or slag dust, hydraulic cement, or other inert material.

**2.02 ASPHALT MATERIALS**

- A. Asphalt Binder: AASHTO M 320, PG 64-22. Retain "Tack Coat" Paragraph below if required. Tack coat is usually diluted in equal amounts of water and emulsified asphalt. It is usually applied to vertical surfaces of curbs, gutters, cold pavement joints, and structures in the pavement that will be in contact with hot-mix asphalt. Tack coat is also applied to existing pavement surfaces to bond new hot-mix asphalt overlays.
- B. Tack Coat: ASTM D 977 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

**2.03 AUXILIARY MATERIALS**

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires, asphalt shingles, or glass from sources

and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

## **2.04 MIXES**

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent or more than 25 percent by weight.
- B. Surface Course Limit: Recycled content no more than 10 percent by weight.
- C. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by WSDOT; and complying with the following requirements:
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Base Course:
  - 3. Surface Course:

## **PART 3 EXECUTION**

### **3.01 COLD MILLING**

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Mill to a depth per plan.
  - 2. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.

### **3.02 PATCHING**

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
- C. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- D. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- E. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

### **3.03 SURFACE PREPARATION**

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- 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.
- C. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### **3.04 PLACING HOT-MIX ASPHALT**

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in 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. Spread mix at a minimum temperature of 250 deg F.
  - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### **3.05 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 course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
  - 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 according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

### **3.06 COMPACTION**

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- 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 hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
- D. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- E. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- F. 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.
- 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.

### **3.07 INSTALLATION TOLERANCES**

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch (13 mm).
  - 2. Surface Course: Plus 1/4 inch (6 mm), 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 (3-m) straightedge applied transversely or longitudinally to paved areas:
- C. Base Course: 1/4 inch (6 mm).
- D. Surface Course: 1/8 inch (3 mm).
- E. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

### **3.08 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### **3.09 WASTE HANDLING**

- A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

**END OF SECTION**

**SECTION 32 17 13  
PARKING BUMPERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Section includes wheel stops.

**1.02 ACTION SUBMITTALS**

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

**PART 2 PRODUCTS**

**2.01 PARKING BUMPERS**

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches (115 mm) high by 9 inches (225 mm) wide by 72 inches (1800 mm) long]. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
  - 1. Mounting Hardware: Galvanized-steel [spike or dowel, 1/2-inch (13-mm) diameter, 10-inch (254-mm) minimum length] [lag screw, shield, and washers; 1/2-inch (13-mm) diameter, 8-inch (203-mm) minimum length] [hardware as standard with wheel-stop manufacturer].

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer.

**END OF SECTION**

**SECTION 32 17 13  
PARKING BUMPERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Section includes wheel stops.

**1.02 ACTION SUBMITTALS**

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

**PART 2 PRODUCTS**

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**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer.

**END OF SECTION**

**SECTION 32 17 23  
PAVEMENT MARKINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Painted markings applied to asphalt pavement.

**1.02 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
  - 1. Aexcel Inc.
  - 2. Benjamin Moore & Co.
  - 3. Color Wheel Paints & Coatings.
  - 4. Columbia Paint & Coatings.
  - 5. Conco Paints.
  - 6. Coronado Paint; Division of INSL-X Products Corporation.
  - 7. Diamond Vogel Paints.
  - 8. Dunn-Edwards Corporation.
  - 9. Ennis Traffic Safety Solutions, Inc.
  - 10. Frazee Paint.
  - 11. General Paint.
  - 12. Kwal Paint.
  - 13. M.A.B. Paints.
  - 14. McCormick Paints.
  - 15. Miller Paint.
  - 16. Parker Paint Mfg. Co. Inc.
  - 17. PPG Industries.
  - 18. Pratt & Lambert.
  - 19. Rodda Paint Co.
  - 20. Rohm and Haas Company; a subsidiary of The Dow Chemical Company.
  - 21. Scott Paint Company.
  - 22. Sherwin-Williams Company (The).

SECTION 32 84 00 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes piping, valves, sprinklers, specialties, controls, and wiring for an automatic, electronically-controlled low-water use drip irrigation system.
- B. This Section provides a Warranty Period for the irrigation system for 1 year.
- C. The irrigation system layout graphically shown is schematic and diagrammatic. Field conditions may warrant contractor modifications to be made to complete installation.
- D. Related Sections include the following:
  - 1. Section 32 92 00 "Turf and Grasses"
  - 2. Section 32 93 00 "Plants"
  - 3. Division 16 Electrical
  - 4. Division 22 Plumbing
  - 5. Division 33 Utilities

1.3 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Irrigation Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- C. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. ADS Advanced Drainage Systems
  - 3. FRP: Fiberglass-reinforced plastic.
  - 4. PA: Polyamide (nylon) plastic.
  - 5. PE: Polyethylene plastic.
  - 6. PP: Polypropylene plastic.
  - 7. PTFE: Polytetrafluoroethylene plastic.
  - 8. PVC: Polyvinyl chloride plastic.
  - 9. TFE: Tetrafluoroethylene plastic.
- D. The use of the word "Architect" and "Landscape Architect" is referring to the same entity for work described within this section.

#### 1.4 SUBMITTALS

- A. Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:
  - 1. Water regulators.
  - 2. General-duty valves.
  - 3. Specialty and quick coupler valves.
  - 4. Control-valve boxes.
  - 5. Backflow preventer.
  - 6. Drip emitter lines
  - 7. Irrigation specialties.
  - 8. Controllers. Include wiring diagrams and Controller Zone chart.
  - 9. Control cables. Include splice kits and conduit.
- B. Submit product data before beginning work. Include manufacturer's product literature for all products to be installed in three (3) three-ring binders indexed and tabbed. Include material showing manufacturer's name, catalog numbers, catalog cuts, technical data, installation, operation and maintenance instructions for each product.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures Operation and Maintenance Data", include data for the following:
  - 1. Automatic-control valves.
  - 2. Below-grade drip emitter tubing lines.
  - 3. Controller.
- E. As-Built (Record) Drawings.
  - 1. The Contractor shall maintain a current record of all pipe and equipment placement and shall record any variations and changes in work approved by the Architect. Upon completion of the system and prior to release of final payment, the Contractor shall provide the Owner with a neat and legible "As-Built" plan of the completed system using red ink on a black-lined plan. Any pipe not installed in accordance with the plans as originally contracted shall be sufficiently dimensioned to a permanent structure for location after burial.
  - 2. As-built records shall be updated DAILY and plans maintained on-site. Show locations, depth, size and other information as required of all system components to graphically depict the installed irrigation system.
  - 3. Verify available static water pressure near point of connection and document on as-built.
  - 4. Submit an Manufacturer's Equipment Manual and Installation data plus an Operations and Maintenance Manual during initial product submittals

#### 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. Contractor must be a certified irrigation contractor with a minimum of 5 years experience with the design and installation of automatic irrigation systems.
- C. Perform works in strict accordance with the applicable Federal, State and Local plumbing, electrical and health codes and regulations.
- D. Obtain and pay for all permits and approval required by the local jurisdictional authorities for the full operation of the system.
- E. Contractor to have manufacturer representatives inspect and certify that all system components have been properly installed. Contractor to provide written verification from manufacturer that this procedure has occurred. Include in Operation & Maintenance Manual information for owner on how to contact manufacturer.
- F. The work is subject to tests and inspections by the Architect as specified. Furnish written notice to the Architect two (2) weeks prior to the required test or inspection.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping during shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight, ambient temperatures and weather in accordance with manufacturer's recommendations. Support to prevent sagging and bending.
- C. Assume all responsibility for damage to existing construction and restore to its original condition should damage occur as a result of this work.
- D. Deliver irrigation system components in manufacturer's original, undamaged and unopened containers with labels intact and legible.
- E. Deliver products in sufficient quantities to allow a continuity of the work.

