

PROJECT SPECIFICATIONS

**CITY OF SISTERS
CONTRACT DOCUMENTS 2020
WELL #4 IMPROVEMENTS
PROJECT #WA 20-01**

**DIVISION 1
GENERAL REQUIREMENTS
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DIVISION 1 - GENERAL REQUIREMENTS

1A. GENERAL

01. The Contractor shall furnish all labor, materials and equipment necessary and/or specified to complete the Work in all respects as shown in the Plans and/or called for in the specifications. Each major construction item is divided into Divisions in the specifications conforming to "The Construction Specifications Institute". Divisions in these specifications conform generally to customary trade practice; they are intended for convenience only to facilitate specification compliance.
02. Verification of Data. It is understood and agreed that the Contractor has, by careful examination, satisfied themselves as to the nature and location of the work; the conformation of the ground; the character, quality and quantity of materials to be encountered; the character or equipment and facilities needed prior to and during the execution of the work; the general and local conditions; and all other matters which can in any way affect the work done under this Contract. No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.
03. Excavation conducted must comply with the provisions of OR 757.541 to 757.571.
04. Wording. These specifications are of the abbreviated or "streamlined" type and frequently include incomplete sentences. Words such as "shall", "shall be", "the Contractor shall", and similar mandatory phrases shall be supplied by inference in the same manner as they are in a note on the drawings. The Contractor shall provide all items and perform all operations listed, in accordance with the General Conditions, if and as modified in these Specifications.
05. Definitions. The word "approved" as used herein means approved by the Engineer. "For Approval" means for Engineer's approval. "Selected" means selected by Engineer. "As Directed" means as directed by Engineer. "As specified" means the specific item, quality and type as specified in these Contract Documents. Where the words "or approved equal" are used, the Engineer is the sole judge of the quality and suitability of the proposed article, materials and manufacturer's substitutions.

1B. ABBREVIATIONS AND ACRONYMS

01. Whenever the following abbreviations are used in these specifications or on the plans, they are to be construed the same as follows:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
AWPA	American Wood Preserver's Association
AWPB	American Wood Preserver's Bureau
AWS	American Welding Society
AWWA	American Water Works Association
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DEQ	Department of Environmental Quality
EPA	Environmental Protection Agency
FM	Factory Mutual
IEEE	Institute of Electrical and Electronics Engineers
ICEA	Insulated Cable Engineer's Association
NBFU	National Bureau of Fire Underwriters
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NLMA	National Lumber Manufacturer's Association
NSF	National Sanitary Foundation
NWMA	National Woodwork Manufacturer's Association
ODOT	Oregon Department of Transportation
OHD	Oregon Health Division, Drinking Water Section

OSHA	Occupational Safety and Health Act (both Federal and State Agencies)
RMA	Rubber Manufacturer's Association
SAE	Society of Automotive Engineers
UBC	Uniform Building Code
UL	Underwriter's Laboratories
WWPA	Western Wood Products Association

02. Unless otherwise designated, all references to the above specifications, standards or methods shall be understood to refer to the latest revision in effect on the date of the Notice to Contractors.

1C. SUMMARY OF THE WORK

01. The work included under this contract consists of the Contract Documents (this complete bound specification/document book and the accompanying drawings), excepting only those items specifically shown, noted or specified as "not in Contract" or "Furnished By Owner". No work shall be conducted on the site until Engineer has issued the *Notice to Proceed* to the Contractor.
02. Material Furnished By Owner. No materials or work shall be furnished by Owner, except for the chlorine scales noted on plans.
03. Preconstruction Conference. After signing of the Owner-Contractor Agreement and prior to the start of any work; Owner, Engineer and Contractor shall meet together to review procedures for insuring the smooth progress of the work and to discuss any other items requiring clarification.
04. Construction Limits. Shall be as indicated on the Plans.
05. Payments to the Contractor.
- a. Itemized Schedule of Costs for lump sum contracts.
 - (01) Contractor shall prepare, in form satisfactory to Engineer, a complete breakdown of costs. Sum of all items shall be equal to contract sum. Furnish, in triplicate, to Engineer before applying for first monthly partial payment. Breakdown of the costs to follow specification Division format.
 - (02) Monthly and final progress payments will be made as set forth in Agreement in accordance with the General Conditions and Supplementary General Conditions.
 - b. Unit Costs for unit price contracts.
 - (01) Payment will be made on a unit cost basis according to the costs provided by the Contractor in the accepted Proposal. See applicable "Measurement and Payment" section in each portion of each Division.

- (02) Monthly progress payments and final payment will be made as set forth in the Agreement, in accordance with the General Conditions and Supplementary General Conditions.

1D. QUALITY OF WORK

01. Number of Specified Items Required. Wherever in these Specifications an article, device or piece of equipment is referred to in the singular number, such reference shall include as many such items as are shown on the Drawings or required to complete the installation.
02. Only new items of recent manufacturer or quality specified free from defects, will be permitted on the work unless items are specifically noted as existing to be utilized. Remove rejected items immediately from the work and replace with items of quality specified. Failure to remove rejected materials and equipment shall not relieve the Contractor from responsibility for quality and character of items used nor from any other obligation imposed by the Contract.
03. No work defective in construction or quality or deficient in any requirement of the drawings and specifications will be acceptable in consequence of the Owner's or the Engineer's failure to discover or to point out defects or deficiencies during construction; nor will the presence of Resident Project Representatives on the work relieve the Contractor from responsibility for securing the quality and progress of work as required by the Contract. Defective work revealed within the time required by guarantees shall be replaced by work conforming with the intent of the Contract. No payment, whether partial or final, shall be construed as an acceptance of defective work or improper materials.
04. Materials and workmanship specified by reference to number, symbol, or title of a specified standard such as commercial standard, a Federal Specification, a trade association standard, or other similar standard, shall comply with requirements in latest edition or revision thereof and with any amendment or supplement thereto in effect on the date of origin of this project's specifications. Such standard, except as modified herein, shall have full force and effect as though printed in the specifications.

1E. PROGRESS OF THE WORK

01. It is the intent of these Contract Documents that the progress of the work proceed in a systematic manner so that a minimum of inconvenience to the public results in the progression of the work. Suitable equipment will be required to properly execute the work with the least amount of disruption to services and access. Contractor shall contain operations to within the designated public right-of-ways or within the obtained easements for this project.

02. Order and schedule delivery of materials in ample time to avoid delays in construction. If an item is found to be unavailable, notify the Engineer immediately to permit the Engineer's selection of suitable substitute. Timely delivery of all materials and equipment is Contractor's responsibility, and no extensions in contract time will be allowed due to delays caused by late delivery of items. Availability of items should be determined during bidding.
03. The Contractor shall protect the work and materials from damage due to the nature of the work, the elements, carelessness of other contractors, or from any other cause until the completion and final acceptance of the work. All loss or damages arising out of the nature of the work to be done under these Contract Documents, or from any unseen obstruction or defects which may be encountered in the execution of the work, or from the action of the elements, shall be sustained by the Contractor.
04. The Contractor shall remove completely all materials designated for removal, to the extent specified and/or indicated in the drawings. For such materials, removal, hauling, disposal (including providing disposal location), and applicable precautions are entirely the Contractor's responsibility. Allow no excess accumulation of non- reusable material at job site(s).
05. Contractor is responsible for the protection of all existing improvements which are to remain in place. This includes, but is not necessarily limited to: existing utilities, roads, driveways, drainage ditches, culverts, shrubbery, and all landscaping and vegetation. Temporary enclosures, walls, covers, or other protection shall be provided and maintained by the Contractor as required. Contractor shall cooperate with the owners of such improvements, and shall restore and/or replace all damaged items as directed, without any additional expense to the Owner or payments to the Contractor.

1F. PHYSICAL SITE DATA

01. General. Information and data furnished or references are furnished for the Contractor's information; however, it is expressly understood that neither the Owner nor Engineer will be responsible for any interpretation or conclusion drawn therefrom by the Contractors.
02. Site Visitation. Contractor may personally inspect the project site prior to bidding, Bidders shall contact Owner to make arrangements for site visits.
03. Weather Condition. The Contractor acknowledges that he has satisfied himself before submitting his bid as to hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from the National Weather Service.

04. Transportation Facilities.
- a. The Contractor acknowledges that he has, before submitting the bid, obtained necessary data as to the existence of highways, roads, streets, railroad facilities and waterways. The unavailability of transportation facilities shall not become a basis for claim for additional compensation or extension of time for completion of the work.
 - b. Agreement for cooperative use and maintenance of existing roads, either public, private or Contractor-constructed roads shall be made directly between Contractor and the Owner-operator of such transportation facilities.
05. Subsurface Conditions.
- a. No probe or test hole data has been prepared for the site of the work by the Owner or Engineer.
 - b. The Contractor may make separate subsurface investigations to satisfy himself as to site and subsurface conditions, but all such investigations shall be performed under arrangements in advance with the Owner and property owners.
 - c. Neither the Owner or Engineer assumes any responsibility whatever in respect to subsurface conditions, or of Contractor's investigations, or of the interpretations made thereof, and there is no warranty or guarantee, either expressed or implied, that unforeseen developments may not occur.
06. Underground Utilities.
- a. Contractor's Responsibility for Utility Properties and Service.
 - (01) Where the contractor's operations are adjacent to or cross utility systems or are adjacent to other property (damage to which might result in considerable expense, loss and inconvenience) no work shall be started until all arrangements necessary for protection thereof have been made.
 - (02) The Contractor shall be solely and directly responsible to the owners and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the carrying out of the work to be done under this contract.
 - (03) In the event of interruption of domestic water, electric, telephone, television, sewer or to other utility services as a result of accidental breakage, or as a result of being exposed or unsupported or damaged during constriction, the Contractor shall promptly notify the proper authority. He shall cooperate with the said authority in restoration of service as promptly as possible and shall bear all costs of repair. In no case shall interruption of any utility service be allowed to exist outside working hours unless prior approval is received.
 - (04) Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the location of the underground facilities being other than that shown on the plans or for the existence of underground utilities not shown on the Plans.

- (05) If interfering utility facilities are encountered, the Contractor shall notify the affected utility at least seven (7) days in advance of construction to permit arrangements for protection or relocation of the installation. However, failure of the utility to respond shall create no obligation on Owner, and Contractor shall protect all utilities against damage, or shall stand all costs involved thereof.
 - (06) It shall be entirely the responsibility of the Contractor to locate and expose all existing utilities in advance of the excavation and/or work. Preliminary small-scale excavations (pot-holing) by the Contractor maybe required to adequately locate some utilities. Neither the Owner, Engineer, nor any of their officers or agents shall be responsible to the Contractor for damages as a result of any underground facilities being located differently than indicated in the drawings, nor for underground facilities which exist and are not indicated on the drawings, nor for any other location information obtained by the Contractor.
 - (07) Contractor shall notify all affected utilities at least ten (10) days in advance of any excavation, so that proper locates can be made if required.
- b. Major public utilities within Deschutes County may be notified for locates by telephoning 1-800-332-2344.
07. Interfering Structures, Improvements, and Landscaping.
- a. Where Contractor's operations are adjacent to, or are near to properties and structures, no work shall be started until Contractor has made all arrangements necessary for protection thereof have been made. Contractor shall exercise all possible precautions to prevent damage to existing structures and improvements.
 - b. The Contractor shall be solely and directly responsible to the owner's and operator's of such properties and structures for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the carrying out of the work to be done under this Contract.
 - c. It shall be entirely the responsibility of the Contractor to locate and expose all existing structures in advance of the excavation and/or work. Neither the Owner, Engineer, nor any of their officers or agents shall be responsible to the Contractor for damages as a result of any structures or improvements being located differently than indicated in the drawings, nor which exist and are not indicated on the drawings.
 - d. If the Contractor encounters existing structures which will prevent the construction or restoration of any portion of the project and/or which are not properly shown on the Plans, the Contractor shall notify the Engineer before continuing with the work so that Engineer may make field revisions as necessary to avoid the conflict. This includes times when the location of new construction as shown on the Plans prohibits the restoration of existing

- structures to original condition. The cost of waiting or "down" time during such field revisions shall be borne by the Contractor without additional cost to the Owner. If Contractor fails to inform the Engineer of any such discrepancies and continues with the work, such work will be conducted at the Contractor's risk.
- e. If interfering power poles, telephone poles, guy wires, or anchors are encountered, the Contractor shall notify the affected utility at least seven (7) days in advance of construction to permit arrangements for protection or relocation of the structure. However, failure of utility to respond shall create no obligation on Owner, and Contractor shall protect all utilities against damage, or shall stand all costs involved thereof.
 - f. Landscaping, Tree and Plant Protection. Provide adequate protection of existing landscaping against damage from construction operations, including all structures and vegetation. Protect roots, trunk and foliage of existing and new shrubs and trees from all damage including that possible from compaction and dust. Contractor shall be entirely responsible to remove and replace all property which is damaged by work related to the project. Contractor shall bear all costs associated with replacement of existing landscaping, and shall cooperate with the owner of such improvements, the Owner, and the Engineer in all protection and restoration/replacement that is required. In specific circumstances, Contractor may make special arrangements with property owners for removal of landscaping without replacement. Copies of written agreements for all such arrangements shall be furnished to the Engineer.
 - g. When construction operations will affect the property of a private citizen (such as driveways, landscaping, etc.), the Contractor shall notify the owner of such property and the Owner, at least seven (7) days in advance of any affecting Work, so that any desired preparations can be made.
08. Roads and Access
- a. Excavation and grading operations shall be conducted in such a manner that the streets, curbs, sewers, storm drains, utilities and all other public and private facilities and improvements which are to remain in place permanently or which are to remain in place temporarily during performance of the contract work will not be subjected to vertical settlement or horizontal movement. See preceding section on "Public Safety and Convenience".
 - b. All paved surfaces (asphaltic concrete cement and/or Portland Concrete Cement) damaged or altered by construction or related travel, shall be repaired to conditions specified in Division 2 of these Contract Documents.
 - c. All graveled roadways and other roads used by Contractor are to be maintained during construction and any damage or alteration repaired to good condition as directed.
09. Restoration of Existing Improvements. Except as shown on the Plans or as provided elsewhere in these specifications, the Contractor shall, at their own expense, repair and/or replace all utilities, services, landscaping, structures,

substructures and other improvements damaged by the operations associated with this project, as directed. These repairs and replacements shall all be suitable and proper for intended use and in every respect acceptable to the Owner, Engineer and appropriate governing body or owner of such improvement. At minimum, restoration will be required to match the existing adjacent structure/improvement in thickness, finish, quality, quantity, and aesthetics.

1G. TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES

01. Office and Sheds.
 - a. Office Building. Not required.
 - b. Storage Sheds. If the Contractor provides a storage shed for tools, equipment and materials, the shed provided shall be painted. Protection of stored tools, equipment and materials shall be the responsibility of the Contractor. Remove upon completion of the Contract.
 - c. The Contractor shall secure and pay for all permits and fees required for temporary facilities and controls.
 - d. Temporary facilities shall comply with State, County and City ordinances, statutes, laws, rules and regulations relating to the same with authorities and insurance companies having jurisdiction.

02. Utilities.
 - a. Temporary Water. The Contractor shall make his own arrangements to obtain suitable water and shall pay all costs.
 - b. Temporary Electrical Power. Contractor shall make his own arrangements to obtain and pay for electrical power. Cost of electrical power used during construction to be paid by the Contractor.
 - c. Temporary Telephone. Contractor shall provide telephone service for their operations.
 - d. Temporary Sanitary Facilities.
 - (01) Contractor shall provide and maintain toilet facilities for use of all persons working at the site as required by ORS 437 including Amendments and other regulations of the local and State Departments of Health.
 - (02) Contractor shall keep toilets clean and in sanitary condition at all times. Provide toilet tissue in suitable holder.

03. All temporary facilities shall be removed by the Contractor upon completion of the Work.

III. LAYOUT OF THE WORK

01. The Engineer shall establish a horizontal baseline and vertical control points at the site(s) of the Work. Contractor shall notify Engineer at least five (5) days, but no more than ten (10) days before scheduled work at the site so that reference points may be established. Contractor will not be allowed extensions in contract time, or damages as a result of delays caused by insufficient control points, unless Contractor has notified Engineer five (5) to ten (10) days in advance requesting control points at such location.
02. From the Engineer's control points, the Contractor shall layout the work by establishing all lines and grades necessary to control the Work to the tolerances specified. Contractor shall be responsible for all measurements that maybe required for the execution of the Work, to the location, limits and tolerances prescribed in the specifications and/or the drawings.

The above are minimum requirements and the Contractor shall place and establish such additional stakes and markers as maybe necessary for control and guidance of the construction operations. All survey data shall be recorded in accordance with standard and approved methods. All field notes, sketches, recordings and computations made by the Contractor in establishing above horizontal and vertical control points shall be available at all times during the progress of the work for ready examination by the Engineer.

03. The Contractor shall furnish, at their own expense, all such stakes, spikes, steel pins, templates, platforms, equipment, tools and material, and all labor as may be required in the laying out any part of the work from the control points established by the Engineer. It shall be the responsibility of the Contractor to maintain and preserve all stakes and other markers established until authorized to remove them. If any of the control points established at the site by the Engineer are destroyed by or through the negligence of the Contractor prior to their authorized removal, they may be replaced by the Engineer and the expense of replacement will be deducted from any amount due or which may become due the Contractor. The Engineer may require that work be suspended at any time when horizontal and vertical control points established at the site by the Contractor are not reasonably adequate to permit checking the work. Such suspension will be withdrawn upon proper replacement of the control points.
04. During the progress of the construction, it is expected that minor relocations of line or grade may be necessary. Such relocations shall be made only by direction of the Engineer, and Engineer must be notified prior to any deviations. Unforeseen obstructions encountered as a result of such relocations will not be subject to claim for additional compensation by the Contractor to any greater extent than would have been the case had the obstruction been encountered in the original proposed facility location.