#### 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service as indicated:
  - 1. Notify Construction Manager no fewer than 48 hours in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Construction Manager's written permission.

#### 1.8 SPECIAL PROJECT CONDITIONS

- 1. Above-grade rotor-sprays with large-diameter coverage shall be installed to provide temporary irrigation for native plant areas over the course of the first year (by

Contractor, Rotor sprays to be selected by the Contractor) with the temporary rotor sprays left in place for 2-3 years after plant installation to assure plants are established. After plant establishment, the rotor sprays shall be removed and replaced with a Quick Coupler Valves.

#### 1.9 COORDINATION

- A. Coordinate electrical work during controller installation.

#### 1.10 EXTRA MATERIALS

- A. Furnish extra materials to the owner as described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Valve Box Cover: 1 extra cover and key per every 5 installed covers.
  - 2. Quick Coupler Valve: 1 extra Q.C. Valve per 5 installed Q.C. Valves.
  - 3. Drip Emitter Tubing: 5% extra stock per installed emitter tubing.
  - 4. Provide 2 additional keys for the Irrigation Controller.
  - 5. Deliver extra tools, wrenches, keys and other spare parts to the Owner in a plastic container with lid.

#### 1.11 SUBSTITUTIONS

- A. With the exception of quick coupler valves, which are required to be installed as specified on drawings, substitutions to the specified equipment may be permitted with the express written approval of the Architect if submitted one (1) month prior to installation.
- B. Substitutions will be approved only when the substituted item is equivalent or better in quality and performance than the item originally specified. The final determination for "equivalents" rests with the Architect. Their decision shall be final and binding.

#### 1.12 WARRANTY AND MAINTENANCE

- A. General: The one (1) year maintenance period applies to all irrigated areas.
- B. Warranty system against defects of installation and material for period identified above, after acceptance of the irrigation system. Guarantee shall also cover repair or damage to any part of the premises resulting from leaks or other defects in material, equipment and workmanship to the satisfaction of the Architect. Repairs, if required, shall be done promptly upon notification by the Owner, and, at no cost to the Owner. Irrigation equipment damaged by vandalism or resulting from Owner occupancy of the site will not be required to be replaced under this warranty, unless improper installation is a contributing factor in the damage (i.e. heads at improper elevation, irrigation piping at improper depths, etc.)
- C. As part of the warranty, the Contractor shall be responsible for deactivating and draining the system prior to the onset of the freezing season (winterizing) and for reactivating the system at the onset of the Spring growing season; each event must be accomplished once during the warranty period. In the event the system is completed in a season when it will not be in use, the Contractor shall winterize the system upon completion of testing (and approval by the Architect) certifying that the system was winterized and drained including the date such action was accomplished. The Contractor shall be responsible for any damage resulting from failure to comply.

D. Maintenance for irrigation system.

1. General: Concurrent with the one year warranty period for planting and irrigation, the Contractor will monitor and maintain the irrigation system in an operational, water efficient condition with balanced precipitation rates, no excessively wet or dry areas, with adjustments to seasonal changes. Contractor to monitor for properly functioning equipment of the entire irrigation system including controllers, backflow prevention device, valves and drip emitter tubing.
2. Maintenance schedule: Contractor is to monitor and adjust automatic controller on a bi-weekly interval during the months of operation. Bi-weekly maintenance visits also will include checking and adjusting the elevation of valve boxes and irrigation heads, checking and correcting for any settling of trenches and inspecting overall irrigation system operation zone by zone.
3. Inspection: Owner will inspect maintenance during the third week of each month of the maintenance period during the months of operation. Deficiencies will be noted and reported to the Contractor who will correct all deficiencies to the satisfaction of the Owner by the end of the calendar month.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Hunter, Inc. irrigation products with various other products allowed by a different manufacturer (meter, backflow preventers, etc.). All products may be substituted with an approved equal after review and approval.
3. All materials used throughout the system shall be new, unused and in perfect working condition. Refer to the irrigation materials legend, notes, detail drawings and these specifications for specific equipment to be used. Equipment or materials installed or furnished without prior approval of the Architect may be rejected and the Contractor required to remove such materials from the site at the Contractor's expense.

2.2 PIPES, TUBES, AND FITTINGS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

B. PVC Pipe:

1. ASTM D1785, PVC1120, Schedule 40 for mainline and lateral pipes. Schedule 80 PVC for portions of irrigation system as noted on plans.
2. Pipe walls shall be uniform, smooth, glossy and free of interior or exterior extrusion marks; pre-belled or straight to receive solvent-weld couplings; 20 foot standard lengths.

3. Pipe shall be marked with manufacturer's name, class of pipe, NSF seal and date/shift of manufacturing run.

## 2.3 FITTINGS

- A. Schedule 40 PVC: Socket Type, ASTM D 2466, threaded type, ASTM D 2464.
- B. Schedule 80 PVC: Socket Type, ASTM D 2467, threaded type, ASTM D 2464.

## 2.4 CEMENT AND SOLVENT

- A. Primer-P70 purple-tinted, compatible with joint compound as recommended by PVC pipe manufacturer.
- B. Joint compound, slow-drying, heavy-duty PVC solvent cement.

## 2.5 IRRIGATION SYSTEM PLASTIC PIPE

- A. Mainline: PVC Schedule 40 pipe with PVC solvent weld fittings.
- B. Laterals: PVC Class 200 pipe with PVC solvent weld fittings.
- C. Sleeving: PVC Schedule 40 pipe for sleeves. Sleeve size shall be double the diameter of the interior pipe(s). Minimum sleeve size is 2" nominal diameter.

## 2.6 GENERAL-DUTY VALVES

- A. PVC Ball Valves: MSS SP-122, union type, with full-port ball, socket or threaded detachable end connectors, and pressure rating not less than 125 psig.
  1. Material Option: MSS SP-122, of plastic other than PVC and suitable for potable water. Include threaded ends and pressure rating not less than 150 psig unless otherwise indicated.
  2. Available Manufacturers:
    - a. King Bros. Industries.
    - b. Legend Valve.
    - c. NIBCO INC.; Chemtrol Div.
    - d. Watts Industries, Inc.; Water Products Div.

## 2.7 SPECIALTY VALVES

- A. Plastic Automatic Control Valves: Molded-plastic body, normally closed, solenoid operated diaphragm type, normally closed, pressure regulating with manual flow adjustment, and operated by 24-V ac solenoid.
  1. Available Manufacturers.
    - a. Hunter, Inc. (As shown on Irrigation Schedule)
    - b. Approved Equal.

- B. Manual Drain Valves: Spring-loaded-ball type of brass construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.
  - 1. Available Manufacturers:
    - a. Champion, Inc.
- C. Quick-Couplers: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
  - 1. Locking-Top Option: Vandal-resistant, locking feature. Include two matching keys with hose swivel to Owner.
  - 2. Available Manufacturers:
    - a. Hunter, Inc. (As shown on Irrigation Schedule)
    - b. Approved Equal.

## 2.8 CONTROL-VALVE BOXES AND PROTECTIVE SLEEVES

- A. Plastic Control-Valve Boxes: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. Include size as required for valves and service.
  - 1. Shape: Rectangular, 12" x 16" x 10-3/4".
  - 2. Sidewall Material: PE, ABS, or FRP.
  - 3. Cover Material: PE, ABS, FRP, or polymer concrete.
    - a. Lettering: VALVE NO. (X), Valve number to match designated valve zone.
    - b. Color: Color shall be black when located in barked planting beds, green when located in lawn areas.
  - 4. Available Manufacturers:
    - a. Carson Industries, Ametek or approved equal.
- B. Double Check Valve Assembly Box, Super Jumbo XL model, black.
  - 1. Carson Industries, Ametek or approved equal.
- C. Protective Sleeves, Class 160 PVC, length as required, with locking caps.
- D. Provide 5 sets of keys required for valves, protective pipe sleeves and valve box covers.
- E. Drainage Backfill: Cleaned gravel or crushed stone, graded from 1 1/2 inch minimum to 2 1/2 inches maximum. Existing soil may be used, if approved.

## 2.9 PIPING SPECIALTIES

- A. Water Regulators: ASSE 1003, single-seated, direct-operated, water-pressure regulators, rated for 150-psig minimum initial-inlet working pressure, with size, flow rate, and inlet and outlet pressures indicated. Include integral factory-installed or separate field-installed Y-pattern strainer that is compatible with unit for size and capacity.
  - 1. NPS 2 and Smaller: Bronze body with threaded ends.

2. NPS 2-1/2 and Larger: Bronze or cast-iron body with flanged ends.
3. Interior Components: Corrosion-resistant materials.
4. Available Manufacturers;
  - a. BERMAD
  - b. CLA-VAL Co.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Wilkins Operation.

- B. Pressure Gages: ASME B40.1. Include 4-1/2-inch diameter dial, dial range of 2 times system operating pressure, and bottom outlet.

## 2.10 EMITTER LINES

- A. Description: All products shall be furnished from a single manufacturer required to provide a full and efficient drip irrigation system. Product components shall consist of current models and equipment available and shall supercede obsolete and discontinued models that may be specified in the scope of this work. This includes conventional drip emitters and Hunter irrigation Eco-Mat drip system.
  1. Manufacturers
    - a. Hunter, Inc. (As shown on Irrigation Schedule)
    - b. Approved Equal.

## 2.11 SPRAY HEADS

2. Manufacturers
  - a. Hunter, Inc. (As shown on Irrigation Schedule)
  - b. Approved Equal.

## 2.12 BACKFLOW PREVENTION DEVICE

- A. FEBCO Inc. or approved equal. Coordinate with Civil Plans to match same manufacturer if desired.. Assure conformance with Snohomish County Public Works requirements.

## 2.13 AUTOMATIC CONTROLLERS

- A. Hunter, Inc. (As shown on Irrigation Schedule)
- B. Wiring: Insulated, multi-strand copper designed for 24-50 volts and UL approved as UF (Underground Feeder). UL and UF designations clearly marked on the insulation jacket of the wire. Copper conductor must meet or exceed ASTM B-3 specifications. Minimum gauge direct burial (UL approved) red or black jackets for hot side, white for common ground, auxiliary wires shall have an orange color jacket. Submit sample wire.
  1. Available Manufacturers:
    - a. American Electric Cable Co.
    - b. American Insulated Wire Corp.
    - c. Cerro Wire & Cable Co., Inc.
    - d. Colonial Wire and Cable Co., Inc.
    - e. Paige
    - f. Service Wire

- C. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
  - 1. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
  - 2. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.
- D. Concrete Base: Reinforced precast concrete with opening for wiring.
- E. Install 5/8" x 8" ground rod into subgrade prior to installation of slab foundation of storage unit.
- F. Provide transient protection board and surge protector package. Unit to be installed on same wall as controller below controller, anchor mount into wall and bolt cabinet to masonry. Install surge protector in line of voltage line and mount to metal conduit with power to device above.

#### 2.14 ACCESSORIES

- A. Electrical splices/tape: Scotch-Lok Model No. 3570 or 3M-DBY direct burial splice kit.
- B. Pressure gauge: Liquid-filled, registering 0 to 160 psi.

### PART 3 – EXECUTION

#### 3.1 EARTHWORK

- A. Trenches shall be free of rock, debris or sharp articles with a minimum of 15" of cover over lateral lines, 20 inches of cover over mainline. Depth of cover for sleeving under vehicle paving: 20" over mainline and lateral sleeves. Depth of sleeving within landscape: 20" over mainline sleeves, 15" over lateral sleeves. Trench width must allow for a minimum of three (3) inches between parallel pipelines.
- B. Accomplish backfilling in a manner to ensure no future settlement of the trench. Backfill in maximum 6" lifts. Backfill lines with sand; provide 6" minimum cover on all sides. No foreign matter will be permitted in the initial backfill.
- C. Backfill in sleeving trenches (i.e. under all hardscapes) shall be mechanically compacted in two (2) lifts to a dry density equal to 95% of adjacent undisturbed soil. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.
- D. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting or other construction are necessary, the Contractor shall make all required adjustments without cost to the Owner.
- E. Trenches to remain open for mainline review by Architect – one (1) visit and open trench lateral pressure test – one (1) visit.
- F. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

- G. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.
  - 1. Install piping sleeves by boring or jacking under existing paving is possible.
- H. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
- I. Provide minimum cover over top of underground piping according to the following:
  - 1. Irrigation Main Piping: Minimum depth of 18 inches
  - 2. Circuit Piping: Minimum depth of 12 inches
  - 3. Sleeves: Minimum depth of 20 inches

### 3.2 PREPARATION AND EXAMINATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.
- B. Prior to starting work, carefully inspect the preparatory work of other trades and verify that such work is acceptable for the installation of the work of this section. Report all unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been resolved. Beginning of work constitutes Contractor acceptance of conditions.

### 3.3 PIPING APPLICATIONS

- A. Install components having pressure rating equal to or greater than system operating pressure.
- B. Piping in control-valve boxes and aboveground may be joined with flanges instead of joints indicated.
- C. Plastic Pipe
  - 1. PVC pipe upstream of the control valves shall be Schedule 40 and conform to all requirements of ASTM D2241.
  - 2. PVC pipe (zone lines) downstream of the control valves shall be Class 200 (pressure rated for 200 psi), and conform to all requirements of ASTM D2241.
  - 3. PVC pipe sleeving shall be Schedule 40 and conform to all requirements of ASTM D2241 unless otherwise noted on the drawings.
  - 4. All pipe shall be marked with the Manufacturer's name, class of pipe and NSF seal. Pipe shall bear no evidence of interior or exterior extrusion marks. Pipe walls shall be uniform, smooth, and glossy. Pipe may be pre-belled or with individual solvent-weld couplings.
  - 5. All fittings for mainlines shall conform to the requirements of ASTM D2464, Schedule 80 PVC. All glued fittings for mainlines shall conform to the requirements of ASTM D2466, Schedule 40 PVC.
  - 6. All pipe must be delivered in at least 20-lengths.