11. PUBLIC SAFETY AND CONVENIENCE

01. Access of Government Officials. Authorized representatives of the Federal, State and Local Governments shall at all times have safe access to the Work, whenever in preparation or in progress, and Contractor shall provide proper facilities for such access and inspections.
02. Roads. The Contractor shall comply with all rules and regulations of City, County, State, and Federal authorities regarding the closing, detouring, and load limits of all public streets or highways. If road closures or detours are required, Contractor shall prepare, and submit for approval a traffic control plan to the appropriate governing body of such road.
 - a. No road (public or private) shall be closed or detoured by the Contractor to the public, except by express written permission of the Engineer and entity governing such roadways. Traffic must be kept open on all roads and streets where no detour is possible. The Contractor shall, at all times, conduct the work so as to assure the least possible obstruction to traffic and normal commercial pursuits. The convenience of the general public and residents, safety, and the protection of property is of prime importance and shall be provided for by the Contractor in an adequate and satisfactory manner. Contractor shall furnish all Stagers, lights, signs, etc. as required to comply with regulations and provide safety.
 - b. Spillage of soil, dust, rock, mud, etc. on all roads (including State, County, City and private roads) used by the Contractor (and any working for Contractor) during construction, shall be prevented as much as possible. If spillage can not be prevented, an hourly patrol shall be provided by the Contractor to police and sweep clean all spillage. At the conclusion of each workday, such traveled areas shall be left completely clean and free from all extraneous materials.
 - c. All work shall be conducted to minimize damage to existing roadways, easements and parking lots, including limiting wheel loads to acceptable levels. All damaged concrete and/or asphaltic concrete surfaces shall be repaired as required by the Owner. No cleated or crawl-type equipment shall be operated on paved surfaces, except to cross a road when adequate protection of the surface is provided.
 - d. Contractor is responsible for constructing, maintaining, and removing any additional access that Contractor deems necessary for the Work. All applicable regulations shall be followed by the Contractor in such access construction, including obtaining any required permits.
03. Barricades, Warning Signs, Signal Lights, and Flaggers
 - a. Contractor shall, at their own expense, and without further or other order, provide, erect and maintain at all times during the progress or temporary suspension of the work, suitable barricades, fences, signs or other adequate

- warnings or protection and shall provide, keep and maintain such danger lights, signals, and Stagers as maybe necessary or as may be ordered by the Engineer to insure the safety of the public as well as those engaged in connection with the work.
- b. Failure of the Engineer to notify the Contractor to maintain barricades, barriers, lights, flares, danger signals, or watchmen, shall not relieve the Contractor from this responsibility. All barricades and obstructions shall be protected at night by signal lights which shall be suitably distributed and kept burning from sunset to sunrise. Barricades shall be of substantial construction and shall be suitably painted to increase their visibility at night. Barricades shall conform to the Standard Specifications for Highway Construction of the State Highway Department affecting the location of construction, or to City or County Standards where applicable.
 - c. Whenever the Contractor's operations create a hazardous condition, Contractor shall furnish flagmen and guards as necessary, or as directed, to give adequate warning to the public of any dangerous conditions to be encountered. Contractor shall furnish, erect, and maintain approved fences, barricades, lights, signs, and any other devices that may be necessary to prevent accidents and to avoid damage and injury to the public. Flaggers and guards, while on duty and assigned to give warning to the public, shall be equipped with approved red wearing apparel and a red flag which shall be kept clean and in good repair. Signs, flags, lights, and other warning and safety devices shall meet the requirements of the current ODOT safety manual affecting the location of construction, or to applicable City/County standards.
 - d. The Contractor will be required to confine construction operations within the public right-of-way, obtained easements, or property designated on Plans unless contractor has made special arrangements with other affected property owners in advance and has notified the Owner and Engineer. The Contractor will be required to protect stored materials and other items located adjacent to the construction. During all construction operations, the Contractor shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No person shall be cut off from access to their place of business or residence, unless the Contractor has made special arrangements with the affected persons and has notified Engineer and Owner.
04. Rubbish and Debris. Remove accumulations of rubbish and debris from the site during work. At all times keep the sites of work, and roadways clean and free of excess materials of any kind.

05. Dust Control. During the entire period of construction, the Contractor shall exercise all reasonable and necessary means to abate undue dust. Necessary sprinkling and wetting of the construction site shall be performed by the Contractor so that the site will not be excessively dusty at any time, and the amount of dust carried in the air kept to a minimum. The application of water for dust control shall be under the control of the Engineer at all times and shall be applied at the location and in the amounts designated by the Engineer.
06. Fire Prevention and Protection
 - a. Contractor shall perform all work in a fire-safe manner. Contractor shall supply and maintain on site all fire fighting equipment, supplies, and capable personnel for extinguishing incipient fires as required by all Federal, State and local laws and regulations.
 - b. Each piece of internal combustion engine-driven equipment shall be equipped with a fire extinguisher in accordance with the appropriate recommendation of the National Fire Protection Association (NFPA).

1J. EXPLOSIVES

01. Use of explosives shall be avoided as far as practical. All blasting which must be done shall be controlled in a manner which will prevent possible shattering or loosening of materials outside the limits of the excavation. All blasting shall be supervised and performed by a State Certified Powderman.
02. Contractor shall protect all property and persons from any damage which could result from using explosives. Contractor is responsible for any and all damages to property, or injury to persons resulting from blasting (including accidental or premature detonations), and shall give adequate prior warning to all affected persons and adjacent property owners. Warning signs, horns, and lookout persons shall be used to provide safety.
03. All explosives used shall be fresh, stable materials manufactured to the standards of the "Institute of Makers of Explosives", and conforming to applicable requirements of ORS 476 and 480.
04. Contractor shall comply with all applicable Federal, State, and Local Laws regarding the storage and use of explosives.

1K. PROJECT CLOSE OUT

01. Cleaning Up.
 - a. Upon completion of any portion of the work, promptly remove temporary facilities generated by that portion of the work, including surplus materials, equipment and machinery unless directed otherwise by the Owner. All construction work by the Contractor shall be clean and free of rubbish, dirt,

- overspray, and extraneous materials to the satisfaction of the Engineer before acceptance of the work.
- b. Immediately prior to final acceptance inspection, remove all protective paper, coatings, etc., thoroughly clean all equipment, valves, etc. Entire project site, including roadways to and from the site, shall be clean and restored to required conditions and ready for use by Owner.
02. Certificates to be Provided by Contractor. Contractor to prepare on Contractor's letterhead with project title and number clearly identified. Submit to Engineer. See also Supplementary General Conditions.
- a. A written certification that Contractor has fully completed the Work in strict compliance with the Contract Documents, and requesting final inspection by the Owner.
 - b. Written certification that Contractor will replace all materials and workmanship that prove defective within one-year after the date of Final Acceptance. Date Owner signs Final Payment Certificate is date of Final Acceptance and starts the Contractor's one-year guarantee period.
 - c. Submission of a signed State or Federal approved Wage Certification Form certifying that Contractor has paid not less than the Prevailing Wage Rate as required by law, and that Contractor has timely submitted the required payroll certificates to the appropriate state or federal wage division. See Article 14.07A of the Supplementary General Conditions.
 - d. Submission of Consent of Surety to final payment with accompanying Power of Attorney.
03. Record Drawings ("As-Builts"). The Contractor shall obtain and maintain at the site (and direct each of their subcontractors performing work to) a set of the project drawings (plans), for the purpose of maintaining a daily record of all installations which vary from the Contract Documents. This set shall be available for inspection at all times. The Record Drawings shall be updated by the Contractor each day, showing all deviations and useful subsurface information obtained.
- At the conclusion of the work, the Contractor shall gather all record drawings from all subcontractors and shall prepare a single complete set of record drawings. Contractor shall mark on a clean set of Contract Documents with a pen of contrasting color, showing all such nonconforming installation, specifically including the sizes and locations thereof. Show deviations from original Plans, as well as other information (such as depth and location of buried utilities) discovered during construction. The Contractor shall sign and date the set and deliver it to the Engineer, together with a letter certifying that the construction is in exact accord with the record drawings.

1L. MAINTENANCE MANUALS AND MATERIALS WARRANTIES

01. General. Diagrams, parts lists and maintenance instructions shall be prepared and assembled into one manual to cover all valves, meters, valve and meter boxes, etc. furnished under these Contracts. All manufacturer's warranties on materials shall be assembled and included in the manual. Maintenance manuals and warranties shall be submitted prior to 50% completion and payment for the work.
02. Content. The manual shall cover operation, maintenance, dismantling, assembling, adjusting, and identification of all parts for ordering replacements. Each item shall be covered in its entirety in a single manual regardless of the number of suppliers, subcontractors, etc., involved in manufacturing or installation. Data submitted for the maintenance manual is in addition to that furnished for shop drawing submittals. Six copies of the above data for each item shall be submitted for approval prior to scheduled testing of the system.
03. Specific Requirements. Binders shall be for 8½ x 11 inch size sheets with side binding or fastening with screwposts enabling ready replacement of sheets. An identifying title shall be provided, which will be visible from the front cover, giving the name and number of project, and equipment or system title. A tabbed divider page with appropriate title shall separate each specific item covered.
04. Parts Catalog. Parts catalogs shall include the identifications, nomenclature, parts numbers, required number of parts, recommended list of spare parts to be stocked at the project, and actual spare parts supplied. All data shall match the actual equipment furnished, and standard catalog sheets, cuts, and diagrams will not be acceptable unless all irrelevant parts are marked out and relevant parts are identified by heavy arrows at each side of the applicable data.
05. Installed Materials Warranties. Prior to 50% completion and payment for work under this Contract, the Contractor shall furnish the Owner through the Engineer, all warranty and/or guarantee forms normally furnished by the manufacturer on the warranted items, or as specified. All information required on the forms pertaining to type, catalog numbers, model numbers, installing agency, and jobber shall be legibly typed on the forms by the Contractor. Installation date will be filled in by the Owner and will coincide with date of substantial completion of the work under this contract. All such warranties shall name the City of Sisters as the warranted party.

1M. RIGHT-OF-WAY

01. All rights-of-way and easements shown on the drawings for the Contractor's use in conducting the work covered by these specifications will be furnished by the Owner at no cost to the Contractor.

02. Access, other than those provided, will be subject to mutual agreement between the Contractor, Owner, Engineer and property owners involved concerning the specific route the Contractor chooses to use. Such mutual agreement must be reached prior to initiation of construction.
03. Contractor's land requirements for material yards, job offices, stockpiles, borrow areas, disposal areas, other than provided, additional working space, or other purposes, shall be obtained by the Contractor. Necessary agreements, deeds or easements, with property owners shall be the responsibility of the Contractor but evidence of such agreements shall be submitted to the Owner prior to entry upon the property.

1N. ADMINISTRATIVE REQUIREMENTS

01. Any work provided on project shall be performed by licensed, bonded contractors and subcontractors. A City business license will be required for all contractors.

10. SITE LOCATION

01. As designated on Plans.

IP. PAYMENT

01. No separate measurement and/or payment will be made for any/all work and items specified or required by this Division 1 - General Requirements. All requirements of Division 1 are considered incidental to the project and shall be fulfilled by Contractor(s) working on this project, with no additional cost to the Owner, unless otherwise provided for in this Division of these Contract Documents.
-

REQUIREMENTS FOR HANDLING CEMENT ASBESTOS BOARD

The following procedures are the Department of Environmental Quality requirements for handling cement asbestos board (CAB). In most cases cement asbestos board is considered to be a non-friable asbestos-containing material and is exempt from many Department asbestos-abatement requirements. In order to maintain this exemption, CAB must be handled, transported and disposed of in such a manner that prevents it from becoming friable or releasing asbestos fibers. For specific information, refer to OAR 340-25-465(4) or contact DEQ at (503) 229-5982.

When handling this material in schools (K-12), contractors should be aware of additional requirements under the federal Environmental Protection Agency (EPA) Asbestos Hazard Emergency Response Act (AHERA). The EPA's regional office can be contacted at (206) 442-4762.

Employers should be aware that the Oregon Occupational Safety and Health Division (OR-OSHA) also has regulations pertaining to the handling of this material (OAR 437, Division 3, Construction). For current rules and policies OR-OSHA may be contacted at (503) 378- 3272.

1. REMOVAL OF CAB OR TRANSITE IN WHOLE PIECES:

The following procedures are required for the removal of CAB (also known as "transite"), where the method of removal does not involve cutting, sawing, grinding, chipping and does not shatter, crumble, pulverize or reduce the boards to dust:

- The removal method is to wet the material, remove retaining nails or screws, and remove CAB in the largest pieces possible.
- The Department acknowledges that some breakage may occur, but this breakage should and will be minimal if specified work practices are followed.
- The debris must be disposed of at a landfill permitted to take demolition waste. Prior to disposal, DEQ advises that the individual landfill be consulted to obtain that landfill's requirements for this debris. Many landfills require this material to be containerized and labeled. Careful handling of the material from removal to final disposal is required to insure that asbestos fibers are not released.

(over)

- Notification is not required.
- Certification of workers is not required.
- Licensing as asbestos-abatement contractor is not required.

2. REMOVAL OF CAB OR TRANSITE RESULTING IN SHATTERED PIECES:

The following procedures apply to the removal of CAB or transite involving physical damage to the CAB which would result in friable asbestos containing materials or a release of asbestos fibers.

- All applicable asbestos-abatement regulations under OAR 340—25 465 must be followed, including the following:
 - The CAB must be wetted during removal.
 - The wetted debris must be placed in labeled leak-tight containers such as two 6 mil thick plastic bags and carefully lowered to the ground.
 - These containers must be disposed of at a landfill approved by the Department to receive asbestos waste.
- Notification and fee are required where applicable.
- Licensing as asbestos-abatement contractor is required.
- Certification of workers is required.

3. DEMOLITION OF BUILDINGS THAT CONTAIN CEMENT ASBESTOS BOARD:

CAB or any other asbestos containing material must be removed from all buildings prior to demolition.

- If CAB is to be removed in whole pieces, the work practices in number 1 on the other side supply.
- If the removal of CAB will result in shattered pieces, the work practices in number 2 above apply.

*Department of Environmental Quality
811 S.W. Sixth Avenue
Portland, Oregon 97204
(503) 229-5982 or toll-free in Oregon 1-800-452 -4011*

October 1990

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Title of work, and type of contract.
- B. Work sequence.
- C. Use of premises.
- D. Owner-furnished items.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of this Contract includes, but is not limited to:
 - 1. Fabrication and erection of a New Well Control Structure, including Pump, Disinfection Equipment, Concrete and Masonry, Mechanical and Electrical construction and miscellaneous work to comply with plans and specifications for Well #4 improvements for the City of Sisters.
 - 2. Other work as noted in Specifications and Drawings.

1.03 CONTRACT METHOD

- A. Construct the work under a single lump sum contract.

1.04 CONTRACTOR USE OF PREMISES

- A. Confine operations at site to areas permitted by:
 - 1. Law
 - 2. Ordinances
 - 3. Permits
 - 4. Contract Documents
- B. Do not unreasonably encumber site with materials or equipment.
- C. Assume full responsibility for protection and safekeeping of products stored on premises, including protection from inclement weather. During cold weather, Contractor shall protect all work from damage. If cold weather makes it impossible to continue operations safely, Contractor shall cease work and notify City. Any damage through failure to provide protection from weather shall be cause for removal and replacement of damaged work with new work, at Contractor's expense.

- D. Move any stored products which interfere with operations of Owner or other Contractor.
 - E. Obtain any pay for use of additional storage or work areas needed for operations.
 - F. Use of Site: Exclusive and complete, for execution of work.
 - G. Project Limits: As shown on site plan.
- 1.05 OWNER-FURNISHED, OWNER-INSTALLED PRODUCTS (NIC)
- A. Not Applicable.
- 1.06 PERMITS
- A. The Contractor shall obtain all required permits.

END OF SECTION

SECTION 02000

SITework

PART 1 - GENERAL

1.01 SCOPE

- A. The General Conditions, the Supplementary General Conditions and Division 1 of these specifications are a part of this Division. Contractor's attention is directed to these other sections and Divisions within these Contract Documents, including information concerning public safety and convenience, existing underground utilities and soil conditions, and protection and restoration of existing improvements.
- B. Lines and Grades. All work shall conform to the lines, grades, and elevations shown on the Plans, within specified tolerances. See Division 1, "Layout of Work"
- C. All waterpipe and pipe appurtenances shall be NSF approved. To facilitate specification compliance, Submittals are required on all materials (valves, pipe, fittings, hydrants, etc.), whether as specified or a proposed substitution. Submittals shall consist of the appropriate combination of catalog sheets, materials lists, brochures, bulletins, diagrams, specifications, or samples, necessary to describe a system, product, or item. Five (5) sets of material submittals shall be sent to Engineer within three weeks following the signing of the Contract.

END OF SECTION

SECTION 02050

COORDINATION

PART 1 - GENERAL

- 1.01 This item concerns parties involved with public utilities and personal property within, adjacent to, or near proposed construction. Contractor shall cooperate and coordinate work with that of:
- A. City of Sisters
 - B. Central Electric Cooperative
 - C. Bend Broadband
 - D. Century Link
 - E. All affected private property owners and other contractors.
- 1.02 Note special consideration for private property owners and occupants for clearing of vegetation, protection of landscaping, access, and restoration. Obtain Owner's approval prior to cutting of trees and shrubbery within currently developed right-of-way or easements.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

PART 4 - PAYMENT (NOT APPLICABLE)

END OF SECTION

SECTION 02201

MOBILIZATION

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of operations and preparatory work necessary to become ready to perform the work or phase of the work.
- B. Related Work: Division 1 - General Requirements.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

- A. Mobilization includes, but is not limited to the following:
 - 1. Move personnel, equipment, supplies and incidentals to the work site.
 - 2. Establish offices, buildings and other facilities necessary for work on the project.
 - 3. Premiums on bonds and insurance.
 - 4. Perform other work and operations or 1 hour costs as necessary before beginning work on the project.
- B. Set up temporary construction facilities in a neat and orderly manner.

END OF SECTION

SECTION 02225

REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of removing and disposing wholly or in part of man-made materials as contracted with materials or matter of natural or native origin, together with cleaning up areas they occupy.
- B. Related Work: Section 02315 - Excavation, Embankment, Bedding and Backfill.

1.02 EXCLUSIONS

- A. Removal work does not include removal or disposal of materials which are:
 - 1. Designated to remain.
 - 2. Included in Excavation, Embankment, Bedding and Backfill.
 - 3. Indicated by the Specifications of Plans to be removed incidental to other items of work under the Contract.
 - 4. Designated to be salvaged.
 - 5. Owned and controlled by third parties.

1.03 LIMITS

- A. Perform removal work in the same area as specified in Section 02230.
- B. Should it become necessary to expand removal area limits; confine area of removal to minimum dimensions required, within the right-of-way or easement, which will permit proper construction of the project.

1.04 PROJECT CONDITIONS

- A. The Contractor shall determine the actual condition of the site as it affects this section of the work.
- B. Disturbed area shall be kept to a minimum.
- C. Barricade open depressions and holes occurring as a part of the work and post warning lights on property adjacent to or with public access.
- D. Operate warning lights during hours from dusk to dawn each day and as otherwise required to ensure safety of persons.