### 3.4 VALVE APPLICATIONS

- A. Underground, Shutoff-Duty Valves: Use the following:
  - 1. 2" and Smaller: Curb stop with tee head, curb-stop service box, and shutoff rod.

2. 2 ½" and Larger: AWWA cast-iron gate valve with elastomeric gaskets and stem nut, valve box, and shutoff rod.
- B. Underground, Manual Control Valves: Bronze globe valve with control-valve box and valve key.
- C. Automatic Control Valves:
1. Install as per details. Use valve box extensions to insure that the box extends completely below the bottom of the valve and specified clearance space. Valve pit shall be left with a clean layer of gravel in the bottom with 4" clearance minimum between gravel and bottom of valve.
  2. Valve inlet pipe size to match outlet lateral line size.
- D. Drain Valves:
1. NPS 1/2 and NPS 3/4: Bronze, non-rising-stem gate valve.

### 3.5 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
- B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- C. Install piping free of sags and bends.
- D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- E. Install fittings for changes in direction and branch connections.
- F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.
- G. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- H. Install PVC piping in dry weather when temperature is above 40 deg F 5 deg C. Allow joints to cure at least 24 hours at temperatures above 40 deg F 5 deg C before testing unless otherwise recommended by manufacturer.
- I. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet.

### 3.6 AUTOMATIC VALVES

- A. Use valve box extensions to assure that the box extends completely below the bottom of the valve. Valve pit shall be left with a clean layer of gravel in the bottom with 4" clearance minimum between gravel and bottom of valve.

### 3.7 JOINT CONSTRUCTION

- A. Refer to division 2 section "piped utilities -- basic materials and methods" for basic pipe joint construction.

### 3.8 VALVE INSTALLATION

- A. Underground Gate Valves: Install in valve box with top flush with grade.
- B. Control Valves: Install in control-valve box.
- C. Manual Drain Valves: Install in control-valve box. Install on mainline at low points to facilitate future repairs (minimum of 1 valve per loop section in areas between mainline isolation valves of mainline. Install 2" Class 160 PVC sleeve over cross handle and extending to finish grade. Mark valve with rubber valve marker, which fits snugly into sleeve.
- D. Quick Coupling Valves: Install in locations required for hose connections and for winterization at point of connection.
- E. Mainline Isolation Valves: Triangulate valve locations to PERMANENT structures and include on As-Built Drawings.
- F. Install per details and irrigation drawings.

### 3.9 DRIP EMITTER LINE INSTALLATION

- A. Drip emitter line fittings must be mated by pushing the fitting into the tubing while twisting side to side until the tubing abuts either to adjoining tubing or a fitting stop.
- B. Cap or plug all openings as soon as lines have been installed to prevent debris from entering that may obstruct the pipe. Leave in place until removal is required to complete installation.
- C. Thoroughly flush all lines prior to installing valves and other accessories.
- D. Install one (1) 6" long metal wire staple at 3'-0" o.c. and two (2) staples at each change of direction (tee, elbow, crossing).
- E. Use only Teflon tape at all threaded connections. Make adjustments as required to properly supply desired amount of water to each plant.
- F. Install drip emitter line per the drawing and details.

### 3.10 AUTOMATIC CONTROLLERS

- A. Install all components per manufacturer's installation instructions.

### 3.11 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Ground equipment according to Division 16 Section "Grounding and Bonding."
- C. Connect wiring according to Division 16 Section "Conductors and Cables."
- D. 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.

### 3.12 CONTROL WIRES

- A. Tape wire bundle at 10 foot intervals. Do not tape wire harness to water pipe. Provide an 18" harness loop at all sleeve ends and direction changes.
- B. All splices must be contained in plastic valve box where a valve is installed. Allow expansion coils long enough so valve bonnet may be removed and placed outside the box for maintenance purposes. Provide separate hot lead for each automatic valve. One common wire for each controller.
- C. Provide one spare wire to run from controller to end valve on each loop section of the mainline. Identify each spare at the controller. Loop a 24" coil of spare wire inside each valve box.
- D. Install in sleeves under pavement areas.

### 3.13 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
  - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- B. Refer to Division 2 Section "Piped Utilities -- Basic Materials and Methods" for equipment nameplates and signs.
- C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tape over underground piping, during backfilling of trenches.

### 3.14 TESTING OF SYSTEM

- A. After flushing and valving main line and prior to backfilling a pressure test will be required on the main line. Attach test compressor with pressure gauge to head of mainline.
- B. Mainline shall have a one-hour test at a static pressure of 150 PSI. A maximum pressure loss of 5 PSI will be allowed. Test shall be for 30 minutes.
- C. Contractor is responsible to set up all equipment necessary to comply with test. Leave all mainline, system joints, connections, etc. exposed in open trenches until after completion and acceptance of the pressure test.

- D. Contractor shall schedule pressure test 48 hours in advance with Technical Representative and with General Contractor present.
- E. Lateral lines shall be visually tested before heads are installed at line pressure. Schedule pressure tests on lateral with Technical Representative 48 hours in advance.
- F. Before any testing starts all air must be expelled from the pipe by opening valve at end of mainline until all air is removed. Close gate valve and install pressure gauge, then re-open valve.
- G. Any section of pipe not passing test shall be repaired and re-tested.
- H. Test water pressure at point of connection and submit written certification of test and signed by the general Contractor verifying that the pressure test was completed and meets pressure requirements to Architect.

3.15 PERFORMANCE TEST

- A. System performance demonstration (one visit by Architect)
  - 1. Upon completion of the system installation and after the flushing and pressure tests are completed, perform a system coverage test for each zone in the presence of the Architect and Owner's maintenance personnel.
- B. Repair any clogged or damaged lines. Correct all deficiencies, without additional cost, until the Architect approves the system. System shall be tested for both manual and fully automatic operation.

3.16 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each drip emitter line circuit.
- C. Adjust drip emitter lines as required to avoid obstacles and that lines remain significantly buried. Adjustments to the system will be made without additional cost to the Owner.

3.17 CLEANING AND REPAIRS

- A. Flush dirt and debris from piping before installing drip emitter lines and other devices.
- B. Drain and blow-out system prior to shutting down for the winter.
- C. Repair or replace any damaged materials, surfaces and finishes caused by Work of this Section to the satisfaction of the Owner and at no additional cost to the owner.
- D. Clean-up shall be done as each portion of work progresses. Refuse and excess dirt shall be removed from the site and legally disposed of off-site. All walks and paving shall be swept down.

3.18 OWNER'S SYSTEM FAMILIARIZATION

- A. Before final acceptance of the system, the Contractor shall provide the necessary keys and/or other tools required to operate, drain and activate the system. Contractor shall instruct the owner on all system operations, so that maintenance and winterization can continue after the departure of the Contractor. Provide two (2) complete sets of tools and keys to the Owner (i.e. water keys, quick coupler keys with hose swivel attachments, valve cover keys, controller keys and sprinkler adjustment and disassembling tools, etc.)

3.19 MAINTENANCE MANUALS

- A. The Contractor is to provide three (3) operation and maintenance manuals to the owner and one (1) additional manual to the Architect. The manuals shall be indexed and tabbed, bound in hardback 3-ring binders. Include the following items/information:
  - 1. List of authorized distributors and service representatives (in the area) for each item of irrigation equipment: include names, addresses and phone numbers.
  - 2. Guarantee/warranty certificates for all equipment used and Contractor's written warranty for entire system one (1) year guarantee.
  - 3. Manufacturer's maintenance sheets, replacement parts list and equipment brochures for all equipment used. All composite data sheets shall have the specified products used in the field clearly highlighted.
  - 4. Winterization and Spring start-up procedures.
  - 5. A pocket for one (1) blackline copy of the approved record drawings. This print shall be added at the time of final inspection.

3.20 MAINTENANCE TRAINING

- A. Upon acceptance of the system at Substantial Completion by the Owner's Representative, furnish sufficient training to the Owner's personnel in the operation in the operation maintenance and winterization of the system. The Contractor shall be liable for all damages or losses resulting from failure to comply with the provisions of this paragraph.

3.21 SYSTEM PROTECTION

- A. Deactivate and drain the system prior to the onset of the freezing season and reactivate at the onset of the Spring season. Accomplish each at least once during the warranty period. If construction is completed when the system is not in use, winterize after testing. Certify by letter the dates of winterization / activation. Repair damage from failure to comply.
- B. When using compressed air to winterize the system, do so in short cycles at no more than 40 psi air pressure. Do not allow pipe close to the compressor to get "hot to the touch".

3.22 FINAL APPROVAL

- A. Contingent upon receiving signed and approved permits as may be applicable, reproducible "As-Built" drawings and three (3) three ring binders of all catalog cuts/manufacture's instruction/maintenance and operation information as well as two (2) complete sets of all tools and keys, and extra sprinkler stock as required and specified previously.

END OF SECTION 328400

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Hydroseeding.
- 2. Erosion-control material.
- 3. Eco-Lawn

- B. Related Requirements:

- 1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawings for specific planting soils.
- E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site with Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
  - 1. Certification of each seed mixture for turfgrass. Include identification of source and name and telephone number of supplier.
- C. Product Certificates: For fertilizers, from manufacturer.
- D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.
  - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  - 2. Experience: Three years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
  - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 4. Personnel Certifications: Installer's personnel assigned to the Work shall have certification in one of all of the following categories from the Professional Landcare Network:
    - a. Landscape Industry Certified Technician - Exterior.
    - b. Landscape Industry Certified Lawncare Manager.
    - c. Landscape Industry Certified Lawncare Technician.
  - 5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: March 15 to June 15.
2. Fall Planting: September 1 to October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

C. Grass-Seed Mix: Proprietary seed mix as follows:

1. Products: Subject to compliance with requirements, provide the following:
  - a. "Northwest Playground Seed Mix"
  - b. PT 770 Water-Less Eco-Lawn seed mix.

D. Seed Carrier: Inert material, sharp clean sand or perlite.

2.2 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

## 2.3 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
  1. Organic Matter Content: 50 percent of dry weight.
  2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- E. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

## 2.4 PESTICIDES

- A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 EROSION-CONTROL MATERIALS

- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.
- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 3. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  - 1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
  - 2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
  - 1. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Plants.
  - 2. Landscape edgings.

1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- C. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.
- D. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site as requested by Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples of each type of mulch.

1.5 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Material shipping / delivery tickets.
- C. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year.

1.7 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 1. Pesticide Applicator: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plants within 36 hours of digging. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- C. Handle planting stock by root ball.
- D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.9 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
    - b. Structural failures including plantings falling or blowing over.
  - 2. Warranty Periods: From date of Project Substantial Completion.
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
    - c. Annuals: Three months.

## PART 2 - PRODUCTS

### 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
- B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- C. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

### 2.2 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
  - 1. Size: 21-gram tablets.
  - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

### 2.3 MULCHES

- A. Organic Mulch: Fine to medium ground bark chips (hemlock / fir) as indicated on the Drawings.
- B. Mineral Mulch: Rounded riverbed gravel or smooth-faced stone.
  - 1. Size Range: 4" minimum to 8" maximum.
  - 2. Color: Light gray color to match boulder color.

### 2.4 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd.

2.5 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.6 LANDSCAPE EDGINGS

- A. Plastic Edging: Standard black polyethylene or vinyl edging, V-lipped bottom, horizontally grooved, extruded in standard lengths, with 9-inch steel angle plastic stakes.

- 1. Edging Size: 0.1 inch thick by 5 inches deep.

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade] [Place manufactured planting soil over exposed subgrade or Blend planting soil in place as indicated on the Drawings.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
  - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  - 2. Excavate approximately three times as wide as ball diameter.
  - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
- B. Backfill Soil: Subsoil and topsoil removed from excavations **may** be used as backfill soil unless otherwise indicated.

3.3 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where

the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
  - 1. Backfill: Planting soil, for trees, use backfill as indicated on the Tree Installation Detail.
  - 2. Balled and Burlapped Stock: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 3. Container-Grown Stock: Carefully remove root ball from container without damaging root ball or plant.
  - 4. Fabric Bag-Grown Stock: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 6. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
  - 7.
    - a. Quantity: Two per plant, three for each caliper inch of trees.
  - 8. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

### 3.4 TREE, SHRUB, AND VINE PRUNING

- A. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- B. Do not apply pruning paint to wounds.

### 3.5 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.

- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.6 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 4.0' dia. around deciduous tree trunk and 6.0' dia. ring around coniferous tree trunk. Do not place mulch within 6 inches of trunks or stems.
  - 2. Organic Mulch and Mineral Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area and finish level with adjacent finish grades. Do not place mulch within 6 inches of trunks or stems.

### 3.7 EDGING INSTALLATION

- A. Plastic Edging: Install plastic edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 36 inches apart, driven through upper base grooves or V-lip of edging.
- B. Shovel-Cut Edging: Separate mulched areas from turf areas, curbs, and paving with a 45-degree, 4 to 6-inch deep, shovel-cut edge where plastic edging is not shown on the Drawings.

### 3.8 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
- D. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

- E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

### 3.9 MAINTENANCE SERVICE

- A. Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
  - 1. Maintenance Period for Trees and Shrubs: 12 months from date of Project Substantial Completion.
  - 2. Maintenance Period for Ground Cover and Other Plants: 12 months from date of project Substantial Completion.

END OF SECTION 329300

- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

### 3.5 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
  - 1. Mix slurry with non-asphaltic, fiber-mulch manufacturer's recommended tackifier.
  - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
  - 3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydro-mulching) at a rate of 1000 lbs. / acre.
  - 4. Seed PT 770 Water-Less Eco-Lawn seed mix at a rate of 7 pounds / 1,000 s.f.

### 3.6 TURF RENOVATION

- A. Renovate existing turf where indicated.
- B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish turf where settlement or washouts occur or where minor re-grading is required.
  - 2. Install new planting soil as required.
- C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

- D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- E. Mow, dethatch, core aerate, and rake existing turf.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- I. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
  - 1. Soil Amendment(s): Add soil amendments according to requirements of Section 329113 "Soil Preparation."
  - 2. Initial Fertilizer: Commercial fertilizer applied according to manufacturer's recommendations.
- J. Apply seed and protect with straw mulch as required for new turf.
- K. Water newly planted areas and keep moist until new turf is established.