- E. Protect existing structures, utilities, sidewalks, pavements and other facilities from damage caused by operations of this section.
- F. Do not close or obstruct street, drive lanes, utility easements, walks and exit passageways without permission of authorities having jurisdiction.
- G. Keep streets and sidewalks clean.
- H. Use means necessary to prevent dust becoming a nuisance to the public, neighbors and to other work being performed on or near the site.
- I. Removal of Structures and Obstructions work shall be performed in strict compliance with federal, state, county and city laws and regulations pertaining to removal of structures and obstructions.
- J. The Contractor shall comply with issued Oregon Health Authority, Oregon Water Resources Department, DEQ and Deschutes County.
- K. It is the intent of this Specification that all disturbed areas shall be restored to a condition at least equivalent to the condition prior to the Contractor's work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 REMOVAL WORK

- A. Where construction operations require the removal of pavement, curbs, walks, driveways and similar concrete or bituminous structures or portions of, the area to be removed shall be cleanly saw-cut. Cuts shall be sawn outside each side of the trench, to a depth sufficient to permit the removal of material without damage to adjoining areas or structures to be left in place. All cuts shall be clean, vertical and made true to lines designated by the Engineer. Material lying within the limits and other damaged adjoining material of said cutting shall be removed and disposed of by Contractor. See Standard Detail Drawing.
- B. Existing Pipes.
 - 1. When designated for removal, shall be removed (a) in their entirety, (b) to limits shown on Plans or (c) to limits necessary to permit proper connections.
 - 2. Remaining open ends of existing pipes, shall be capped or plugged in a watertight manner. Make clean, smooth, vertical cuts with a saw or other approved cutting device.
- C. Where construction operations require the removal of pavement, curbs, walks, driveways and similar concrete or bituminous structures or portions of the area to

be removed shall be cleanly saw-cut. Cuts shall be sawn 6 inches outside each side of the trench, to a depth sufficient to permit the removal of material without damage to adjoining areas or structures to be left in place. All cuts shall be clean, vertical and made true to lines designated by the Engineer. Material lying within the limits and other damaged adjoining material of said cutting shall be removed and disposed of by Contractor.

- E. Fences. Existing fences requiring removal for construction, or damaged during construction shall be replaced in similar quality to that existing prior to construction.
- F. Removal and Salvaging of Existing Pipelines.
 - 1. Existing pipelines, when designated for removal, shall be removed in their entirety, to limits shown on Plans or to the limits necessary to permit proper connections. Remaining ends of pipe shall be suitably capped or plugged in a watertight manner.
- G. Removal and Salvaging of Valves and Appurtenances. Valves, fittings, and other pipe appurtenances, when designated for removal, shall be removed in their entirety or to limits shown on Plans, or as required to permit proper installation of new materials. Remaining ends of pipe shall be suitably capped or plugged in a watertight manner.
- H. Removal and Salvaging of Fire Hydrants. Hydrants when designated for removal shall be removed in their entirety or to limits shown on Plans. Remaining ends of fittings or pipes shall be suitably capped or plugged in a watertight manner.
- I. Removal and Salvaging of Culverts. Culverts removed during waterline construction, determined by the Engineer to be reusable, shall be salvaged and relayed. Culverts found to be reusable, which are damaged by Contractor, shall be replaced at no cost to Owner. Culverts that are in need of replacement shall be replaced.
- J. Existing Manholes and Cleanouts.
 - 1. Manholes designated for removal and under eight feet deep, shall be removed in their entirety. Remaining inlet and outlet pipes shall be capped or plugged in accordance with Section 02225, Part 3, paragraph 3.01 C.
 - 2. Manholes designated for removal and over eight feet deep shall be removed to a depth of eight feet below the surface elevation to which the affected area is to be finished. Manhole inlet(s) and outlet shall be suitable plugged and remaining manhole sections backfilled with controlled low-strength material (CLSM) Class IV backfill.
- K. Repair of Damage. Damage to materials or items not intended to be removed shall be repaired promptly by Contractor in a thoroughly workmanlike manner. If Engineer determines it necessary, repairs shall consist of complete replacement of

material affected. All such repairs and replacements shall be made by the Contractor without compensation.

3.02 SALVAGING

- A. Metal grates, frames, rings, covers, valves, valve boxes, fire hydrants and other metal fixtures or fittings shall be removed, salvaged and used on new structures if designated on the Plans.

3.03 DISPOSAL OF MATERIAL

- A. All materials, excluding salvaged fixtures or fittings determined reusable in Section 02225, Part 3, paragraph 3 02, shall become the property of the Contractor at the place of origin and shall be disposed of at Contractor's expense.
- B. Materials shall not be disposed of on City owned or controlled land except by written permission. If permitted, place the materials at such locations and in such manner as City may direct.
- C. Subject to federal, state, county and city laws and regulations, materials may be placed on Owner's properties in a manner consistent with environmental requirements.

3.04 EXCAVATION IN CONNECTION WITH REMOVAL

- A. Excavation required to perform removal of structures and obstructions will be considered incidental to removal work.

3.05 REPAIR OF DAMAGE

- A. Promptly repair any breakage or damage to materials or items not intended to be removed. If Engineer determines it necessary, complete replacement of affected material may be required. All such repairs and replacements shall be made by the Contractor in a workmanlike manner and without compensation.

END OF SECTION

SECTION 02230

SITE CLEARING

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of removing and disposing of vegetation and buried matter to the limits of the project site, including right-of-ways, access ways, or as directed. The work also includes preserving vegetation and objects designated to remain in place and cleanup of the work area.
- B. Related Work: Section 02315 - Excavation and Fill

1.02 DEFINITIONS

- A. Clearing.
 - 1. Preserving trees and other vegetation designated to remain in place.
 - 2. Salvaging marketable timber.
 - 3. Cutting and removing vegetation, such as weeds, grasses, crops, brush and trees.
 - 4. Removing downed timber and other vegetative debris.
- B. Grubbing:
 - 1. Removing stems remaining above ground surface after clearing work.
 - 2. Removing tree stumps in areas where excavation is planned.
 - 3. Removing roots and other vegetation found below ground surface.
 - 4. Removing partially buried natural objects.

1.03 LIMITS

- A. Areas on which clearing and grubbing is to be performed shall be limited to the following:
 - 1. Seven (7) feet on each side of all trench centerlines.
 - 2. One (1) foot outside of excavation slope line and all areas of excavation.
 - 3. One (1) foot outside of embankment slope line and all areas of embankment.

1.04 PROJECT CONDITIONS

- A. The Contractor shall determine the actual condition of the site as it affects this portion of the work.
- B. Disturbed areas shall be kept to a minimum.

- C. Clearing and grubbing in sensitive areas and beyond designated limits shall be prohibited.
- D. Barricade open depressions and holes occurring as part of work and post warning lights on property adjacent to or with public access. Warning lights in accordance with FAA guidelines shall be placed on all equipment during construction, and shall be left operational outside working hours if equipment infringes on required air clearance for the airport.
- E. Operate warning lights during hours from dusk to dawn each day and otherwise required to ensure safety of persons and aircraft.
- F. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by operations of this section.
- G. Do not close or obstruct street, drive lanes, utility easements, walks and exit passageways without permission of Owner.
- H. Keep streets and sidewalks clean.
- I. Use means necessary to prevent dust becoming a nuisance to the public, neighbors and to other work being performed on or near the site.
- J. Clearing, grubbing and stripping work shall be performed in strict compliance with federal, state, county and city laws and regulations pertaining to clearing, grubbing and stripping.
- K. The Contractor shall comply with issued City of Sisters permit conditions and special provisions.
- L. It is the intent of this Specification that all disturbed areas shall be restored to a condition at least equivalent to the condition prior to the Contractor's work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 CLEARING

- A. Cut trees and brush so they fall onto the areas specified to be cleared.
- B. Remove all evidence of clearing matter and debris. This work includes removal of
 - 1. Sod, weeds and dead vegetation.

2. Down timber, brush and other vegetation.
3. Trees, sticks and branches with diameters greater than 1/2 inch, in areas planned for construction.
4. Dead trees, down timber, stumps and specified trimmings from areas where live trees and other vegetation are designated to remain.

3.02 GRUBBING

- A. Within excavation and embankment limits, stumps shall be removed in their entirety.
- B. Within excavation limits, remove roots and other vegetation to a depth no less than 6 inches below excavation subgrade or sloped surface.
- C. Within embankment limits, remove roots and other vegetation to a depth no less than 1 foot below subgrade or sloped surface on which the embankment is to be constructed.

3.03 PRESERVATION AND TRIMMING OF VEGETATION

- A. Preserving vegetation includes keeping equipment and materials off of the critical root zone.
- B. Within the work areas.
 1. Avoid injuring vegetation planned to remain in place. Preservation of this vegetation includes protection.
- C. Outside the work area.
 1. Avoid injuring any vegetation. Confine operations which may injure vegetation to areas that have no vegetation or to the work areas.
 2. Remove hazardous, dead and damaged trees outside the clearing limit as directed.
- D. Trimming.
 1. Trim trees according to good tree surgery practices and as directed to remove safety hazards, including but not limited to:
 - a. Unsound branches of trees to remain in place.
 - b. Branches or limbs over roadways to provide not less than 20 feet of clearance above roadway surface.
 - c. Branches or limbs over walks to provide not less than 8 feet of clearance above the walk surface.

3.04 OWNERSHIP AND DISPOSAL OF MATERIAL

- A. All matter and debris accumulated from clearing, grubbing, stripping and trimming shall become Contractor's property at the place of origin.
- B. Contractor shall comply with all applicable federal, state, county and city laws and regulations pertaining to fire permits, burning and disposal.
- C. Contractor shall be responsible for obtaining any required permits.
- D. No burning of matter or debris allowed at project site.
- E. Woody matter may be disposed of by chipping and spreading the chips uniformly over selected landscape areas, as directed, in loose layers not more than 3 inches in any dimension.
- F. No burying of matter or debris allowed at project site.
- G. Matter or debris shall not be disposed of on City owned or City controlled land except by written permission. If permitted, place at such locations and in such manner as City may direct. Subject to federal, state, county and city laws and regulations, matter and debris may be placed on Owner's properties in a manner consistent with environmental requirements.

3.05 BACKFILLING HOLES AND CLEAN UP

- A. Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with specified structure backfill material and compacted in accordance with Section 02300. Backfilling and compaction of excavations will be considered incidental to site clearing grubbing work.
- B. All areas lying outside the limits of earthwork on which work under this specification has been performed and all areas which have been disturbed by other operations in connection with the contract shall be smoothed and reshaped to blend to surrounding or contiguous area contours.
- C. All areas on which work is performed under this specification shall be cleaned up in a workmanlike manner and made free from litter, debris and other matter which is undesirable from the standpoint of cleanliness, safety, sanitation and sightliness.

END OF SECTION

SECTION 02240

CONTROL OF WATER

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of controlling surface water runoff, dewatering pipeline trenches and structural excavations and other elements required for control of water if work conditions should dictate the need.

- B. Related Work:
 - 1. Section 02250 - Shoring and Bracing.
 - 2. Section 02315 - Excavation and Fill.

1.02 SUBMITTAL

- A. Prior to commencing any excavation, the Contractor shall submit a statement of the method, installation and details of proposed dewatering system to Engineer. The statement shall also include disposal.

PART 2-PRODUCTS

- 2.01 Materials and equipment required for control of water shall be furnished and maintained as required to perform the construction.

PART 3 - EXECUTION

3.01 GENERAL

- A. The necessary machinery, appliances and equipment shall be provided and operated to keep excavations free from water during construction, and to dispose of the water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public. Sufficient pumping equipment and machinery in good working condition shall be provided for all emergencies including power outage, and sufficient workmen shall be available at all times for the operation of the pumping equipment.

END OF SECTION

SECTION 02250

SHORING AND BRACING

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of shoring and bracing of trenches and other excavation as required to furnish safe and acceptable working conditions, protect existing and new structures, utilities, vegetation and maintaining existing slopes, fills and open excavations.
- B. The Contractor shall have sole responsibility to determine the construction means and methods required to satisfy the requirements of this section. The method of shoring and bracing may include the use, or the combination of sheeting, shoring, bracing, sloping, sliding trench shield or other methods to accomplish the work.
- C. Shoring and bracing shall also include other means and procedures such as draining and recharging groundwater and routing and disposing of surface runoff, required to maintain the stability of soils.

1.02 QUALITY ASSURANCE

- A. The method of protection shall be according to the Contractor's design.
- B. The Contractor shall design sheeting, shoring, bracing, etc. in accordance with Oregon Occupational Safety and Health Act (OSHA).
- C. The Contractor's design shall furnish a safe place of work pursuant to the provisions of OSHA of 1970 and the subsequent amendments and regulations and provide for protection of the work, structures and other improvements.

1.03 SHORING AND BRACING SAFETY PLAN

- A. For trenches and excavations 5 feet or more in depth, the Contractor shall have a detail plan design of sheeting, shoring, bracing, sloping, etc., available at the work site for review by the Engineer and OSHA representative, to be made for worker protection from hazards of casing ground.

1.04 CONTRACTOR'S SUPERVISOR

- A. The Contractor shall appoint a qualified supervisor, who shall be responsible for determining the shoring system that shall be used, depending on local soil type, water table, and so on.

- B. This supervisor shall have experience in the direction of such excavation and shoring work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL

- A. Shoring and bracing shall be installed and maintained continuously and not be limited to normal working hours.
- B. The construction of sheeting, shoring and bracing shall not disturb the state of soil adjacent to the trench of excavation or below the excavation bottom. Sheeting, shoring and bracing shall be removed after placement and compaction of initial backfill except otherwise specified.

3.02 STRUCTURE AND EXISTING PIPING

- A. The Contractor shall provide support of existing and new structures where necessary Existing piping shall be protected with shoring and bracing where excavation could expose the pipe and/or cause damage to the pipe.

3.03 DAMAGES

- A. Any damages for new or existing structures occurring through settlements, water or earth pressures, or other causes due to failure or lack of sheeting, shoring or bracing, or through negligence or fault of the Contractor shall be repaired by the Contractor at his own expense.

END OF SECTION

SECTION 02310

GRADING

PART 1- GENERAL

1.01 SCOPE

- A. Work consists of trimming, shaping and finishing the subgrade, slopes and other graded surface areas to the lines, grades, cross sections established by the Engineer and conditions specified.
- B. Related Work:
 - 1. Section 02225 - Removal of Structures and Obstruction
 - 2. Section 02230 - Site Clearing
 - 3. Section 02240 - Control of Water
 - 4. Section 02315 - Excavation and fill

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Complete all underground work, including backfill before commencing grading work. This requirement includes work by contractor and, if required, work to be performed by Owner or others.

3.02 SUBGRADE

- A. Trim and shape the entire subgrade to be free of ruts, depressions and irregularities.
- B. Compact all fills according to Section 02315.
- C. Finish the surface to within a tolerance of plus or minus 3/4 inch or as directed.

3.03 SLOPES

- A. Remove all exposed roots, debris and all stones more than 2 inches in size which are loose or liable to be loosened.
- B. Make embankment slopes as smooth, safe and slightly as practical with the materials used for embankment construction.
- C. Trim and shape all excavation and embankment side slopes.

3.04 STRUCTURE SITES

- A. Perform applicable work tasks from paragraphs 3.01 through 3.04 above.
- B. Clean out all storm drains, culverts and their appurtenances constructed under the contract.
- C. Remove all extraneous matter in the vicinity of storm drain ends, inlets, walls and other areas.
- D. Trim and shape the cleaned areas.

3.05 DISPOSAL OF MATERIALS

- A. Dispose of all materials removed according to Section 02225.

END OF SECTION

SECTION 02315

EXCAVATION, EMBANKMENT, BEDDING AND BACKFILL

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of excavation, ditching, trenching, backfilling, embankment construction, grading, leveling and other earth-moving work required in the construction of the project.
- B. Existing power and telephone lines, trees, signs, posts, fences, pipelines or other conduits, embankments, and structures in the vicinity of the work shall be supported and protected from injury by the Contractor during the construction and until the completion of the Work. The Contractor shall be liable for all damages to such structures, as herein provided, and shall save and keep the Owner and Engineer harmless from any liability or expense for injuries, damages, or repairs to same.
- C. A thorough attempt has been made to show the type, size, location, and number of all utilities. However, no guarantee is made as to the location and number of such utilities. The Contractor shall repair, in a manner satisfactory to the Engineer, all utilities damaged in the progress of his work. The Contractor shall notify all owners of utilities of commencement of Work and sufficiently in advance to have the utilities mark the location of their facilities. The Contractor shall be prepared at all times with labor, equipment, and materials to make repairs on damaged mains or utilities.
- D. Earthwork includes but is not limited to providing all hauling and disposal of unsuitable or excess excavated material to sites designated or arranged by Contractor as needed for any excess materials, providing bypass pumping for uninterrupted flow of existing water systems, drains, culverts, and sewers and the temporary disposal of water from those sources during the progress of the work, cleanup work, removal of surplus material and restoring property damaged as a result of the work.
- E. Related work:
 - 1. Section 02225 - Removal of Structures and Obstructions
 - 2. Section 02230 - Site Clearing
 - 3. Section 02240 - Control of Water
 - 4. Section 02250 - Shoring and Bracing
 - 5. Section 02310 - Grading

1.02 DEFINITIONS

- A. **Unclassified Excavation.** Unclassified excavation is defined as all excavation, regardless of type, nature or condition of materials encountered, including rock excavation. The Contractor shall assume full responsibility to estimate the kind and extent of various materials to be encountered in order to accomplish the work.
 - 1. **Rock Excavation.** Rock excavation is defined as removal of all material which is systematically drilled and blasted or broken by power operated tools designated for rock excavation. The term Rock Excavation shall be understood to indicate a method of removal and not a geological formation.
 - 2. **Common Excavation.** Common excavation is defined as removal of all material not classified as rock excavation.

- B. **Trench Excavation.** Trench excavation is defined as removal of material encountered in the trench to the depths and widths as shown or as directed, and is classified as either common or rock excavation.

- C. **Borrow Excavation.** Borrow material is defined as material obtained from borrow sources lying outside of, separated from, and independent of planned excavation occurring within the project limits.

- D. **Embankment.** Embankment is defined as furnishing, placing, and compacting selected excavated material to the depth and configuration as shown.

- E. **Foundation Stabilization.** Foundation stabilization is defined as the removal of unsuitable material in the bottom of an excavation and replacement with specified material for support of a roadbed, pipe, main conduit, structure or appurtenance thereto.

- F. **Pipe Bedding.** Pipe bedding is defined as furnishing and placing suitable material under and around the pipe to the horizontal centerline (springline) of pipe, in accordance with the appropriate detail drawings.

- G. **Pipe Zone.** Pipe Zone is defined as the full width of trench from the top of the bedding to a point 6 inches above top outside surface of the pipe barrel or as shown on the appropriate detail drawings.

- H. **Trench Backfill.** Trench backfill is defined as furnishing, placing and compacting backfill material in the trench between the top of the pipe zone and bottom of pavement base, ground surface or as directed.

1.03 SUBMITTALS

- A. Reports and test results that demonstrate the materials comply with the specifications for the foundation stabilization, pipe bedding, pipe zone and native or granular fill. Samples shall be submitted 14 days in advance of material use to allow verification by the Engineer for compliance with the specifications.
- B. Samples shall be tagged with the following information:
 - 1. Pit name and location.
 - 2. Stockpile name and location, if different than the pit.
 - 3. Recent sieve analysis of the proposed material. Statement from the Contractor or supplier that the proposed material conforms to the specifications of this project.

1.04 QUALITY ASSURANCES

- A. The Contractor shall retain and pay all costs for an independent certified test agency qualified according to ASTM E 329 and acceptable to Engineer to take samples, perform moisture content, gradation, compaction and density tests during placement of backfill, embankment engineered fills and granular underlayments and excavated subgrade.