### 3.7 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
  - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and

become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

- D.
  - 1. Mow perennial ryegrass to a height of 1 to 2 inches.
  - 2. Mow Northwest Playground Seed Mix to a height of 1 to 2 inches.
- E. Turf Post-fertilization: Apply commercial fertilizer after initial mowing and when grass is dry.
  - 1. Use fertilizer that provides actual nitrogen of at least 1 lb / 1000 sq. ft. to turf area.

### 3.8 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

### 3.9 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

### 3.10 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove non-degradable erosion-control measures after grass establishment period.

### 3.11 MAINTENANCE SERVICE

- A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each

SECTION 32 92 00  
TURF AND GRASSES

area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 12 months from date of planting completion.
  - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

END OF SECTION 32 92 00

**SECTION 33 05 00  
COMMON WORK  
FOR UTILITIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Piping joining materials.
- B. Dielectric fittings.
- C. Identification devices.
- D. Grout.
- E. Piping system common requirements.
- F. Concrete bases.

**1.02 REFERENCE STANDARDS**

- A. Standard Specification for Road, Bridge, and Municipal Construction as amended by City of Chehalis Standards. Hence forth referred to as Standard Specifications.
- B. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses 2017.
- C. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop 2018.
- D. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2019.
- E. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)) 2012, with Editorial Revision (2015).
- F. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method 2015, with Editorial Revision (2016).
- G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2017, with Editorial Revision.
- H. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2017a.

**1.03 SUBMITTALS**

- A. See Section 01 33 00, Submittal Procedures, for submittals.
- B. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Identification devices.

## **PART 2 PRODUCTS**

### **201 PIPING JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

### **202 DIELECTRIC FITTINGS**

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Hart Industries, International, Inc.
    - e. Watts Water Technologies, Inc.
    - f. Zurn Plumbing Products Group; Wilkins Div.
- C. Dielectric Flanges:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Capitol Manufacturing Co.

- b. Central Plastics Company.
  - c. Epco Sales, Inc.
  - d. Watts Water Technologies, Inc.
- 2. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 (DN 65 to DN 100) and larger.
  - a. Pressure Rating 175 psig.
  - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric Couplings:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
  - 2. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.
    - a. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    - b. End Connections: Threaded.

## **203 IDENTIFICATION DEVICES**

- A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  - 2. Location: Accessible and visible.
- B. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- C. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
- D. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- E. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

## **204 GROUT**

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## **PART 3 EXECUTION**

### **301 DIELECTRIC FITTING APPLICATIONS**

- A. Wet Piping Systems: Connect piping of dissimilar metals with the following:
  - 1. NPS 2 (DN 50) and Smaller: Dielectric couplings or dielectric nipples.
  - 2. NPS 2-1/2 (DN 65) and Larger: Dielectric nipples.

### **302 PIPING INSTALLATION**

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. [PVC] [Steel] Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

**3.03 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

**3.04 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Install dielectric fittings at connections of dissimilar metal pipes.

**3.05 EQUIPMENT INSTALLATION**

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

**3.06 IDENTIFICATION**

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
- B. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
- C. Locate pipe markers on exposed piping according to the following:
- D. Near each valve and control device.
- E. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
- F. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
- G. At manholes and similar access points that permit view of concealed piping.
- H. Near major equipment items and other points of origination and termination.
- I. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
- J. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
- K. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- L. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

**307 CONCRETE BASES**

- M. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
  3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  7. Use 3000-psi (20.7-MPa) 28-day compressive-strength concrete and reinforcement as specified in Section 033053 Miscellaneous Cast-in-Place Concrete.

**308 GROUTING**

- N. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
1. Clean surfaces that will come into contact with grout.
  2. Provide forms as required for placement of grout.
  3. Avoid air entrapment during placement of grout.
  4. Place grout, completely filling equipment bases.
  5. Place grout on concrete bases and provide smooth bearing surface for equipment.
  6. Place grout around anchors.
  7. Cure placed grout.

**END OF SECTION**

**SECTION 33 14 16  
SITE WATER UTILITY DISTRIBUTION PIPING**

**PART 1 GENERAL**

**2.01 SECTION INCLUDES**

- A. Water pipe for site conveyance lines.
- B. Pipe valves.
- C. Fire hydrants.

**2.02 RELATED REQUIREMENTS**

- A. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

**2.03 REFERENCE STANDARDS**

- A. AWWA C502 - Dry-Barrel Fire Hydrants 2018.
- B. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service 2015.
- C. AWWA C800 - Underground Service Line Valves and Fittings 2014.
- D. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution 2016.
- E. UL 246 - Hydrants for Fire-Protection Service Current Edition, Including All Revisions.

**2.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

**2.05 SUBMITTALS**

- A. See Section 01 33 00, Submittal Procedures, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

**2.06 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**2.07 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - 1. Comply with requirements of City of Chehalis. Including tapping of water mains and backflow prevention.
  - 2. Comply with standards of City of Chehalis for potable-water-service piping, including materials, installation, testing, and disinfection.
  - 3. Comply with standards of City of Chehalis for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance:
  - 1. Comply with NSF 14 for plastic potable-water-service piping.
  - 2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

**2.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves in shipping containers with labeling in place.
- B. Protect crosslinked polyethylene tubing from direct and indirect UV exposure.

**2.09 PROJECT CONDITIONS**

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

**2.10 COORDINATION**

- A. Coordinate connection to water main with utility company.

**PART 2 PRODUCTS**

**3.01 WATER PIPE**

- A. Ductile Iron Pipe: AWWA C151/A21.51:
  - 1. Fittings: Ductile iron, standard thickness.
  - 2. Joints: AWWA C111/A21.11, Styrene butadiene rubber (SBR) or vulcanized SBR gasket with rods.
  - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- B. PE, Service Pipe: ASTM F 714, AWWA C906, Class 200.
  - 1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
- C. Copper Tubing: ASTM B88, Type K, Annealed:
  - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
  - 2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.
- D. PVC Pipe: ASTM D1785 Schedule 40.
  - 1. Fittings: ASTM D2466, PVC.
  - 2. Joints: ASTM D2855, solvent weld.
- E. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

- 2. Gaskets: AWWA C111, rubber.
- F. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
  - 1. Grooved-End, Ductile-Iron Pipe Appurtenances:
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- G. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

### **3.02 JOINING MATERIALS**

- A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. JOINING MATERIALS
  - 1. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.
  - 2. Brazing Filler Metals: AWS A5.8, BCuP Series.
  - 3. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
  - 4. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

### **3.03 VALVES**

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches (75 mm):
  - 1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.
- C. Gate Valves 3 Inches (75 mm) and Over:
  - 1. Shall be resilient wedge with O-ring seals.
  - 2. Valve ends shall be mechanical join by ANSI flanges.
  - 3. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, post indicator, valve key, and extension box.
  - 4. Manufacturers:
    - a. Mueller
    - b. M&H
    - c. Kennedy
    - d. Clow R/W
    - e. Waterous series 500
- D. Ball Valves Up to 2 Inches (50 mm):
  - 1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.

**3.04 DOUBLE CHECK VALVE AND FIRE DEPARTMENT CONNECTION**

- A. All materials shall meet the comply of City of Chehalis standards.
  - 1. See City standard drawing 4-6

**3.05 HYDRANTS**

- A. Hydrants: shall be Mueller Centurion A423, M&H Reliant style 929, Clow Medallion, or Kennedy Guardian K81D.
- B. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- C. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles , one pumper nozzle.
- D. Pressure Rating: According to utility company.
- E. Finish: Primer and two coats of enamel in sunburst yellow high-grade enamel after installation.

**3.06 FIRE DEPARTMENT CONNECTIONS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Elkhart Brass Mfg. Co., Inc.
  - 2. Fire End & Croker Corporation.
  - 3. Guardian Fire Equipment, Inc.
  - 4. Kidde Fire Fighting.
  - 5. Potter Roemer.
  - 6. Reliable Automatic Sprinkler Co., Inc.
- B. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.
  - 1. Standard: UL 405.
  - 2. Connections: Two NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) outlet.
  - 3. Inlet Alignment: Square.
  - 4. Finish Including Sleeve: Polished bronze.

**3.07 YARD HYDRANT-**

- A. Description lead-free, non-freeze yard hydrant Woodford model Y1 or approved equal. Hydrant with cast iron head and lift handle with lock option, galvanized steel pipe, bronze and stainless-steel interior components, 1-inch inlet connection with tapped drainage port on housing, and a removable 3/4" male hose connection.

**3.08 BEDDING AND COVER MATERIALS**

- A. Bedding: As specified in Section 31 20 00.
- B. Cover: 30 inches min.

**3.09 ACCESSORIES**

- A. Valve Boxes: All valves will have a standard Olympic Foundry 910 or 940 water valve box as determined by the water division of City of Chehalis.
  - 1. If the city approves or requires the use of an Olympic 910 valve box, it will be set to grade with a six-inch ASTM 3034 SDR 35 PVC riser from valve to approximately six inches from

the valve box top. If valves are not set in a paved area, a three-by-three-foot concrete pad four inches thick will be set around each valve box at finished grade.

2. An Olympic Foundry 940 valve box will be required for all locations of heavy traffic. In areas where the valve box is on the shoulder of the road, the ditch and shoulder will be graded before placing an asphalt or concrete pad. Valve box lids will be ductile iron, anti-kickout, and marked "WATER" (see Standard City Drawing 4-12).
  3. All valve locations will be marked on the face of the adjacent curb with a "WV" embossed one-fourth inch into the concrete.
  4. Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.
- B. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
- C. Concrete for Thrust Restraints: Concrete type per City of Chehalis standards.
- D. Backflow Preventer: Meeting City of Chehalis standards.
- E. Meter: Meeting City of Chehalis Standards

### **PART 3 EXECUTION**

#### **4.01 EXAMINATION**

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

#### **4.02 PREPARATION**

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

#### **4.03 EARTHWORK**

- A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

#### **4.04 PIPING APPLICATIONS**

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- D. Underground water-service piping NPS 3/4 to NPS 1.5 shall be soft copper tube, [ASTM B 88, Type K (ASTM B 88M), solder-joint fittings, and brazed joints.
- E. Underground water-service piping NPS 2 to NPS the following:
1. PE, Service Pipe: ASTM F 714, AWWA C906, Class 200.

#### **4.05 VALVE APPLICATIONS**

- A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation

valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, [metal] [resilient] [high-pressure, resilient]-seated gate valves with valve box.
- C. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.

#### **4.06 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

#### **4.07 PIPING INSTALLATION**

- A. Water-Main Connection: Tap water main according to requirements City of Chehalis and of size and in location indicated.

#### **4.08 MAKE CONNECTIONS LARGER THAN NPS 2 (DN 50) WITH TAPPING MACHINE ACCORDING TO THE FOLLOWING:**

- A. Install tapping sleeve and tapping valve according to MSS SP-60.
- B. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
- C. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
- D. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- E. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:
- F. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by City of Chehalis.
- G. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
- H. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
- I. Install corporation valves into service-saddle assemblies.
- J. Install curb valve in water-service piping with head pointing up and with service box.
- K. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

**4.09 JOINT CONSTRUCTION**

- A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.
- B. Make pipe joints according to the following:
  - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
- C. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
- D. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
- E. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
- F. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
- G. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

**4.10 ANCHORAGE INSTALLATION**

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Heat-fused joints.
  - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
- C. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
- D. Fire-Service-Main Piping: According to NFPA 24.

**4.11 VALVE INSTALLATION**

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. MSS Valves: Install as component of connected piping system.
- D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- E. WATER METER INSTALLATION
- F. Install water meters, piping, and specialties according to utility company's written instructions.

**4.12 BACKFLOW PREVENTER INSTALLATION**

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install bypass piping around backflow preventers.

**4.13 WATER METER BOX INSTALLATION**

- A. Install water meter boxes in paved areas flush with surface.
- B. Install water meter boxes in grass or earth areas with top 2 inches (50 mm) above surface.

**4.14 CONCRETE VAULT INSTALLATION**

- A. Install precast concrete vaults according to ASTM C 891.

**4.15 FIRE HYDRANT INSTALLATION**

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

**4.16 FIRE DEPARTMENT CONNECTION INSTALLATION**

- A. Install protective pipe bollards on two sides of each fire department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

**4.17 CONNECTIONS**

- A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.
- B. Connect water-distribution piping to existing water main. Use [tapping sleeve and tapping valve in accordance with City of Chehalis standards.
- C. Connect water-distribution piping to interior domestic water, irrigation and fire-suppression piping.

**4.18 FIELD QUALITY CONTROL**

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
  - 1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

**4.19 IDENTIFICATION**

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 330500 "Common Work Results for Utilities" for identifying devices.

**4.20      CLEANING**

- A. Clean and disinfect water-distribution piping as follows:
- B. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
- C. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
- D. Prepare reports of purging and disinfecting activities.

**END OF SECTION**

**SECTION 33 31 13  
SITE SANITARY SEWERAGE GRAVITY PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sanitary sewerage drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to municipal sewers.
- C. Cleanout access.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 30 53 - Cast-In-Place Concrete: Concrete for cleanout base pad construction.
- B. Section 31 20 00 - Excavation: Excavating of trenches.
- C. Section 31 20 00 - Trenching: Excavating, bedding, and backfilling.
- D. Section 31 20 00 - Fill: Bedding and backfilling.

**1.03 DEFINITIONS**

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

**1.04 REFERENCE STANDARDS**

- A. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021.
- B. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications 2020.
- C. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping 2001 (Reapproved 2014).
- D. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2017.
- E. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2016.
- F. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material 2014.

**1.05 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the installation of City of Chehalis with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

**1.06 SUBMITTALS**

- A. See Section 01 33 00, Submittal Procedures, for submittals.
- B. Product Data: Provide data indicating pipe, pipe accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- E. Field Quality Control Submittals: Document results of field quality control testing.
- F. Project Record Documents:
  - 1. Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

## **PART 2 PRODUCTS**

### **2.01 SEWER PIPE MATERIALS**

- A. Provide products that comply with applicable code(s).
- B. Plastic Pipe: ASTM D3034, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 4 to 12 inches, bell and spigot style solvent sealed joint end.
- C. Joint Seals: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

### **2.02 PIPE ACCESSORIES**

- A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service" in large letters.
- B. Casing Spacer: Polyethylene spacer designed to maintain pipe casing integrity.
  - 1. Manufacturers:
    - a. Advance Products & Systems, LLC: [www.apsonline.com/#sle](http://www.apsonline.com/#sle).