1.05 PROJECT CONDITIONS

- A. The Contractor shall determine the actual condition of the site as it affects this portion of the Work.
- B. Disturbed areas shall be kept to a minimum.
- C. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by operations of this section.
- D. Do not close or obstruct street, drive lanes, utility easements, walks and exit passageways without permission of authorities having jurisdiction.
- E. Keep streets and sidewalks clean.
- F. Use means necessary to prevent dust from becoming a nuisance to the public, neighbors and to other work being performed on or near the site.
- G. The Contractor shall comply with issued City of Sisters permit conditions and special provisions. Notify and complete arrangements with applicable agencies 48 hours prior to commencing construction within respective right-of-ways.
- H. Excavation operations shall be conducted in accordance with ORS 757.541 through

757.571.

PART 2 - PRODUCTS

2.01 EMBANKMENT AND BORROW MATERIAL

- A. Embankment and borrow materials provided for general embankment construction shall be soil that is free of peat, humus, frozen ground, organic matter or other characteristics detrimental to construction of firm, dense and sound embankments.
- B. Use approved material originating from required excavations as far as practicable in the formation of embankments and subgrades. Maximum particle size shall be 6 inches.

2.02 FOUNDATION STABILIZATION

- A. Stabilization material shall be 2 inch minus imported crushed rock of approved clean well graded granular material free from organic matter. Gradation shall conform to ODOT/APWA 2002 Oregon Standard Specifications for Construction.

2.03 PIPE BEDDING

- A. Bedding material shall be 3/4 inch minus imported crushed rock of approved clean well graded granular material free from organic matter. Gradation shall conform to Section 02630 of the ODOT/APWA 2002 Standard Specifications for Construction.
- B. Clean 5/8 inch pea gravel, river, bank, beach, or reject sand are approved alternate pipe bedding materials.

2.04 PIPE ZONE MATERIAL

- A. In the pipe zone use imported material conforming to pipe bedding material or selected trench side material which is friable and free of vegetation containing no frozen ground, rock, clay masses, clods or other pieces of material larger than 1 inch.

2.05 TRENCH BACKFILL

- A. Class III Backfill - All trenches.
 - 1. Use imported 3/4" inch minus crushed rock conforming to the requirements for base aggregates as specified in Section 02630 of the ODOT/APWA 2010 Standard Specifications for Construction.

2.06 ENGINEERED FILL

- A. Aggregate used for engineered fill shall be imported 1-inch crushed rock, conforming to Section 02630 of the ODOT/APWA Standard Specifications for Construction. Aggregate shall be uniformly graded from coarse to fine, conform to the grading requirements set forth in Table 02630-1 of Section 02630.

2.07 STRUCTURE AND SLAB GRANULAR UNDERLAYMENT

- A. Aggregate used for underlayment shall be 3/4 inch minus crushed rock, conforming to Section 02630 of the ODOT/APWA 2002 Standard Specifications for Construction. Aggregate shall be uniformly graded from coarse to fine, conforming to the grading requirements set forth in Table 02630-1 of Section 02630.

2.08 STRUCTURE BACKFILL

- A. Use approved native material excavated from within limits of the project free from vegetation and other detrimental material and containing no frozen ground. Maximum particle size shall be 1” inches. Engineer will make approval of material prior to placement.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards caused by earthwork operations. Refer to Section 02250, Shoring and Bracing.
- B. Protect subgrades and foundation bases against freezing temperatures or frost.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water run-off or airborne dust to adjacent properties and walkways.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades and from flooding project site and surrounding area; refer to requirements of Section 02240.
- B. Drainage of surface water and ground water through the trench or pipeline under construction is prohibited unless approved by the Engineer.

3.03 WATERING

- A. Furnish and apply water for the following:
 - 1. Compaction and preparation of excavations, embankments, backfill, subgrade and underlayments.
 - 2. Alleviation or prevention of dust nuisance.
 - 3. Washing of streets.

- B. Moisture Control.
 - 1. Insofar as practicable, maintain optimum moisture required for compaction, as determined by ASTM D 698, throughout each lift of embankment, backfill, fill and underlayment. Add any required water to material by sprinkling or spraying during compaction operation.
 - 2. Materials shall not be placed in final position in embankments or as backfills or fills until moisture in excess of optimum moisture has been removed therefrom. Removal of excess moisture may be by such processes as scarifying, blading, discing, or by other means at the option of the Contractor. All costs involved in the removal of excess moisture from the materials will be included in the contract price.

3.04 EXCAVATION

- A. General.
 - 1. Excavate, remove and dispose of all formations and materials, natural or man-made, irrespective of nature or conditions, encountered within limits hereinafter defined in Part 3 of this Section 02315, required for construction of the project . Method of excavation used is optional.
 - 2. Incidental to excavation shall be the furnishing, installing and removal of all shoring and bracing required to support adjacent earth banks and structures, and for the safety of the public and workmen.
 - 3. Limits of Excavation.
 - a. Excavate to the depths and widths indicated, allowing for forms, shoring, working space and gravel base. Do not excavate deeper than elevation shown without approval. Excavation carried below grade lines shown or established without approval shall be replaced with compacted foundation stabilization material specified in Part 2 of this Section 02315.
 - 4. Slope Grading.
 - a. Make slopes free of all exposed roots and loose stones. All surfaces shall be neatly and smoothly trimmed. Over excavating and backfilling to the proper grade will not be acceptable.
 - 5. Unsuitable Subgrade.
 - a. If, in the judgement of the Engineer, material in the bottom of an excavation is unsuitable for supporting foundations, cribbing, pipes or similar facilities, over excavate as directed and backfill to required grade with foundation stabilization material specified in Part 2 of this Section 02315.

- b. Compact in layers not exceeding 6 inches deep to required density and grade.
 - 6. Disposal of Excess Material.
 - a. Excavated materials not suitable or required for backfill or embankment as directed by Engineer shall be deposited on sites supplied by Contractor. All costs for disposing of unsuitable or excess material shall be at Contractor's expense.
 - b. Materials shall not be disposed of on Owner owned or controlled land except by written permission. If permitted, place the materials at such locations and in such manner as Owner may direct.
 - c. Subject to federal, state, county and city laws and regulations, materials may be placed on other properties in a manner consistent with environmental requirements and written permission of the property owner. Furnish Owner and Engineer a copy of the signed agreement with the property owner and fill permit before disposal of material.
 - 7. Temporary Location of Excavated Material.
 - a. Pile in such a manner that it will cause a minimum inconvenience to the public. Furnish the Owner and Engineer a copy of written approval from each property owner prior to stockpiling material on private property.
 - b. Provide free access to all fire hydrants, water valves, and meters, and leave clearance to enable free flow of stormwater in all gutters, conduits and natural water courses.
 - c. Place excavated material, suitable for embankment or backfill and not excess material, only within the construction easement, right-of-way or approved work area.
- B. Common Excavation.
 - 1. Perform all excavation regardless of type, nature or condition of material encountered. Method of excavation used is optional. Use hand methods for excavation that cannot be accomplished without endangering existing or new structures or other facilities.
 - 2. When the precise location of subsurface structures or other facilities are unknown, locate such structures or other facilities by hand excavation prior to utilizing mechanical excavation equipment.
- C. Rock Excavation and Explosives.
 - 1. Depth of Excavation.
 - a. Excavate to depths designated or as shown on the plans. Correct over excavation with compacted foundation stabilization as specified in Part 2 of this Section 02315, at no additional expense to Owner. In trenches for sewers, storm drains, water mains or conduits, remove all material necessary to provide a minimum clearance of 6 inches below pipe and replace with bedding material

specified in Part 2 of this Section 02315.

2. Use of Explosives. Use explosives which are fresh, stable materials manufactured to the standards of the "Institute of Makers of Explosives", and conforming to applicable requirements of ORS Chapters 476 and 480.

Use of explosives shall be avoided as far as practicable. Such blasting as must be done shall be controlled in a manner which will avoid possible shattering or loosening of materials back of lines to which the excavations are to be made. All blasting shall be supervised and performed by a State certified powderman. Be responsible for any and all damages to property or injury to persons resulting from blasting, or accidental or premature explosives that may occur in connection with the use of explosives. Give adequate warning to all affected persons and adjacent property owners prior to blasting.

3. Cover area to be shot with blasting mats or other approved type of protective material that will prevent scattering of rock fragments outside of the excavation.

D. Trench Excavation

1. Maximum Open Trench Length.

- a. Except by permission of Engineer, the maximum length of open trench shall be 100 feet. The distance is the collective length of any location, including open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.
- b. Except by permission of the Engineer, the maximum length of open trench in any one location where concrete structures are cast in place or vaults installed will be that which is necessary to permit uninterrupted progress.
- c. Failure of the Contractor to comply with the limitations specified herein may result in an order to halt work until such time as compliance has been achieved.
- d. A section of trench shall be considered as unfinished until excavation, construction, backfilling, compaction, gravel road restoration, Portland Cement concrete pavement, minimum of first lift of asphaltic concrete pavement, and cleanup operations have been completed. Cleanup of backfilled and construction area shall include resurfacing and cleaning of area so as to allow use of trench and adjacent construction area for its intended purpose.

2. Trench Width.

- a. It is the intent of the Specifications that trench width be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches must be of sufficient width to allow for shoring and permit proper jointing of pipe and compaction of backfill material along the sides of the pipe. Minimum trench width, in the pipe zone, must provide a clean working space of 6 inches on each side of the pipe

- bell.
 - b. Maximum width of trench shall be pipe diameter plus 18 inches. If maximum width is exceeded by Contractor without written authorization, Contractor will be required, at no expense to Owner, to provide pipe of a high strength designation, a high class of bedding, or both, as approved. All trenches shall be excavated with vertical walls unless otherwise specified.
 - c. Confine top width of trench to dedicated right-of-way or construction easements. Special written agreements to extend width may be made by the Contractor with affected property owner, provided such agreement is first approved by Owner and Engineer.
3. Grade.
- a. Excavate trench to lines and grades shown or as established by Engineer, with proper allowance for pipe thickness, pipe bedding and foundation stabilization. The subgrade upon which bedding is to be placed shall be firm, undisturbed, and true to grade. If the trench is over excavated, restore to grade with foundation stabilization material specified in Part 2 of this Section 02315, at no expense to Owner. Place material over full width of trench in compacted layers not exceeding 6 inches deep to established grade with allowance for pipe bedding.
- E. Embankment Subgrade Preparation
- 1. Prior to construction of embankments, strip existing sod and organic topsoil in all areas of the site to a depth of six inches, excavate unstable material or unsuitable foundation material and dispose of as directed. Limit excavation to lines, grades and cross sections shown or approved. Backfill trenches and holes which occur within embankment limits with approved material. Where the slope or condition of the ground surface under proposed embankments is such that materials placed thereon would not positively bond therewith, the ground surface shall be broken up and roughened before embankment material is placed thereon.
 - 2. When the natural ground underlying embankment is of such nature and is so located as to be compactible by equipment normally used for embankment construction, the upper 8 inches shall be compacted in place to provide a density specified for embankment material placement.
- F. Engineered Fill Subgrade Preparation
- 1. Prior to construction of engineered fill, excavate unstable material or unsuitable foundation material and dispose of as directed. Limit excavation to lines, grades and cross sections shown or approved. Backfill trenches and

holes which occur within engineered fill limits with approved material. When the natural ground underlying engineered fill is of such nature and is so located as to be compactible by equipment normally used for engineered fill construction, the upper 8 inches shall be compacted in place to provide a density specified for the engineered fill material placement.

2.02 FILLS AND BACKFILL

A. Embankment

1. Construction.

- a. Embankments and fillings shall be placed in horizontal layers not more than 10 inches thick, and each layer shall be separately and thoroughly compacted.
- b. The toe of all embankments shall be keyed into the slope by the use of a key trench the depth of embedment shall be two feet into undisturbed native soils. The key trench shall be wide enough to accommodate excavation and compaction equipment (6 to 8 feet minimum) with a flat base.
- c. In the immediate vicinity of structures, curbs, walks, driveways, catch basins, manholes and other structures, in holes and elsewhere where embankment and filling materials cannot be or are not reached by the heavy compacting equipment, materials shall be placed in horizontal layers not more than 4 inches thick, with each layer separately and thoroughly compacted by pneumatic operated, machine operated or mechanical tampers.
- d. In all cases, proper precautions shall be taken to ensure that embankment construction and filling does not move, endanger or cause undue strain or stress to any structure.

Unless permitted by Engineer, embankments shall not be constructed when the embankment materials, the foundation or the embankment on which it would be placed is frozen or too wet.

2. Compaction and Density Requirements.

- a. Density of compacted materials in place will be determined by AASHTO T 191 or T 205 and maximum density by ASTM D 698.
- b. Compact all embankments, fills and backfills to a minimum density in place of 95 percent of maximum dry density according to ASTM D 698. The higher percentage of rock particles greater than 3/4" causes laboratory and field density test results to be erratic. Embankments and fills constructed with specified borrow and embankment materials, each 10 inch lift shall be compacted by a minimum of four passes with a heavy vibratory roller. One "pass" is defined as the roller moving across an area once in both directions. After compaction proof roll entire area with a loaded dump truck to verify density has been achieved.

Field density testing by nuclear methods will be adequate for verifying compaction of 3/4 to 2 inch minus crushed aggregate.

- c. Cuts and foundations for structures to a depth of 12 inches below subgrade shall be compacted to a minimum density in place of 95 percent of maximum density.
- d. Perform watering of materials to enhance compaction of embankments, fills and backfills. Unless otherwise directed by Engineer, the moisture content of materials at the time of compaction shall be within plus 2 or minus 4 percentage points of optimum moisture.

B. Trench Backfill

1. Bedding Placement.

- a. Bedding consists of leveling the bottom of trench or top of foundation stabilization material and placing bedding material to the horizontal centerline (springline) of pipe. Bedding material shall be as specified in Part 2 of this Section 02315. Bedding shall be placed in at least two lifts. Place first lift to provide a 6-inch minimum depth of bedding material below the barrel of the pipe before the pipe is installed. Spread and compact to 95% maximum density as determined by ASTM D 698. Smooth bedding material to proper grade so that pipe is uniformly supported along the barrel. Excavate bellholes at each joint to permit proper assembly and inspection of the entire joint. Bedding under pipe shall provide a firm, unyielding support along entire pipe length. Place subsequent lifts of not more than 6 inches thickness up to the horizontal centerline of the pipe. Bring lifts up together on both sides of pipe and carefully work under pipe haunches by slicing with a shovel, vibrator or other approved procedure. Each lift shall be compacted to 95% maximum density as determined by ASTM D 698.
- b. Particular attention must be given to the area from the flow line to horizontal centerline of pipe or top of bedding to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

2. Pipe Zone Placement.

- a. Place specified zone material carefully around pipe in 6-inch layers and compact to 95% maximum density as determined by ASTM D 698. Prevent pipe from movement either horizontally or vertically during placing and compaction of pipe zone material.
- b. If, in the judgment of the Engineer, insufficient or unsuitable material exists at trench side for placement in the pipe zone, import and place approved material.

3. Backfill

- a. General

- 1) Backfill shall not be placed in the trench in such a way as to permit free fall of material until at least three feet of cover is provided over the top of the pipe. Under no circumstances shall the Contractor allow sharp, heavy materials to drop directly onto the pipe or pipe zone material.
 - 2) As specified under "Compaction Testing" section of this Division, density tests may be taken on a lift of compacted backfill immediately before placing the next lift. Contractor shall take all necessary precautions to ensure proper compaction is achieved.
 - 3) If the required compaction density has not been obtained, the Contractor shall remove the backfill from the trench, replace with approved backfill and recompact as many times as it is necessary to obtain the required specified densities. Should routine field density tests indicate that specified compaction densities are not being obtained, the Engineer may indicate such causes and recommend changes.
 - 4) Any subsequent settlement of trench during the one-year correction period shall be considered to be the result of improper compaction and shall be promptly corrected.
 - 5) In paved and gravel areas, maintain surface of the backfilled trench level with the adjacent and existing grade with 3/4" inch minus crushed aggregate material until the final pavement replacement is completed or the entire project is accepted by Owner.
- b. Class I Backfill.
- 1) Backfill trench above the pipe zone with approved material to the specified grade, or as shown on the plans in lifts not thicker than 1 foot. Compact each lift to a minimum of 95 percent of maximum density as determined by ASTM D 698, Method D, with mechanical vibrating or impact tampers, unless Engineer has approved mechanical compaction equipment for deeper lifts.
- c. Class II Backfill.
- 1) Backfill trench above the pipe zone with approved material pushed back into the trench by mechanical means. Earth shall be pushed first onto the slope of the backfill previously placed and allowed to roll down into the trench. The Contractor will not be allowed to push the backfill material into the open trench. A windrow of excavated material shall be placed over the trench for compaction. Compact entire trench line by wheel rolling of loaders or graders, at least six passes will be required. After wheel rolling has been completed, the entire work area,

including the trench line, shall be graded.

- d. Class III Backfill.
 - 1) Backfill trench above the pipe zone with specified Class III Backfill material to the specified grade, or as shown on the plans in lifts not thicker than 1 foot. Material shall be compacted in the manner specified for Class I Backfill.
- e. Class IV Backfill.
 - 1) Controlled Low Strength Material (CLSM) shall be mixed in accordance with ODOT Highway Division Standard Specifications, 2002 Edition Highway Construction, Section 00540.21; delivered in a truck mixer conforming to 00540.21(b); and conveyed in accordance with 00540.22. Contractor shall provide and maintain steel jump plates as required for traffic and safety.
 - 2) In areas to be open to the public, the top of the trench shall be plated until the CLSM is adequately set (generally 48 hours).

C. Engineered Fill

- 1. Construction.
 - a. Engineered fill and fillings shall be placed in horizontal layers not more than 10 inches thick, and each layer shall be separately and thoroughly compacted.
 - b. In the immediate vicinities of curbs, walks, driveways, catch basins, manholes and other structures, in holes and elsewhere where engineered fill and filling materials cannot be or are not reached by the heavy compacting equipment, materials shall be placed in horizontal layers not more than 4 inches thick, with each layer separately and thoroughly compacted by pneumatic operated, machine operated or mechanical tampers.
 - c. In all cases, proper precautions shall be taken to ensure that engineered fill construction and filling does not move, endanger or cause undue strain or stress to any structure.
 - d. Unless permitted by the Engineer, engineered fill shall not be constructed when the engineered fill material, the foundation or the engineered fill on which it would be placed is frozen.
- 2. Compaction and Density Requirements.
 - a. Density of compacted materials in place will be determined by AASHTO T 191 or T 205 and maximum density by ASTM D 698.
 - b. Compact all engineered fill, fills and backfills to a minimum density in place of 95 percent of maximum dry density according to ASTM D 698.

C. Cuts and foundations for structures to a depth of 12 inches below subgrade shall be

compacted to a minimum density in place of 95 percent of maximum density.

D. Granular Underlayment.

1. When shown, natural ground shall be graded and prepared as approved, and granular underlayment material placed under structures and slabs. Deposit material in maximum 10-inch lifts and compact to 98 percent of maximum density as determined by ASTM D 698, Method D.

E. Structural Backfill.

1. Place backfill around concrete structures only after the concrete has attained 2/3 of its specified compressive strength. Remove all form materials and trash from the excavation before placing backfill. Place common backfill in all areas, unless otherwise shown or directed.
2. Deposit material in 12 inch lifts. Compact each lift to at least 90 percent of maximum density at optimum moisture content, as determined by the applicable method of ASTM D 698, before placing the next lift. Jetting or ponding will not be permitted. Make adequate provisions for thorough drainage of backfill.
3. Earth moving equipment shall not be operated within 5 feet of walls of concrete structures unless approved. Compact backfill adjacent to curbs, concrete walks, etc. with pneumatic tampers or other approved equipment that will not damage the structure.

END OF SECTION

SECTION 02500

SITE DRAINAGE

PART 1 - GENERAL

1.01 SCOPE

- A. This work consists of furnishing all labor, materials, equipment and performing all work for the construction of new storm drains, drains from floor drains, and culverts required in the construction of the project.
- B. Related Work:
 - 1. Section 02240 - Control of Water
 - 2. Section 02250 - Shoring and Bracing
 - 3. Section 02315 - Excavation, Embankment, Bedding and Backfill

1.02 SUBMITTALS

- A. To facilitate specification compliance, submittals are required on all pipe materials and appurtenances; whether as specified or as a proposed substitution. Submittals shall consist of the appropriate combination of catalog sheets, material lists, brochures, bulletins, diagrams, specifications or samples necessary to describe a system, product or item.
- B. Five (5) sets of material submittals shall be submitted to Engineer within three weeks following the contract signing.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All pipe, fittings and appurtenances shall be new and unused.

2.02 POLYVINYL CHLORIDE (PVC) STORM DRAINS AND CATCH BASIN
LATERALS

- A. Nominal Pipe Size: 4 inch through 15 inch.
 - 1. PVC pipe with nominal inside diameters between 4 and 15 inches shall conform to ASTM D-3034, SDR 35, PMS Polyvinyl Chloride Sewer Pipe.
 - 2. Pipe shall be furnished with an integral bell. The bell shall consist of an integral wall section with an elastomeric gasketed joint conforming to ASTM D-3212. Rubber rings shall conform to ASTM F-477.

3. Pipe shall be as manufactured by J-M Manufacturing Company, Pacific Western Extruded Plastics Company, or approved equal.
- B. Fittings.
1. General. All fittings shall be of sufficient strength to withstand all handling and load stresses. All fittings shall be of the same materials as the pipe unless otherwise specified. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface. Use the same type of joints on all fittings that are used on the drain line pipe.

PART 3 - EXECUTION

3.01 LINE AND GRADE FOR STORM DRAIN PIPE AND LATERALS

- A. Line and Grade. Do not deviate from line or grade, as established by Engineer, more than 1/2 inch for line and 1/8 inch for grade, providing that such variation does not result in a level or reverse sloping invert. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness. Establish line and grade for pipe by the use of approved lasers or by transferring the cut from the offset stakes to batterboards at maximum intervals of 25 feet.

3.02 PIPE DISTRIBUTION AND HANDLING.

- A. Distribute material on the job no faster than it can be used to good advantage. Unload pipe only by approved means. Do not unload pipe of any size by dropping to the ground. Do not distribute more than one week's supply of material in advance of laying, unless approved.
- B. Inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken or otherwise defective materials are used. Clean ends of pipe thoroughly, Remove foreign matter and dirt from inside of pipe and keep clean during and after laying.
- C. Use approved implements, tools and facilities for the safe and proper protection of the work. Lower pipe into the trench in such a manner as to avoid any physical damage to the pipe. Remove all damaged or rejected pipe from the job site. Do not drop or dump pipe into trenches.

3.03 PIPE LAYING AND JOINTING OF PIPE.

- A. Proceed with pipe laying upgrade with spigot or tongue ends pointing in direction of flow. Place pipe in such a manner as to ensure solid bearing between pipe and the full cross-sectional in accordance with the recommendations of the manufacturer, Take care to properly align the pipe before joints are forced entirely

home. Upon completion of pipe laying, all pipe joints shall be in the "home position", which is defined as the position where the least gap (if any) exists, when pipe components that comprise the joint are fitted together as tightly as the joint design will permit. Gaps at pipe joints shall not exceed that allowed by the manufacturer's recommendations. After installation, prevent movement from any cause including uplift or floating.

- B. Take special care to prevent movement of the pipe after installation when laid within a movable trench shield.
- C. When laying operations are not in progress, protect the open end of pipe from entry of foreign material and block the pipe to prevent movement or creep of gasketed joints.
- D. Plug off pipes which are stubbed out for manhole construction or for connection by others.
- E. Provide all pipes, 36 inches and smaller in diameter, entering or leaving manholes or other structures, with flexible joints within 18 inches of the exterior wall. Pipes larger than 36 inches in diameter shall have this flexible joint within a distance from the exterior wall equal to one-half the inside pipe diameter.
- F. When cutting and/or machining the pipe is necessary, use only tools and methods recommended by pipe manufacturer.

3.04. CLEANING OF STORM/DRAIN PIPE.

- A. Cleaning Prior to Manhole to Manhole Inspection. Prior to manhole to manhole inspection of the storm/drain system by the Engineer, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign materials from the storm/drain system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

Upon Engineer's manhole to manhole inspection of the storm/drain system, if any foreign matter is still present in the system, reflush and clean the sections and portions of the line as required.

END OF SECTION

SECTION 02510

WATER PIPE AND INSTALLATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Furnishing all labor, materials, equipment and performing all work for installation of waterlines and sterilization and testing thereof.

1.02 RELATED SECTIONS

- A. Section 02240 - Control of Water
- B. Section 02250 - Shoring and Bracing
- C. Section 02315 - Excavation and Fill
- D. Section 02515 - Water Pipe Appurtenances
- E. Section 02799 - Compaction Testing

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. A 53 Specification for pipe, steel, black and hot-dipped, zinc-coated welded and seamless.
 - 2. D 1784 Specification for rigid Polyvinyl Chloride (PVC) compounds and Chlorinated Polyvinyl Chloride (CPVC) compounds.
 - 3. D 1785 Specification for Polyvinyl Chloride (PVC) pipe, Schedules 40, 80 and 120.
 - 4. D 3139 Specifications for joints for plastic pressure pipes using flexible elastomeric seals.
 - 5. D 2564 Specifications for Solvent Cements for Polyvinyl Chloride (PVC) plastic pipe and fittings.
 - 6. F 477 Specification for elastomeric seals (gaskets) for joining plastic pipe.
 - 7. D 1248 Specifications for High Density Polyethylene Pipe
 - 8. D 3350 Specifications for High Density Polyethylene Pipe
- B. American Waterworks Association (AWWA).
 - 1. C-104 Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings.

2. C-105 Polyethylene Encasement for Gray and Ductile Cast-Iron Piping.
3. C-110 Gray-Iron and Ductile-Iron Fittings, 2 inch through 48 inch.
4. C-111 Rubber-Gasket Joints for Gray-Iron and Ductile-Iron Pressure Pipe and Fittings.
5. C-150 Thickness Design of Ductile-Iron Pipe.
6. C-151 Ductile hon Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds.
7. C-153 Ductile-hon Fittings 3" Through 48".
8. C-600 Installation of Cast-Iron Water Mains.
9. C-605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
10. C-651 Disinfecting Water Mains.
11. C-900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 4" Through 12".
12. C-906 Polyethylene Pressure Pipe and Fittings.

1.04 QUALITY ASSURANCES

- A. Water mains, services and appurtenances shall be subject to hydrostatic and leakage tests.
- B. Water mains, services and appurtenances shall be sterilized prior to connection to existing systems.
- C. The Engineer may require manufacturer's certificates showing conformance with the specifications for any of the pipe materials.
- D. All pipe materials shall be National Sanitary Foundation, Standard 61 approved.
- E. All pipe materials shall be American made.

1.05 SUBMITTALS

- A. To facilitate specification compliance, submittals are required on all pipe materials and appurtenances; whether as specified or as a proposed substitution. Submittals shall consist of the appropriate combination of catalog sheets, material lists, brochures, bulletins, diagrams, specifications or samples necessary to describe a system, product or item.
- B. Material submittals shall be submitted to Engineer within three weeks following the contract signing.

PART 2 - PRODUCTS

2.01 4" - 12" POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipe shall be made from Class 12454-A or Class 12454-B virgin compounds, defined in ASTM D 1784.
- B. PVC pressure pipe shall be Class 150 (DR 18) conforming to AWWA C-900 with a cast iron pipe equivalent outside diameter.
- C. Pipe shall be furnished in 20 foot laying lengths with an integral wall-thickened bell end. The bell shall consist of an integral wall section with a bonded-in, elastomeric gasket manufactured to conform with the requirements of ASTM F 477.
- D. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C900 and ASTM D 3139.
- E. Pipe shall be as manufactured by J-M Corporation, Pacific Western Extruded Plastics Co., or approved equal.

2.02 14" - 36" POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipe shall be made from Class 12454-A or Class 12454-B virgin compounds, as defined in ASTM D 1784.
- B. PVC pressure pipe shall be Class 165 (DR 25) conforming to AWWA C-905 with a cast iron pipe equivalent outside diameter.
- C. Pipe shall be furnished in 20 foot laying lengths with an integral wall-thickened bell end. The bell shall consist of an integral wall section with a bonded-in, elastomeric gasket manufactured to conform with the requirements of ASTM F 477.
- D. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C900 and ASTM D 3139.
- E. Pipe shall be as manufactured by J-M Corporation, Pacific Western Extruded Plastics Co., or approved equal.

2.03 DUCTILE IRON PIPE

- A. Centrifugally cast ductile-iron pipe and spools shall be Class 53 conforming to AWWA C-151 and AWWA C-150. Pipe furnished shall be designed for 10 foot depth of cover, lay condition Type 5.

- B. Ductile-iron pipe shall be cement lined on the inside conforming to AWWA C-104. Outside coating shall be a bituminous coat 1 mil thick, conforming to AWWA C-151.

- C. Polyethylene encasement meeting AWWA C-105 Method A or B is required with all Class 53 ductile-iron pipe. Tube type encasement shall be used except at valves, tees, or other appurtenances where flat sheets may be used to wrap the appurtenances. Encasement material shall be at least 8 mil in thickness.

- D. Joints.
 - 1. Joints shall be mechanical, push-on or flanged as required by the Drawings. Push-on joints may be used where no fittings are required.
 - 2. Spools shall be mechanical joint by plain end, flange by plain end or plain end by plain end as required by the Drawings.
 - 3. Mechanical Joint.
 - a. Joint to conform to AWWA C-111. The bell shall be cast integrally with the pipe or fitting and shall be provided with an exterior flange having bolt holes or slots, and a socket with annular recesses for the sealing gasket by plain end pipe or fitting. Provide sealing gasket, follower gland with bolt holes, black iron tee-head bolts, washers and hexagonal nuts.
 - 4. Push-on Joint.
 - a. The integral cast socket bell shall be rubber ring type "Tyton Joint" or approved equal. Joint shall meet same strength requirements of the pipe. Joint shall conform to AWWA C-111.
 - 5. Flange Joint.
 - a. Flanged joints shall meet AWWA C-115. The bolt circle and holes in the flanges shall conform to ANSI B16.1, Class 125, and can be bolted to Class 125 B16.1 or Class 150 ANSI B16.5 (steel) flanges, unless otherwise specified.
 - b. Gasket material for flanged joints shall be commercial neoprene sheet conforming to ASTM D 2000, SAE J200, 1 BC 609, 1/8 inch thick, approved for use with potable water. The gasket shall be full cut with holes to pass bolts. All bolts and nuts shall be cadmium plated.

- E. Pipe shall be as manufactured by Tyler Pipe, US Pipe and Foundry, Clow Corporation, Pacific States Cast Iron Pipe Co., or approved equal.

2.04 GALVANIZED PIPE

- A. Galvanized steel pipe for combination air and vacuum relief and blow-off valves shall be seamless or electric resistance welded type, Schedule 40 conforming to ASTM A 53.

2.05 2-1/2" AND SMALLER PIPE

- A. Wirsbo by Aquapex.
- B. Fittings shall be Wirsbo propex.

PART 3 - EXECUTION

3.01 GENERAL

- A. Materials shall not be distributed on the job faster than can be used to good advantage.
- B. All necessary signing and flagging to provide a safe working environment shall be used.
- C. Remove material from job site that in the judgment of the Engineer is damaged beyond repair or rejected. Payment will not be made for damaged or rejected materials, their removal, or for repairs to such materials.

3.02 EXCAVATION AND FILL

- A. Prepare trench for pipe laying as specified in Section 02315.

3.03 PIPE LAYING - ALL MATERIALS

- A. Distribute the pipe so that no hazard will be presented to occupants of the joining property, pedestrians or vehicular traffic.
- B. Lift the pipe during unloading using two slings placed at quarter points of the pipe sections. Pipe may be lifted into the trench using one sling near the center of the pipe, providing the pipe is guided to prevent its uncontrolled swinging. The sling shall bear uniformly against the pipe. When not being handled, support the pipe on timber cradles or on properly prepared ground, graded to eliminate all sharp points and to provide uniform support along the full length. When being transported support the pipe at all times in a manner which will not permit distortion or damage to the lining or coating. Replace or repair any pipe damaged in handling to the satisfaction of the Engineer. Payment will not be made for damaged pipe or repairs

to such damaged pipe.

- C. PVC pipe shall be installed in accordance with AWWA C-605 and manufacturer's recommendations.
- D. Ductile iron pipe shall be installed in accordance with AWWA C-600 and manufacturer's recommendations.
- E. Maximum deflection at any joint shall not exceed 2-1/2'. Maximum deviation from line or grade shall not exceed 1/2 inch.
- F. Provide concrete thrust blocking in accordance with the standard details at the end of this division.
- G. Prior to lowering pipe in the trench, the Engineer will check for damages to the pipe coating. Repair all damages or flaws to the coating before the pipe is placed in the trench. Materials used for repair shall be the same as the material being repaired.
- H. Thoroughly clean the ends of the pipe to remove all foreign matter from the pipe joint.
- I. Prevent foreign material from entering the pipe while it is being placed in the trench. Remove all foreign material from the inside of the pipe and joint before the next pipe is placed. Keep debris, tools, rags or other materials out of the pipes at all times. Follow pipe laying operations closely with joint coating operations as required and backfilling of trenches as specified in Section 02315.
- J. Lay pipe with its bell end facing the direction of laying. For lines on an appreciable slope, face bells up grade unless otherwise allowed by the Engineer. Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, do not exceed the deflection recommended by the pipe manufacturer.
- K. When pipe laying is not in progress, close the open end of the pipe with a water tight plug or by other approved means to prevent entry of trench water or other foreign materials into the pipe.
- L. Ductile-Iron Pipe Polyethylene Encasement. All seams and punctures or rips are to be taped with polyethylene tape. Appurtenances shall be completely encased and seams shall be made by bringing edges together, folding twice, and taping down. Tape material securely at valve stems, services, and other penetrations. Exterior surface of pipe shall be clean and free of all foreign material prior to encasement placement. Bedding and backfill shall be free of any debris that could damage the polyethylene encasement.
- M. Where new water pipe is installed near existing or new sanitary sewer lines, all provisions of OAR 333-61-050(10) regarding placement of pipe near, under, or

over sanitary sewer lines shall be followed. See other sections of this Division.

- N. Jointing.
 - 1. Lay pipe with push-on type joints in strict accordance with manufacturer's recommendation. Lubricate the bell and spigot end as required by manufacturer with approved pipe lubricant.
 - 2. Furnish the gaskets required for the joint being assembled. Install the gasket with uniform tension around the joint groove before placing the pipe in the trench.

3.04 CONNECTION TO EXISTING SYSTEMS

- A. Connections to existing systems shall 'not be made until the new mains have been satisfactorily disinfected and have passed all tests herein specified.
- B. Connection of new water main to existing distribution system shall be performed no later than 48 hours after bacteriological examination results have been received and approved by the Engineer. If the system connection is not performed within this period of time, disinfection and bacteriological examination processes shall be repeated.

3.05 PRESSURE AND LEAKAGE TESTS

- A. General.
 - 1. All newly laid pressure pipe shall successfully pass a hydrostatic pressure test prior to acceptance. Test first section of pipe laid to establish that the pipe materials are capable of meeting design requirements. Section of test line shall be at least 200 feet in length. If test indicates materials or workmanship that does not meet design requirements, defective materials or workmanship shall be corrected and test re-run until specifications are fulfilled.
- B. Water and Test Equipment
 - 1. Make all arrangements for furnishing water. Perform tests and provide personnel, hoses, tank trucks, plugs and other equipment to complete the tests at no cost to Owner.
 - 2. Make all taps in the pipe as required.
- C. Pressure Test
 - 1. After each valved section of pipe has been laid and partially backfilled, it shall be subjected to a hydrostatic pressure of 50% in excess of specified pipe strength.
 - 2. After the entire pipeline is completed, a final test shall be undertaken under the same conditions and utilized to guarantee the performance of the completed system.

D. Duration

1. The duration of each pressure test shall be at least 1 hour at 150 psi to determine leakage by formulas contained herein.

E. Procedure

1. Each valved section of pipe shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump connected to the pipe connection. Means of measuring the water necessary to maintain test pressure, gauges and all necessary apparatus, shall be furnished by the Contractor. The Contractor shall furnish all necessary assistance for conducting the test.

F. Expelling Air

1. Before applying the specified test pressure, all air shall be expelled from the pipe.

G. Examination During Test

1. All exposed pipe, fittings and valves and all joints shall be examined during the tests. Any visible leaks shall be repaired until tight. Any cracked, broken, or defective pipe, couplings, fittings or valves shall be replaced at the Contractor's expense.

H. Leakage

1. Leakage shall be defined as the quantity of water supplied into the pipe, or any section of it, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled. No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula in which:

$$L = \frac{ND\sqrt{p}}{7400}$$

L = allowable leakage in gph.

N = number of joints in length of pipe tested.

D = nominal diameter of pipe in inches

p = average test pressure during test, in pounds per square inch.

2. Should any test of pipe laid disclose leakage greater than that allowed under section above, the Contractor shall, at his own expense, locate and repair the defective joints or pipe until the leakage is within the specified allowance.

3.06 STERILIZATION OF WATER MAINS

- A. Following the pressure test and before being placed in service, all new water lines shall be chlorinated.