### **2.03 CLEANOUT MANHOLE**

- A. Lid and Frame: Cast iron construction.
  - 1. Lid Design: Open checkerboard grille.
  - 2. Nominal Lid and Frame Size: 26 inches (660 mm).
- B. Acceptable Products:
- C. Shaft Construction and Concentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12 inches (300 mm); nominal shaft diameter of 36 inches (900 mm).
- D. Acceptable Products:
- E. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00, levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

### **2.04 BEDDING AND COVER MATERIALS**

- A. Pipe Bedding Material: As specified in Section 31 20 00.
- B. Pipe Cover Material: As specified in Section 31 20 00.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Perform work in accordance with applicable code(s).

### **3.02 TRENCHING**

- A. See Section 31 20 00 for additional requirements.

- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

**3.03 INSTALLATION - PIPE**

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
  - 1. Plastic Pipe: Also comply with ASTM D2321.
- C. Lay pipe to slope gradients noted on layout drawings.
- D. Connect to building sanitary sewer outlet and municipal sewer system.
- E. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 20 00.

**3.04 INSTALLATION - CLEANOUTS**

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

**3.05 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with City of Chehalis requirements.

**3.06 PROTECTION**

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**

**SECTION 33 41 00  
STORM UTILITY DRAINAGE PIPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe and fittings.
- B. Manholes.
- C. Cleanouts.
- D. Non-pressure transition couplings.
- E. Catch basins.

**1.02 REFERENCE STANDARDS**

- A. Standard Specification for Road, Bridge, and Municipal Construction as amended by City of Chehalis Standards. Hence forth referred to as Standard Specifications.
- B. ASTM A 716 - Standard Specification for Ductile Iron Culvert Pipe.
- C. ASTM D 3034 SDR 35 - Gasketed Integral Bell PVC Pipe.
- D. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- E. ASTM F 679 - Standard Specification for Poly Vinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings Active Standard
- F. ASTM F 794 - Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- G. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses 2017.
- H. AASHTO M252 TYPE S - Standard Specification for Corrugated Polyethylene Drainage Pipe
- I. AASHTO M294 TYPE S - Standard Specification for Corrugated Polyethylene Pipe 12- to 60-in.
- J. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop 2018.
- K. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- L. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water This standard covers 3-in. through 64-in.
- M. AWWA C153 - .Ductile-Iron Compact Fittings

### **1.03 SUBMITTALS**

- A. See Section 01 33 00, Submittal Procedures, for submittals.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings:
  - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
  - 2. Catch basins and stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.

### **1.04 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. Field quality-control reports.

### **1.05 PROJECT CONDITIONS**

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Architect's written permission.

## **PART 2 EXECUTION**

### **201 DUCTILE-IRON, CULVERT PIPE AND FITTINGS**

- A. Pipe: ASTM A 716, for push-on joints.
- B. Standard Fittings: AWWA C151, ductile or gray iron, for push-on joints.
- C. Compact Fittings: AWWA C153, for push-on joints.
- D. Gaskets: AWWA C111, rubber.

### **202 PE PIPE AND FITTINGS**

- A. Smooth Interior pipe conforming to AASHTO M252 types or AASHTO M294 type S.
- B. Gasketed Bell and Spigot Joints

### **203 PVC PIPE AND FITTINGS**

- A. PVC Conforming to ASTM D 3034 SDR 35 or ASTM F 794 or ASTM F 679 type 1
- B. Joints and Gaskets conforming to ASTM 3212 and ASTM F 477.

## **204 CONCRETE PIPE AND FITTINGS**

- A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM M 86 SCLASS 2.
- B. Reinforced-Concrete Sewer Pipe and Fittings: AASHTO M 170

## **205 NONPRESSURE TRANSITION COUPLINGS**

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

## **206 CLEANOUTS**

- A. Cast-Iron Cleanouts:
  - 1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
  - 2. Top-Loading Classification(s): Light Duty, Medium Duty, Heavy Duty, and Extra-Heavy Duty.
  - 3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. Plastic Cleanouts:
  - 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## **207 MANHOLES**

- A. Standard Precast Concrete Manholes:
  - 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
  - 2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
  - 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
  - 4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
  - 5. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
  - 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
  - 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
  - 8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
  - 9. Steps: Individual FRP steps or FRP ladder] [Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade

is less than 60 inches.

10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

**B. Manhole Frames and Covers:**

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

**208 CATCH BASINS**

**A. Standard Precast Concrete Catch Basins:**

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
6. Grade Rings: Include two or three reinforced-concrete rings of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
7. Steps: Individual FRP steps, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches (1500 mm).
8. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

**B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.**

1. Size: 24 by 24 inches (610 by 610 mm) minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

**209 Nyloplast (Yard Drains) Catch Basin and Grates**

- A. Yard drains shall be Nyloplast Inline Drains or Drainage Basins sized for PVC connection pipe.
- B. Grate Inlets shall be cast iron and ADA compliant.

**210 FILL MATERIALS**

- A. General Fill Complying with City of Chehalis Public Works
- B. General: **Provide imported borrow soil materials.** Native soils are expected to be Unsatisfactory soils.
- C. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- D. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- E. Bedding material shall conform to section 9-03.16 of standard specification for road, bridge, and municipal construction as amended by City of Chehalis Standards.
- F. Bank run gravel for trench backfill shall conform to 9-03.19 Bank Run Gravel for Trench Backfill of standard specification for road, bridge, and municipal construction as amended by City of Chehalis Standards

**211 SOURCE QUALITY CONTROL**

- A. Provide materials of each type from same source throughout the Work.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.

**3.02 PREPARATION**

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate existing utilities that remain from damage.
- C. Protect benchmarks; survey control points; existing structures; fences; sidewalks, and curbs from excavating equipment and vehicular traffic.
- D. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

**3.03 EARTHWORK**

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

**3.04 PIPING INSTALLATION**

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install Nyloplast PVC basins per manufacturers recommendations.
- E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- G. Install gravity-flow, nonpressure drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow.
  - 2. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
  - 3. Install PE corrugated sewer piping according to ASTM D 2321.
  - 4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
  - 5. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
  - 6. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

### **3.05 CLEANOUT INSTALLATION**

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
  - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  - 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
  - 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
  - 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

### **3.06 MANHOLE INSTALLATION**

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops [3 inches (76 mm)] <Insert dimension> above finished surface elsewhere unless otherwise indicated.

### **3.07 CATCH BASIN AND YARD DRAIN INSTALLATION**

- A. Set frames and grates to elevations indicated.

**3.08 CONCRETE PLACEMENT**

- A. Place cast-in-place concrete according to ACI 318.

**3.09 IDENTIFICATION**

- A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
- B. Use detectable warning tape over ferrous piping.
- C. Use detectable warning tape over nonferrous piping and over edges of underground structures.

**3.10 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction.:
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

**END OF SECTION**