- B. Prior to commencing disinfection procedures, all lines shall be flushed thoroughly to remove dirt, construction debris and other potential contaminants.
- C. Contractor shall have the option of applying chlorine by either a liquid chlorine gas- water mixture, direct fed chlorine gas or a calcium or sodium hypochlorite and water mixture conforming to AWWA C-651.
- D. Initial amounts of chlorine shall be injected into the line to provide a dosage of at least 50 ppm (mg/l). Treated water shall be retained in the pipe for at least 24 hours. A free chlorine residual of not less than 25 ppm shall be maintained in all parts of the line after the 24-hour period has elapsed.
- E. During the sterilization process, all valves in the main line shall be operated and all hydrants flushed until a strong residual is found.
- F. After chlorination has been satisfactorily completed, the lines shall be thoroughly flushed until the chlorine content in all parts of the system has been proven by test to be comparable to the chlorine content of the existing system.
- G. It shall be the responsibility of the Contractor to lawfully dispose of the chlorinated water and flushing water, and avoid flooding or damage to adjacent properties or facilities.
- H. After flashing the chlorine from the water system and prior to placing line in service, the Contractor shall engage the services of an approved commercial testing laboratory, approved by the State of Oregon Health Division for microbiological analysis. Samples shall be taken at various points along the water main to be certain all portions of the system have been sterilized.
- I. No section of water systems will be allowed to be connected to the water purveyor's existing water system when any sample of water tests indicate coliform bacteria as tested by the 24 Hour Membrane Filtration Method. Should the laboratory report show that any sample taken was not acceptable, Contractor shall re-chlorinate and test the water again as herein before specified. This process shall be repeated until a satisfactory disinfection has been accomplished.
- J. Contractor shall direct the laboratory to send the original report of Bacteriological Examination to the Engineer.
- K. Sterilization shall be conducted in the presence of the Engineer.

END OF SECTION

SECTION 02515

WATER PIPE APPURTENANCES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Furnishing all labor, materials, equipment and performing all work necessary for installation of pipe appurtenances required in the construction of the project.

1.02 RELATED SECTIONS

- A. Section 02240 - Control of Water
- B. Section 02250 - Shoring and Bracing
- C. Section 02315 - Excavation and Fill
- D. Section 02510 - Water Pipe and Installation

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. A 47 Specification for Ferritic Malleable Iron Castings.
 - 2. A 153 Specification for Zinc Coating (Hot-Dipped) on Iron and Steel Hardware.
 - 3. B 88 Specification for Seamless Copper Water Tube.
 - 4. D 1784 Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.
 - 5. D 2464 Specification for Threaded Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 - 6. D 2467 Specification for Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.
 - 7. D 1248 Specifications for High Density Polyethylene Pipe
 - 8. D 3350 Specifications for High Density Polyethylene Pipe
- B. American Water Works Association (AWWA).
 - 1. C-104 Cement Mortar Lining for Cast Iron and Ductile-Iron Pipe and Fittings.
 - 2. C-110 Gray-Iron and Ductile-Iron Fittings, 2 inch through 48 inch.
 - 3. C-111 Rubber-Gasket Joints for Gray-Iron and Ductile-Iron Pressure Pipe and Fittings.
 - 4. C-153 Ductile-Iron Fittings 3 inch through 48 inch.
 - 5. C-502 Dry Barrel Fire Hydrants.

6. C-504 Rubber Seated Butterfly Valves.
7. C-509 Resilient Seated Gate Valves for Water Supply Service.
8. C-550 Protective Epoxy Interior Coatings for Valves and Hydrants.
9. C-600 Installation of Cast-Iron Water Mains
10. C-605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
11. C-651 Disinfecting Water Mains
12. C-900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings
13. C-906 Polyethylene Pressure Pipe and Fittings

1.04 QUALITY ASSURANCES

- A. The Engineer may require manufacturer's certificates showing conformance with the specifications for any of the appurtenances.
- B. All appurtenances shall be National Sanitary Foundation Standard 61 approved.
- C. All appurtenances shall be American made.

1.05 SUBMITTALS

- A. To facilitate specification compliance, submittals are required on all pipe materials and appurtenances; whether as specified or as a proposed substitution. Submittals shall consist of the appropriate combination of catalog sheets, material lists, brochures, bulletins, diagrams, specifications or samples necessary to describe a system, product or item.
- B. Five (5) sets of material submittals shall be submitted to Engineer within three weeks following the contract signing.

PART 2 - PRODUCTS

2.01 MATERIALS GENERAL

- A. Pipe appurtenances may include, but are not necessarily limited to the following:
 1. Fittings
 2. Valve and valve boxes
 3. Thrust blocking
 4. Fire hydrants
 5. Blow-offs and air-vac relief valves
- B. All pipe appurtenances shall be new and unused.

2.02 FITTINGS

- A. All fittings shall be sufficient strength to withstand all handling and load stresses. All fittings shall be of the same materials as the pipe unless otherwise specified. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.
- B. Cast/Ductile Iron Fittings.
 - 1. Mechanical Joint Fittings used with ductile-iron and C900 and C905 PVC pipe shall conform to ANSI/AWWA C-110/A21.10 and ANSI/AWWA C-111/A21.11, or ANSI/AWWA C-153/A21.53. Fittings shall be cement mortar lined, 250-psi working pressure.
 - 2. Flanged fittings shall conform to ANSI/AWWA C110/A21.0 and ANSI B16.1, Class 125, unless otherwise noted, or as required by end fittings of adjoining materials. Flanged fittings shall have a 250-psi minimum pressure rating.
 - 3. Rubber gasket joints for mechanical joint fittings shall conform to ANSI A21.11 (AWWA C111). Furnish with galvanized steel tee head bolts, washers and nuts.
 - 4. Flanges shall conform to ANSI A16.1, Class 125, unless otherwise specified. Flanges shall be faced and drilled. Gasket material for flanged joint fittings shall be commercial neoprene sheet conforming to ASTM D 2000, SAE J200, 1 BC 609, 1/8 inch thick approved for use with potable water. Gasket shall be full cut with holes to pass bolts. Bolts, washers, and nuts shall be cadmium plated.
 - 5. Mechanical joint and flange joint fittings shall be as manufactured by Tyler/Union, Clow, Stockham, or approved equal.

2.03 COUPLINGS

- A. Cast Couplings.
 - 1. Transition and straight couplings shall have ductile-iron sleeve, end rings and resilient gaskets. Furnish with corrosion resistant, high-strength 316 stainless steel bolts, nuts and washers. Coupling shall be fusion-epoxy lined and coated.
 - 2. Transition and straight couplings shall be Rockwell "443", Dresser Style "153" or approved equal.
- B. Cast Reducing Coupling.
 - 1. Reducing couplings shall have ductile-iron sleeve, end rings and resilient gaskets. Furnish with corrosion resistant, high-strength galvanized steel bolts, nuts and washers. Coupling shall be fusion-epoxy lined and coated.
 - 2. Reducing couplings shall be Rockwell "415" or approved equal.

- C. End Caps.
 - 1. End cap couplings shall have ductile-iron sleeve, end ring and end cap and resilient gaskets. Furnish with corrosion resistant, high-strength galvanized steel bolts, nuts and washers. End cap coupling shall be fusion-epoxy lined and coated.
 - 2. End cap coupling shall be Rockwell "482", Romac "EC 501" or approved equal.

2.04 MJ JOINT RESTRAINT DEVICE

- A. Joint restraints required at elbows and other fittings where indicated on the Drawings or required, shall be designed for the type of pipe being installed (PVC or ductile- iron). Restraints for use with PVC pipe shall conform to ASTM F 1674, Standard Test Method for Joint Restraint Projects for use with PVC pipe.
- B. Device shall be cast from Grade 65-45-12 ductile-iron material in accordance with ASTM A 536 and shall consist of multiple gripping wedges incorporated into the following gland.
- C. Device shall work with standard mechanical joint fittings and offer full deflection capabilities after installation. Device shall have a rated working pressure of at least twice that of the pipe.
- D. MJ joint restraint devices shall be manufactured by EBAA Iron, Ford Meter Box Company (Uni-Flange) or approved equal.

2.05 SCHEDULE 80 PVC FITTINGS

- A. Use Schedule 80 PVC fittings conforming to:
 - Threads - ASTM D 2464
 - Sockets - ASTM D 2467
 - Material - ASTM D 1784
- B. Solvent cement for PVC slip fittings shall conform to ASTM D 2564.
- C. Teflon tape shall be used as sealant for threaded joints.

2.06 GALVANIZED PIPE FITTINGS

- A. Galvanized pipe fittings for combination air/vacuum relief and blow-off valves shall be 150 pound malleable iron fittings conforming to:
 - Material - ASTM A 47
 - Dimensions - ASA B16.3
 - Threads - ASA B2.1
 - Galvanizing - ASTM A 153

2.07 WATER SUPPLY AND AIR LINE PIPING

- A. Material PEX (Cross-linked polyethylene), PE-AL-PE (Polyethylene-aluminum-polyethylene), PEX-AL-PEX (Cross-linked polyethylene-aluminum-cross-linked polyethylene).
- B. Size as indicated on drawings.

2.08 CAST IRON GATE VALVES

- A. General
 - 1. Unless indicated on the Drawings, waterlines 2 inch through 8 inch shall use resilient wedge gate valves.
 - 2. Special note should be taken of the end configuration of valves as indicated on the Drawings for various installation conditions. Flanged and mechanical joints on valves shall conform to pipe materials specifications. Gate valves used with combination air/vacuum relief and blow-off valves shall be furnished with iron pipe threads.
 - 3. Gate valves shall be furnished with buried traffic rated valve boxes and lids as specified hereafter in this Section.
 - 4. Stem extensions shall be installed to bring the operating nut to within two (2) feet of finish grade where the depth from finished grade to operating nut exceeds three (3) feet
- B. Gate Valves.
 - 1. Valves shall conform to the latest revision of AWWA C-509, resilient seated gate valves and be UL listed and FM approved. All internal parts shall be accessible without removing the body from the line. The wedge shall be of cast iron completely encapsulated with resilient material. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber paving bond to meet ASTM D 429. Non-rising stem shall be cast bronze and shall be manufactured to open when the stem is rotated counterclockwise. Furnish with a two-inch square operating nut unless otherwise specified. All valves shall be 250-psi working pressure and hydrostatically tested at 500 psi to the requirements of both AWWA and UL/FM. The stuffing box shall have two "O-Ring" seals above the thrust collar. All bolts and nuts shall be cadmium plated.
 - 2. All valves shall be fully fusion bonded epoxy coated (body and bonnet). Interior and exterior to be fully coated per AWWA C550.
 - 3. Valves shall be manufactured by Clow, M&H, Mueller or approved equal.

2.09 BUTTERFLY VALVES

- A. General.
 - 1. Unless indicated on the Drawings, waterlines 10 inches and larger shall use butterfly valves.

2. Special note should be taken of the end configuration of valves as indicated on the Drawings for various installation conditions. Flanged and mechanical joints on valves shall conform to pipe materials specifications.
3. Buried butterfly valves shall be furnished with traffic rated valve boxes and lids as specified hereafter in this Section.
4. Stem extensions shall be installed to bring the operating nut to within two (2) feet of finish grade where the depth from finished grade to operating nut exceeds three (3) feet.
5. Interior butterfly valves shall be provided with hand wheel.

B. Butterfly Valves.

1. Valves shall conform in all respects to the physical and performance requirements of AWWA C504, short body type having operators suitable for direct burial. Furnish Class 150B valves unless otherwise indicated. Furnish valves having two-inch square operating nut which shall rotate counter clockwise to open. All valves shall be tested for 200-psi pressure. Furnish with cadmium plated bolts and nuts. Interior butterfly valves shall be provided with hand wheel.
2. Valves shall be Dresser 450, or approved equal by Kennedy, Figure 40.

2.10 BRONZE 1-1/2" AND SMALLER GATE VALVES

- A. Valves shall be non-rising stem Class 200 bronze gate valve with bronze union bonnet, bronze solid wedge disc, and stainless steel seat rings. Valves shall conform to Federal Specification MSS SP-80 Type 1. Furnish with bronze tee handle.
- B. Two hand wrenches shall be provided to operate all tee handle gate valves.
- C. Crane No. 426, Stockham Fig. B-140, Walworth, Jenkins, Nibco or approved equal.

2.11 VALVE BOXES

- A. Cast iron traffic rated valve boxes and lids shall be furnished and installed with all buried gate or butterfly valves.
- B. Boxes shall be two-piece (top and base) adjustable length for varying installation conditions, with a slip type means of adjustment, and a top flange. Box shall be suited for valve size.
- C. Shaft shall be 7 inch inside diameter. Cover shall be "lift pocket" type and fettered WATER.
- D. Shaft extensions shall be provided where required.
- E. Boxes shall be Rich "926" or approved equal.

2.12 THRUST BLOCKING

- A. Reinforcement for concrete thrust blocking shall be deformed billet steel bars conforming to ASTM A 615, Grade 60.
- B. Concrete for thrust blocking shall be Portland Cement concrete conforming to ASTM C 94, developing a 28-day compressive strength of at least 2,500 psi.

2.13 WELL SERVICE AIR RELIEF VALVES

- A. Furnish and install well service relief valves, size as shown on the Drawings, and per Standard Detail.
- B. Valves shall have cast iron body, covers and baffle and stainless steel float, designed for normal usage of 150 psi. All other trim shall be stainless steel with the exception of Buna-N seat and adjustable Viton Orifice.
- C. One 1-inch gate valve, as specified in this Section, shall allow removal and reconditioning of well service relief valve. Connections to pump discharge spool shall be made through the use of service saddles specified in this Section.
- D. Miscellaneous piping shall be galvanized iron pipe as specified in this Section.
- E. Valve shall be Model 101WS as manufactured by Val-Matic Valve and Manufacturing Corp. or approved equal.

2.15 SILENT CHECK VALVES

- A. Manufacturer
 - 1. Tal-Matic Valve and Manufacturing Corp.
 - 2. Or approved equal.
- B. Model Numbers
 - 1. Series 1800
 - 2. The Check Valve shall be of the silent operating type that begins to close as soon as the forward flow diminishes and is fully closed at zero velocity, preventing flow reversal and resultant water hammer or shock.
 - 3. The check valve shall be globe style type. Valve shall be provided with flanges conforming to ANSI B16.1, Class 125
 - 4. Valve design shall incorporate a center guided, spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe size.
 - 5. Operation of the valve shall not be affected by the position of installation.

The valve shall be capable of operating in the horizontal or vertical positions with the flow up or down.

6. All component parts shall be field replaceable without the need of special tools. A replaceable guide busing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide a cracking pressure of 0.5 psi and to fully open at a flow velocity of 4 ft/sec.
7. The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
8. The exterior and interior of the valve shall be NSF 61 approved fusing coated epoxy coated, in accordance with AWWA C-550.

2.16 BLOW-OFF VALVES

- A. Install blow-off valve, size as shown on the Drawing and per Standard Detail.
- B. One 2-inch gate valve, as specified in this Section, shall be installed for manual operation.
- C. Miscellaneous piping shall be galvanized iron pipe as specified in this Section.
- D. One 4" x 4" painted cedar or pressure treated Douglas Fir post shall be furnished for ready field location, and to secure outfall piping. Connection to water main shall be made through use of service saddle as specified in this Section.

2.17 SERVICE SADDLES

- A. C-900 PVC Pipe.
 1. Saddles with 3/4 inch to 2 inch taps shall be cast iron with stainless steel strap (s) with "O" ring gasket.
 2. Saddles shall be sized specifically for C-900 pipe.
 3. Saddles shall be Romac or approved equal.
- B. Ductile-Iron Pipe.
 1. Saddles with 3/4 through 2 inch taps shall be cast iron with double strap stainless steel with "O" ring gasket. Supply with I.P. threads.
 2. Saddles shall be Romac or approved equal.

PART 3 - EXECUTION

3.01 Manufacturer's installation recommendations are a part of this Section and shall be followed. (See Standard Detail Drawings for various items below).

3.02 FITTINGS

- A. Install fittings at the location shown or as directed by the Engineer. Handle, clean, lubricate and install fittings as specified in Section 02510 for laying pipe. Where a cut in the pipe is necessary for inserting fittings or closure pieces, cut the pipe mechanically without damaging pipe or lining and leave a smooth end at right angles to the centerline of the pipe. Dress and bevel the cut end of the pipe to remove sharp edges and projections which may damage the gasket. Repair all damaged lining and coating to the satisfaction of the Engineer. On the pipelines, securely anchor all tees, plugs and elbows as shown or directed to prevent movement due to thrust. Achieve anchorage only by use of approved thrust blocking or approved joint restraint.

3.03 COUPLINGS

- A. Install per manufacturer's recommendations.

3.04 VALVES

- A. Set valves in the same manner as previously specified for installation of pipe. Clean flange faces thoroughly before assembling the flanged joint. Insert the gasket and tighten the nuts uniformly around the flange. Align pipe carefully on both sides of the valve before final tightening of the flanges to avoid stressing the valve body. After installation, operate the valve from full open to full closed to make sure the valve does not bind during operation. Correct any malfunction in the operation of the valve. Test valve joints with adjacent pipeline. Repair any leaks as previously specified. Backfill around valves in same manner as specified for pipe.

3.05 VALVE BOXES

- A. Center valve boxes and set plumb over the operating nut of the valve. Set valve box bases so they do not transmit shock or stress to the valve. Set the valve box covers flush with the surface of the finished pavement or to such other level as may be directed. Adjust the extensions to the proper length as required for proper installation. Backfill shall be the same as specified for the adjacent pipe. Correct any misalignment of valve boxes without additional expense to the Owner.

3.06 THRUST BLOCKING

- A. Provide thrust blocking, as shown or as directed by the Engineer, using concrete as specified. Place the concrete blocking between undisturbed earth and the polyethylene encased fitting to be anchored. The bearing surface shall be sized and located to adequately withstand the applied thrust force. Do not encase pipe joints

or fitting joints with concrete.

3.07 WILL SERVICE AIR RELIEF VALVE

- A. Install per Standard Detail Drawing.
- B. Install at high points or summits of any waterline.

3.08 BLOW-OFF VALVES

- A. Install per Standard Detail Drawing.
- B. Install at low points of any waterline.

3.09 SERVICE SADDLES

- A. Install at locations as shown or as directed by Engineer.

END OF SECTION

SECTION 02590

TONING WIRE AND WARNING TAPE

PART 1 - GENERAL

1.01 SCOPE

- A. The work to be done under this section consists of furnishing all labor, material, equipment and performing all work specified herein for the burying of an insulated copper wire and plastic underground warning tape in close proximity to all installed pipelines and conduits.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Toning Wire shall be No. 14 AWG, solid copper with blue colored insulation for water, green colored for sanitary sewer.
- B. Underground Warning Tape shall be 6" wide, APWA Standard Blue color, reading "CAUTION - WATERLINE BURIED BELOW" or Standard Green color, reading "CAUTION - SEWERLINE BURIED BELOW".

PART 3 - EXECUTION

3.01 WORKMANSHIP.

- A. Wire and Tape shall be buried the entire length of trench and placed above pipe or conduit per standard trench detail drawing.
- B. Wire shall be brought to the surface and connected at each valve box or manhole. Distance between tracer lead access locations shall not be more than 1,000 feet. Joints or splices in wire shall be waterproof.
- C. Tape shall be placed over the pipe zone material, approximately 6 inches above top of installed pipe or conduit. Lay flat and untwisted.

END OF SECTION

SECTION 02730

AGGREGATE BASE AND SURFACING

PART 1 - GENERAL

1.01 SCOPE

- A. Work consists of furnishing labor, materials, equipment and performing all work for placing of one or more aggregate courses as base or surfacing, on a prepared surface in accordance with these specifications and in reasonably close conformity to the lines, grades, thicknesses shown on the Plans or established by the Engineer.
- B. Related Sections:
 - 1. Section 02315 - Excavation and Fill.
 - 2. Section 02799 - Compaction Testing.

1.02 SUBMITTALS

- A. Reports and test results that demonstrate the materials comply with the specifications for aggregate base and surfacing. Samples shall be submitted 14 days in advance of material use to allow verification by the Engineer for compliance with the specifications.
- B. Samples shall be tagged with the following information:
 - 1. Pit name and location.
 - 2. Stockpile name and location, if different than the pit.
 - 3. Recent sieve analysis of the proposed material. Statement from the Contractor or supplier that the proposed material conforms to the specifications of this project.

1.03 QUALITY ASSURANCES

- A. The Contractor shall retain and pay all costs for an independent certified test agency qualified according to ASTM E 329 and acceptable to Engineer to take samples, perform moisture content, gradation, compaction and density tests during placement of aggregate base and surfacing.

PART 2 - PRODUCTS

2.01 AGGREGATE BASE AND SURFACING MATERIAL

- A. Base and surfacing material shall conform to the requirements of Section 02630 of the ODOT/APWA 2002 Standard Specifications for Construction, except 70 percent of the particles by weight shall have at least one mechanically fractured faces based on grading requirements of the section. Furthermore, the fracture

requirements shall be applicable uniformly throughout the grading of the materials involved. (All gravel sizing shall have fractured faces applicable by screen sizes to the 70% level.) The material shall be tested and tests shall be furnished to the Owner and Engineer indicating conformance thereto on each of the gradations to which the materials are divided in determining conformance to the requirement for grading of the materials.

- B. Aggregate for base and surfacing shall be 3/4 inch minus crushed rock. Aggregate shall be uniformly graded from coarse to fine and shall conform to the grading requirements set forth in the following table:

<u>Sieve Size Passing</u>	<u>Percentage (By Weight)</u>
3/4"	90-100
1/2"	55-75
1/4"	40-55

*For base aggregates only, of the fraction passing the 1/4-inch sieve 40% to 60% shall pass the No. 10 sieve.

PART 3 - EXECUTION

- 3.01 Sequencing and Scheduling. Notify Engineer 48 hours prior to placement of gravel surfacing to permit inspection.
- 3.02 Preparation of Subgrade. Ensure that all surfaces and materials on which gravel surfacing is to be placed are firm and have been prepared as specified in the applicable portions of Section 02315.
- 3.03 Mixing. Mix to provide a homogeneous mixture of unsegregated and uniformly dispersed materials which will compact to not less than 95% maximum density. Add water during mixing in an amount sufficient to provide optimum moisture content plus or minus two percentage points.
- 3.04 PLACING
 - A. When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be secured, suspend operations. Owner will not be liable for damages or claims of any kind or description by reason of operations suspended by Engineer.
 - B. Aggregate shall be deposited on the subgrade at a uniform quantity per linear foot so that the Contractor will not resort to spotting, picking up, or otherwise shifting of gravel surfacing material. Segregation of aggregates shall be avoided and material so spread shall be free of pockets of coarse or fine materials.
 - C. If the required compacted depth of the base course exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. Maximum

compacted thickness of any one layer shall not exceed 6 inches. Place each layer in spreads as wide as practicable and to full width of the course before a succeeding layer is placed.

3.05 THICKNESS

- A. Aggregate base shall be placed to a compacted thickness of 8-inches. Base aggregate shall be placed and compacted in maximum 6-inch lifts unless the Contractor provides mechanical compaction equipment approved by the Engineer for deeper lifts. In general, each layer shall be placed in spreads as wide as practicable and to the full width of the course and compacted before a succeeding layer is placed.
- B. Gravel surfacing shall be placed equal to the depth of material on existing streets and private driveways with a minimum depth of 6 inches required. Depths to be determined by the Engineer. Shallower depths may be approved on some areas with minimal gravel surfacing. Width of replacement surface will be as wide as existing gravel street prior to construction. Authorization of Engineer required prior to replacement of material over 6 inches in depth.

3.06 Compaction. Each layer of material shall be compacted to not less than 95% of maximum density as determined by ASTM D 698. Testing methods for density requirements shall be determined by AASHTO T-191 or T-205.

3.07 Surface Finish. The aggregate shall parallel the cross section and grade of the adjacent finish surfaces within 0.05 foot. The finished surface of the base, when tested with a 10-foot straight edge, shall not vary from the testing edge by more than 0.04 foot at any point.

END OF SECTION

SECTION 02740

ASPHALTIC PAVEMENT CONSTRUCTION AND REPLACEMENT

PART 1 – GENERAL

1.01 SCOPE

- A. The work consists of furnishing all labor, materials, equipment and perform all work for new construction and replacement of asphaltic concrete pavement, damaged either directly or indirectly by the operations incidental to this project.
- B. Related Sections.
 - 1. Section 02315 - Excavation, Embankment, Bedding and Backfill
 - 2. Section 02730 - Aggregate Base and Surfacing

1.02 DEFINITIONS

- A. Hot Mixed Asphaltic Concrete (HMAC) is a hot mix of asphaltic cement; well graded, high quality aggregate; mineral filler and additives as required; plant mixed into a uniformly coated mass, hot laid in a prepared foundation, and compacted to a specified density.
- B. Level 2 HMAC (Standard Duty Class “C” Mix) - HMAC for use in applications with low traffic volumes and low volume truck traffic.
- C. Wearing Course - The top lift of HMAC, regardless of thickness.

1.03 QUALITY ASSURANCES

- A. Provide quality control per subsection 00745.16 of ODOT/APWA. The intent of this project is for the Contractor to provide a certified ODOT mix design and compaction tests as provided in Section 00745.16. Other testing provided by Section 00745.16 may be required at the discretion of the Engineer.
- B. Deliver, handle and store materials in accordance with manufacturer’s instructions.

PART 2 - PRODUCTS

2.01 ASPHALT CONCRETE PAVEMENT

- A. Asphalt concrete shall be a mixture of asphalt cement, aggregate, mineral filler, and additives as required, heated and plant mixed into a uniformly coated mass.

- B. Asphalt concrete shall be 1/2 inch Level 2 HMAC (Standard duty Class “C” mix) with PG 64-22 liquid asphalt cement conforming to Section 00745 of ODOT/APWA, 2002 Standard Specifications for Construction.
- C. Patching of improved streets shall utilize infrared patchless technology to eliminate appearance of patching within improved City streets.

2.02 TACK COAT

- A. The tack coat material shall be CSS-1, of CSS-1h, and shall meet the requirements of ODOT/APWA, Section 00730 Standard Specifications for Construction, 2002 Edition.

2.03 JOINT SEAL

- A. Joint seal shall meet the test requirements of ASTM D 244.
- B. Joint seal material shall be CRS-1 or CRS-2 and shall meet the requirements of ODOT/APWA, 2002 Standard Specifications for Construction; Section 02710 for Cationic Emulsified Rapid Setting Asphalt.

PART 3 – EXECUTION

3.01 Mix, process, place, and compact in compliance with Section 00745 of ODOT/APWA, 2002 Standard Specification for Construction.

3.02 The existing surface shall be dry prior to paving.

3.03 Minimum temperature at time of placement shall be 250 degrees F. and shall not be placed when the ambient temperature is below 40 degrees F.

3.04 Care shall be taken at all times to prevent segregation in the mixture.

3.05 Ensure that aggregate base and other surfaces on which asphaltic concrete pavement is to be placed, are sound and compacted.

3.06 ASPHALT TACK COAT

- A. Preparation.
 - 1. Saw cut existing pavement to a straight line to remove and dispose of any pavement which has been damaged or is broken and unsound. Provide smooth, sound vertical edge for joining new pavement.
 - 2. Trenches shall be saw cut 12 inches beyond the trench excavation, “tee cut”. The Contractor shall protect the existing base material located outside the trench limits. Recompact to 95 percent of the maximum density (ASTM D

- 1557) prior to placing new asphalt concrete pavement.
3. Depth of saw cuts shall be sufficient to permit removal of material between and along side, without damage to adjoining area.
4. Manholes, inlets and other structures shall have been completed, adjusted, cured and otherwise prepared, as applicable and made clean and ready for asphalt placement. Cover top surfaces with paper or other material to prevent adherence of asphalt or tack coat.

B. Tack Coat.

1. Contact surfaces of manholes, inlets, gutters, curbs, existing pavement edges and other surfaces shall be treated with a layer of asphalt tack coat to provide a good bond and seal. Do not place on wet surfaces.
2. Contact surfaces of existing pavement shall be treated with a layer of tack coat asphalt. Material, equipment, and construction shall conform to the requirements of Section 00730 of ODOT/APWA, 2002 Standard Specifications for Construction. The tack coat shall be cured thoroughly prior to the application of the asphaltic overlay. Do not place on wet surfaces or during cold weather.

Spread asphalt tack coat by means of pressure-spray equipment which will provide uniformity of application at prescribed rates. Do not apply aggregate cover material to the tack coat. Normally, asphalt shall be applied to the prepared surface at a rate within a range of 0.02 to 0.06 gallon per square yard of surface, actual rate to be as directed. Apply only so far in advance as is appropriate to maintain a tacky, sticky condition.

- C. Deficiencies or damages in surfacing shall be immediately repaired by the Contractor upon request of, and in a manner approved by, the Engineer.
- D. Compaction shall be at least 92% as determined by AASHTO T209, as modified by ODOT/APWA, 2002 Standard Specifications for Construction. Compaction shall be completed before the placed asphalt temperature drops below 180 degrees F.
- E. Compacted depth:
 1. Within City right-of-ways, trenches shall be cold mix patched prior to the end of each day or steel plated and hot mix patched within seven calendar days. Finish pavement depth with Class III backfill shall be 6- and 2-inches respectively, laid in 2-inch lifts.
- F. Test the top surfaces with a 12-foot long straight edge in conformance with Section 00745.70 of ODOT/APWA, 2002 Standard Specifications for Construction. The finish grade shall have a smooth uniform surface for storm drainage with no low spots that would collect water, causing puddling.

- G. Surface of the asphalt concrete after compaction shall be smooth and true to a tolerance of 0.02 foot of the established cross section and grade, conforming to Section 00745.70 of ODOT/APWA, 2002 Standard Specifications for Construction. Any mixture that become loose or broken, mixed with dirt, or is in anyway defective, shall be removed and replaced with fresh hot mixture which, when compacted, shall conform to the surrounding area. There shall be no sign of roller marks. All costs in correcting defective surfaces shall be borne by the Contractor.
- H. No traffic shall come in contact with any newly paved surface until surface has cooled and set sufficiently to prevent marking. The Contractor is responsible for this traffic control.
- I. After completion of paving, the Contractor shall remove from the site all debris resulting from the Contractor's operation.
- J. All costs incurred in the repair of deficiencies or damages shall be borne by the Contractor, and no additional compensation shall be due the Contractor.
- K. Sequencing and Scheduling. Notify Engineer and appropriate state, county or city department at least 48 hours prior to placement of pavement to permit inspection.
- L. Weather Limitation. When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be secured, suspend operations. Owner will not be liable for damages or claims of any kind or description by reason of operations suspended by Engineer.
- M. Adhere to all applicable ODOT, county and city regulations pertaining to road closure, traffic control, and other related safety precautions.

3.07 WARRANTIES

- A. Contractor shall maintain all surfaced areas and shall furnish all required materials and workmanship at no additional cost to Owner for a period of one year following the Owner's final acceptance of the completed project.
- B. The Contractor shall maintain all areas of cut, damaged, or new asphalt within City right-of-ways and shall furnish all required materials and workmanship at no additional cost to the Owner for a period of two years following the Owner's final acceptance of the complete project.
- C. If any of the restored or new gravel or asphalt surfaces settles, cracks, breaks, or is otherwise considered faulty within the warranty period, the deficiencies or damages in surfacing shall be immediately repaired by the Contractor, upon request of and in a manner approved by the Engineer.

- D. All costs incurred in the repair of deficiencies or damages shall be borne by the Contractor and no additional compensation will be due the Contractor.

END OF SECTION

SECTION 02799

COMPACTION TESTING

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall retain and pay all costs for an independent certified testing agency to take samples, perform moisture content, gradation, compaction and density test during placement of backfill, embankments, engineered fills, granular underlayments, subgrades, aggregate base courses and asphaltic concrete pavement.
- B. Related Sections.
 - 1. Section 02230 - Site Clearing
 - 2. Section 02315 - Excavation and Fill
 - 3. Section 02720 - Aggregate Surfacing
 - 4. Section 02740 - Asphaltic Concrete Paving

1.02 QUALITY ASSURANCES

- A. Independent testing agency shall be qualified in accordance with ASTM E 329.
- B. Testing agencies.
 - 1. Carlson Testing; Bend Oregon
 - 2. The Wallace Group; Bend Oregon
 - 3. Foundation Engineering; 5030 SW Philomath Blvd., Corvallis, Oregon.
 - 4. Braun Intertec Northwest, Inc.; 5405 North Lagoon Avenue, Portland, Oregon.
 - 5. Century West Engineering Corp.; 825 NE Multnomah, Suite 425; Portland, Oregon.
 - 6. Soils Testing Laboratory Inc., 130 West 9th Street, Medford, Oregon.
 - 7. Or other certified private testing laboratory approved by Engineer.
- C. Testing agency will conduct compaction testing, recommend methods of compaction, and issue final report to the Owner, through Engineer, on compaction test results and material compliance with specifications.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL

- A. No additional compensation will be made for down time incurred as a result of testing or waiting for test results.

3.02 TEST LOCATION SELECTION

- A. Compaction testing shall proceed within a short distance behind the construction.
- B. Testing agency shall perform compaction tests at such locations and elevations as will be representative of the entire backfill or other material to be compacted.
- C. All failing test costs will be borne entirely by the Contractor. All associated costs arising from any necessary work due to failing compaction test results, including removal and replacement of material, shall be borne by the Contractor.
- D. Provide for Five (5) compaction tests of completed gravel base construction.

END OF SECTION

SECTION 02825

EXTERIOR SITE METAL FENCES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes furnishing all materials, labor and appurtenances necessary for installation of exterior industrial ornamental aluminum fencing and gates to prohibit entry into the new well building.
- B. Related Sections.
 - 1. Section 0310 - Grading
 - 2. Section 02315- Excavation, Embankment, Bedding and Backfill
 - 3. Section 03001 - Concrete
- C. System Description - Manufacturer shall supply a total commercial ornamental aluminum fence system of the Echelon II, Majestic design, or approved equal. The system shall include all components required for pickets, rails, posts, gates and hardware to complete fencing as indicated on the plans. Gates shall be single, 4'-0 aluminum swing type gates, conforming to Ameristar Transport, Echelon II, Majestic Design. Color of fence and gates shall be black.
- D. Quality Assurance - Contractor shall provide laborers and supervisors who are thoroughly familiar with type of construction involved and materials and techniques specified.
- E. Submittal - Manufacturer shall provide a submittal package prior to installation.
- F. Handling and Storage - Upon receipt, and prior to installation, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Aluminum material for fence framework. Aluminum shall be hot-dip galvanized to meet requirements of ASTM B 221.
- B. Material for fence pickets shall be I" square x 0.065 thick tubing. Picket retaining rods shall be aluminum. Posts shall be a minimum of 3" square. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.

- C. Height shall be 6'-0.
 - 1. Aluminum pipe 3" O.D., or approved.
- D. Hinged gates shall conform to Ameristar Transport, 6'-0 height. Materials shall be manufactured from aluminum (Designation 6063-T-6) with a yield strength of 25,000 psi, a tensile strength of 30,000 psi, and a standard mill finish.
- E. Each gate section shall be supplied with truss cables for proper bracing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Gate posts shall be spaced according to the gate openings detailed on plans. Equal spaced between corners.
- B. All installation shall be laid out by the Contractor in accordance with the construction plans.
- C. Fence shall be installed as indicated on the plans and be true to line and grade. Fence shall be installed tight and secure.
- D. Cleanup. Contractor shall clean the jobsite of excess materials.

END OF SECTION

SECTION 02920

LANDSCAPING

PART 1 – GENERAL

1.01

SCOPE

- A. This work consists of furnishing all labor, materials, equipment and performing all work for preparing, fertilizing, topsoil, bark, seeding and mulching, of all areas disturbed by construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Seed.

1. Provide tested grass seed from blue tag stock and from the latest crop available. Deliver each variety in standard containers labeled in accordance with Oregon state laws and U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Provide with label showing seed variety, percentage of purity, germination, maximum weed content, date of test within 9 months of date of delivery, and as set forth in the General Seed Certification Standard by the Oregon State University Certification Board. Mold or evidence of container having been wet or otherwise damaged will be cause for in the rejection of each lot of seed.
2. Glass seed may be delivered to the project as a mixture provided each variety of grass seed in the mixture is identified and labeled as specified.
3. Seed, as a mixture, shall be applied at the following minimum rates:

<u>Kind of Seed</u>	<u>Minimum Quantity Per Surface Acre</u>
*Perennial Bluegrass	200 lbs
Total	200 lbs

B. Topsoil

1. Light, humus, loam like material free from clay, large sticks, rocks, etc., and of general type used in area.
2. Minimum 4".
3. All undesirable material shall be removed.

C. Fertilizer.

1. Furnish fertilizer in moisture-proof bags marked with weight and the manufacturer's certified analysis of the contents showing the percentage for

each ingredient. Furnish fertilizer in a dry condition free from lumps and caking, in granular or pelletized form, of standard commercial grade conforming to all State and Federal regulations and to the standards of the Association of Official Agricultural Chemists. Fertilizer may be furnished in bulk form if an approved transfer hopper is provided.

2. Fertilizer shall be Inorganic 22-16-8 and shall be applied at the minimum rate of 500 pounds per surface acre. Inorganic 22-16-8 shall analyze 22 percent nitrogen, 16 percent available phosphoric acid, 8 percent soluble potash and include a minimum 2 percent sulfur. The fertilizer shall contain not less than 50 percent cold water insoluble nitrogen derived by incorporating a minimum of 800 lbs. of urea formaldehyde per ton of fertilizer. The fertilizer shall have a minimum Activity Index (AI) of 50 as determined by the Association of Official Chemists analytical methods.

D. Mulching Materials.

1. Mulch materials shall be free of noxious weed seeds and plants and shall contain no substance detrimental to plant life. Mulch material shall be wood or grass straw cellulose fiber.
2. Mulch shall be processed so that the wood or straw fibers will remain uniformly suspended under agitation in water. The mulch shall also blend with seed, fertilizer and other typical additives of a hydroseeding mixture to form a homogeneous slurry.

The processed mulch shall have the ability to cover and hold grass seed in contact with soil. The wood or grass straw fiber shall also have moisture-absorption and percolation properties to form a blotter-like ground cover. The cellulose fiber shall be colored green to visibly aid uniform application.

Wood or grass straw cellulose fiber shall be shipped in packages of uniform weight (plus or minus 5 percent) and labeled with manufacturer's name and air-dry weight.

3. The mulch binding agent shall be one of the following types or approved equal, applied at the rate indicated or in accordance with the manufacturer's recommended rate.
 - a. Terra Tack Ar
Rate: 120 pounds binder with 240 gallons water per acre.
 - b. Grass Straw Cellulose, "Grass Mulch" as manufactured by Grass Fiber Inc., 520 E. 2nd Street, Junction City, Oregon 97448.
 - c. Wood Cellulose. Rate: 750 pounds per acre.

END OF SECTION

DIVISION 3
CONCRETE
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SECTION 03001

CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing.

1.02 The General Conditions, Supplementary General Conditions, and applicable portions of Division 1 of these specifications are a part of this Division.

1.03 Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work of this section where cited by abbreviation noted.

- A. International Building Code. IBC.
- B. American Society for Testing and Materials. ASTM.
- C. American Concrete Institute's "Recommended Practice for Concrete Formwork", 1967, ACI 347.
- D. "Specifications for Structural Concrete for Buildings". ACI 301.
- E. "Cold Weather Concreting". ACI 306.
- F. "Hot Weather Concreting". ACI 305.
- G. "Manual for Standard Practice for Detailing Reinforced Concrete Structures". ACI 318.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate pertinent dimensioning.
- B. Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
- C. Manufacturer is responsible for the design of the concrete mix which shall conform to ASTM C94 requirements for ready mix concrete. Prior to delivery of concrete, manufacturer furnish to Owner through Engineer/Architect a written statement giving the design mix and properties by weight of cement and aggregate plus

amount of water in gallons per bag proposed for use in each class or type of concrete specifications. Furnish evidence of testing of proposed design mix which assures design strength as specified, statement in writing on letterhead of manufacturer, identified to this specific project. Address to Owner, mail to Engineer.

1.05 QUALITY ASSURANCE - TESTING

- A. Perform cast-in-place concrete work in accordance with ACI 301, 318, 304, 305 and 306, unless specified otherwise in this Section.
 - 1. Provide materials, equipment and work performance in accordance with ACI
 - 2. Obtain materials from same source through the work.
 - 3. Submit proposed mix design to Engineer for review at least 10 days prior to first scheduled pour day.
 - 4. Provide services of qualified testing agency as outlined below.
 - 5. Concrete. The testing agency will:
 - a. Perform field testing in accordance with ACI 311 and 318.
 - b. Test concrete to control slumps according to ASTM C 143. One slump test will be taken for each set of four test cylinders. Test air content and unit weight once for each four test cylinders.
 - c. Test concrete for required compressive strength as follows:
 - 1) Make and cure four specimen cylinders according to ASTM C 31 for first load, and thereafter each 100 yd³, or fraction thereof, of each class poured at site each day.
 - 2) Use two cylinders for seven day test information and two for twenty-eight day test per ASTM C 39. Base strength for acceptance tests on average of the two 28-day cylinders.
 - 3) Date each set and keep accurate record of pour each set represents.
 - 4) Transport specimen cylinders from job to laboratory within 48 hours.
 - d. The Contractor shall pay testing agency for taking core specimens of hardened structure and testing specimen according to ASTM C42 when laboratory tests of specimen cylinders show compressive strengths below specified minimum.
 - e. The testing agency will submit reports on tests and inspections performed to Owner, Engineer and Contractor. Testing agency technician will issue a daily inspection report of all field test results and document observations made during the day. Items not conforming to the specifications shall be reported immediately to the Engineer. Testing agency shall issue a concrete data report per ACI 311.5R for each set of cylinder samples taken.
- 6. Testing Agencies.

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- a. PSI, 545 Conger Street, Eugene, Oregon.
- b. Braun Intertec, 2285 Nugget Way, Eugene, Oregon.
- c. Or other approved certified private testing laboratory, not a representative of concrete supplier.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK & ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Formwork for cast-in-place concrete, with shoring, bracing, and anchorage.
 - 1. Openings for other affected work.
 - 2. Form accessories.
 - 3. Stripping forms.

1.02 RELATED WORK

- A. Section 03200 - Concrete Reinforcement.
- B. Section 03150 - Expansion and Contraction Joints.
- C. Section 03300 - Cast-In-Place Concrete.

1.03 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 347 - Recommended Practice for Concrete Formwork.
- C. PS 1 - Construction and Industrial Plywood.

1.04 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and ACI 347.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver form materials in manufacturer's packaging with installation instructions, where applicable.
- B. Store off ground in ventilated and protected area to prevent deterioration from moisture and damage.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Plywood: Douglas Fir species, Class I or Class II, exterior solid one side grade, sound, undamaged sheets with straight edges.

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- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.
- C. Wood Framing. WCLIB Standard Grade or better, Douglas Fir.

2.02 FORMWORK ACCESSORIES.

- A. Include all devices necessary for proper placing, spacing, supporting and reinforcing steel in place. Include reinforcing bar supports for slabs on grade.
- B. Form Ties: Removable metal of fixed or adjustable length; cone type; free of defects that will leave holes no larger than one 1-1/4 inches diameter in concrete surface. No metal allowed within one inch of surface after tie removal.
- C. Form Release Agent: Material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete. NSF approval for use in potable water required prior to usage.

PART 3 - EXECUTION

3.01 FORMWORK

- A. Inspection.
 - 1. Verify lines, levels, and measurements before proceeding with formwork.
- B. Preparation.
 - 1. Earth forms not permitted.
 - 2. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
 - 3. Arrange and assemble formwork to permit dismantling and stripping so that concrete is not damaged during its removal.
 - 4. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.
- C. Erection.
 - 1. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
 - 2. Formwork shall transmit loads from successive parts of structure directly through falsework without creating bending or shearing stresses in concrete.
 - 3. Formwork shall withstand wind and earthquake forces.
 - 4. Camber slabs and beams to achieve ACI 301 tolerances.
 - 5. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted

- so that joints will not be apparent in exposed concrete surfaces.
6. Provide chamfer strips on external corners of slabs and walls.
 7. Carefully align snap ties horizontally and vertically where concrete is exposed to view.
 8. Install void forms. Protect from moisture before concrete placement. Protect from crushing during concrete placement.
 9. Do not displace or damage any vapor barriers.
 10. Construct formwork to maintain tolerances in accordance with ACI 301.
 11. Safety. Contractor shall be responsible for adequate strength and safety of all formwork including falsework and shoring.

D. Application of Form Release Agent.

1. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
2. Do not apply form release agent where concrete surfaces are scheduled to receive special finishes or applied coverings which maybe affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

E. Inserts, Embedded Parts and Openings.

1. Provide formed openings where required for work embedded in or passing through concrete.
2. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
3. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.02 ACCESSORY ITEMS

A. General.

1. Include all devices necessary for proper placing, spacing, supporting and reinforcing steel in place.
2. Accessories which will be exposed in the finished concrete surface shall be:
 - a. Galvanized.
 - b. Stainless steel.
 - c. Concrete.
 - d. Plastic.
 - e. Aluminum.

3.03 FORM REMOVAL

- A. Notify Engineer prior to removing formwork.
- B. Do not remove forms, shoring and bracing until concrete has sufficient strength to

Concrete Formwork & Accessories
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support its own weight, and construction and design loads which may be imposed upon it. Remove load supporting forms when concrete has attained 75% of required 28-day compressive strength.

- C. Remove formwork progressively so no unbalanced loads are imposed on structure.
- D. Do not damage concrete surfaces during form removal.

END OF SECTION

SECTION 03150

EXPANSION AND CONTRACTION JOINTS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Forming integral contraction and control joints in concrete.
- B. Visually concealing expansion joints in concrete.

1.02 RELATED WORK

- A. Section 03100 - Concrete Formwork.
- B. Section 03400 - Cast-in-Place Concrete.

PART 2 - EXECUTION

2.01 INSTALLATION

- A. Locate and form expansion control and contraction joints.
- B. Place formed construction joints in floor slab pattern placement sequence. Set top screed to required elevations. Secure to resist movement of wet concrete. Contractor has option to sawcut construction joints in approximate square slabs within 24 hours after construction.
- C. Install joint fillers and sealants in accordance with manufacturer's instructions. Use primers of the type recommended by joint, filler and sealant manufacturer.
- D. Construction Joints.
 - 1. Provide where indicated or required by construction.
 - 2. Prevent formations of shoulders and ledges.
- E. Embedded Items. Properly locate and place inserts and embedded item required by other trades.
- F. Waterstops.
 - 1. All splices made in compliance with manufacturer's instructions.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Reinforced steel bars for cast-in-place concrete.
- B. Support chairs, spacers and bar supports for supporting reinforcement.

1.02 RELATED WORK

- A. Section 03100 - Concrete Formwork & Accessories.
- B. Section 03150 - Expansion and Contraction Joints.
- C. Section 03300 - Cast-in-Place Concrete: Concrete Placement.

1.03 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 315 - Details and Detailing of Concrete Reinforcement.
- C. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- D. ANSI/AWS D1.4 - Structural Welding Code Reinforcing Steel.
- E. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- F. CRSI - Manual of Practice.
- G. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
- H. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.04 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and Documents 63 and 65.
- B. Conform to ACI 301 and 315.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet-steel deformed bars.
- B. Welders Wire Fabric. ASTM S-185. Minimum 6 x 6 x 10 x 10 WWM reinforcing at center of slab.

2.02 SUBMITTALS

- A. Shop Drawings.
 - 1. Bending and placing diagrams prepared by firm supplying reinforcing steel for the project.
 - 2. Bending and placing diagrams prepared in accordance with “Manual of Standard Practice for Detailing Reinforced Concrete Structures”, ACI Publication 315.
- B. Manufacturer’s literature describing products if required by Engineer.

2.03 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type, acceptable patented system.
- B. Chairs, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.04 FABRICATION

- A. Fabricate in accordance with ACI 315, providing concrete cover specified in Section
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress.
- C. Weld reinforcing bars in accordance with ANSI/AWS D1.4.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.
- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.

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- C. Ensure placement will permit concrete protection in conformance with ACI 318 or to dimension shown.
- D. Support and fasten bars securely with concrete blocks, spacers, chairs or ties. Wire-tie bar intersections. Secure bars at intervals not exceeding 80 x diameter of bar for horizontal bars and 192 x diameter of bar for vertical bars.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Cast-in-place concrete floors.
- B. Floors and slabs on fill.

1.02 RELATED WORK

- A. Section 03001 - General - Concrete Testing and Leak Testing.
- B. Section 03100 - Concrete Formwork.
- C. Section 03150 - Expansion and Contraction Joints.
- D. Section 03200 - Concrete Reinforcement.

1.03 REFERENCES

- A. ACI 310 - Specifications for Structural Concrete for Buildings.
- B. ASTM C33 - Concrete Aggregates.
- C. ASTM C94 - Ready-Mixed Concrete.
- D. ASTM C150 - Portland Cement.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: ASTM C1 50, Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.

2.02 CONCRETE MIX

- A. Mix concrete in accordance with ASTM C94.
- B. Submittals: Manufacturer is responsible for the design of the concrete mix which shall conform to ASTM C94-78a requirements for ready mix concrete. Prior to delivery of concrete, manufacturer furnish to Owner through Engineer a written

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statement giving the design mix and properties by weight of cement and aggregate plus amount of water in gallons per bag proposed for use in each class or type of concrete specification. Furnish evidence of testing of proposed design mix which assures design strength as specified, statement in writing on letterhead of manufacturer, identified to this project, addressed to Owner, mail to Engineer.

- C. Provide concrete for all reinforced slabs of the following characteristics:
 - 1. Compression Strength: 4,000 psi (28 days) 6-1/2 sack minimum for well building floors, and interior walls exposed to the weather. Slabs and sidewalks shall utilize the same concrete materials.
 - 2. Aggregate: 3/4 inch maximum.
 - 3. Slump: 4-inch maximum when tested in accordance with ASTM C 39. Concrete for non-reinforced slabs and curbs may be reduced to 6 sacks minimum per cubic yard.
- D. Cement Type: ASTM C150-78a for all concrete. Fly-ash complying with ASTM C618 may be substituted for a portion of the required cement provided that satisfactory test information is submitted with the mix design. Maximum fly-ash content to be one part fly-ash to three parts cement, by weight.
- E. Admixtures. ASTM C494, only as approved by Engineer. Air entrainment will be permitted to a maximum level of 5.0%.
- F. Supplier. Supplier shall have a computer operated batch plant so that all quantities are accurate. The moisture content in the fine and coarse aggregates shall be figured into the daily batch quantities. Computerized batch tickets shall be provided indicating quantities of all materials added and providing the moisture content for the fine and coarse aggregates. Plant shall be operated by a certified batch plant technician. Batch plant shall be within a 45-minute drive of the job site.

PART 3 - EXECUTION

3.01 HOT WEATHER CONCRETING

- A. Conform to ACI 305 and following requirements when mean daily temperature rises above 75 degrees Fahrenheit.
 - 1. Concrete to be cast shall be lowest temperature practicable and no warmer than 75 degrees Fahrenheit in any case.
 - 2. Crushed ice in lieu of water shall be approved to maintain concrete below 75 degrees Fahrenheit.
 - 3. Addition of water-reducing retarders will be permitted if the Engineer approved and mix is redesigned.
 - 4. Concrete shall be discharged within 45 minutes after adding water.

3.02 COLD WEATHER CONCRETING

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- A. Conform to ACI 306 and following requirements when mean daily temperature falls below 40 degrees F.
 - 1. Reinforcing forms or ground to receive concrete shall be completely free from frost.
 - 2. Concrete shall be maintained at temperature no lower than 50 degrees F and shall not be allowed to freeze in any case.
 - 3. Use of calcium chloride or calcium chloride containing admixtures as accelerators will not be permitted.

3.03 INSPECTION

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

3.04 PLACING CONCRETE

- A. Notify Engineer minimum 24 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301. A cement slurry may be placed at the base of deep wall pours to facilitate pouring operations and finish quality of walls.
- C. Hot Weather Placement: ACI 301.
- D. Cold Weather Placement: ACI 301.
- E. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- F. Maintain concrete cover around reinforcing as follows:

Item

- Coverage
 - 1. Bonded Reinforcement
Slabs cast against earth

3”

- G. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.
- H. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify

Engineer upon discovery.

3.05 PATCHING

- A. Notify Engineer immediately upon removal of forms and prior to any patching efforts.
- B. Patch imperfections.
- C. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycomb areas, etc., with patching mortar. Patch shall match finish or adjacent surface unless otherwise noted. Epoxy grout shall be utilized for filling of all existing holes in water containing structures, to make structures watertight.
- D. Remove ledges and bulges.

3.06 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels and lines, details and elevations.
- B. Where concrete is under strength, out of line, level, or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcing or is otherwise defective, and, in the Engineer's judgment, these defects impair proper strength or appearance of the work, the Engineer will require its removal and replacement at the Contractor's expense.

3.07 FIELD QUALITY CONTROL

- A. Contractor to maintain records of placed concrete items. Record date, location or pour, quantity, air temperature, and test samples taken.

3.08 CONCRETE SURFACE FINISH (FLAT WORK)

- A. Steel Trowel Finish.
 - 1. Location. Interior slabs not otherwise indicated.
 - 2. Trowel to smooth, hard, slick surface free from trowel marks.
 - 3. Absorption of wet spots with neat cement not allowed.
- B. Brushed Finish. All other concrete flat surfaces.
- C. Brushed Finish. All concrete wall surfaces.
 - 1. Remove snap ties and fill holes with cement mixed as dry as practicable;

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- all exposed walls, pack solid.
2. Correct all aggregate pockets, honeycombing, and other defects as directed by Engineer.
3. Grind off fins and projections from all exposed concrete.
4. Finish Coating. See Division 9.
5. Concrete exposed sidewalks shall be troweled, brush finished, and trowel edged.

3.09 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury as outlined below.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete - 14 days minimum.
- C. Comply with UBC Chapter 14 and the modifications specified herein.
- D. Curing process must control moisture and temperature within the curing mix for not less than 14 days for all concrete work.
- E. Ideal curing temperature is 70 degrees Fahrenheit. When curing temperature exceeds 80 degrees Fahrenheit or falls below 50 degrees Fahrenheit, special curing procedures must be affected. These procedures must meet with the Engineer's approval and remain in effect so long as he deems it necessary.
- F. Curing Compounds.
 1. Apply sealer and hardener conforming to ASTM C309.
 2. Application in strict compliance with manufacturer's detailed instructions as herein outlined and modified. Spray application, rate not to exceed 300 square feet per gallon. Apply as soon as practical after sheen has disappeared from concrete, no later than one hour after final troweling.
- G. Protection. Protect all concrete from damage, special care given to exposed slabs to prevent staining or discoloration, or freezing. Cover with insulated blankets to prevent freezing during inclement weather.

END OF SECTION

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MASONRY
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SECTION 04700

UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Splitface Concrete Blocks; Mortar
- B. Related Sections:
 - 1. Division 7, Section Flashing Materials.

1.02 SUBMITTALS

- A. Reference Section 01 33 00 - Submittal Procedures; submit following items:
 - 1. Product Data: Manufactured masonry and application materials including mortar color charts, and weather resistant barrier.
 - 2. Quality Assurance/Control Submittals:
 - a. Qualifications:
 - 1) Proof of manufacturer qualifications.
 - 2) Proof of installer qualifications.
 - b. Certificates: ICC-ES Report.
 - c. Test Reports for physical properties.
 - d. Manufacturer's Installation Instructions.
- B. Closeout Submittals: Reference Section 017800 - Closeout Submittals; submit following items:
 - 1. Maintenance Instructions.
 - 2. Special Warranties.
- C. Samples: Submit five full size brick units from dark brown to light brown to show range of color, texture and finish.

1.03 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications:
 - a. Minimum five years experience in producing manufactured masonry.
 - b. Member of following organizations:
 - 1) MSJC
 - 2) ACI
 - 3) ASTM
 - 2. Installer Qualifications: Company with documented experience in

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installation of manufactured masonry including minimum 5 project within
400-mile radius of this Project.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Reference Section 016600 - Product Storage and Handling Requirements:
- B. Follow manufacturer's instructions
- C. Store moisture-sensitive materials in weather protected enclosures.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental Requirements; Maintain materials and ambient temperature in area of installation at minimum 40 degrees F (4 degrees C) prior to, during, and for 48 hours following installation.

1.06 WARRANTY

- A. Special Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing for a period of 50 years following date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Willamette Graystone Inc.
- B. Or Approved.

Splitface Block Concrete Masonry Units (CMU)

- A. Materials
 - 1. Minimum compressive strength : H8,000/Minimum 3000 psi average or 2500 psi individual unit.
- B. Patterns
 - 1. Standard units 4 x 8 x 16 and 8 x 8 x 16. Color as selected by Owner

3.01 PREPARATION

- A. Protection: Prevent work from occurring on the opposite of walls to which manufactured masonry is applied during and for 48 hours following installation of the manufactured masonry.
- B. Surface Preparation: Follow manufacturer's instructions designated below for the

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appropriate type of manufactured masonry and substrate.

3.02 INSTALLATION

- A. Install splitface block products in accordance with manufacturer's installation requirements
- B. Install/Apply Related Materials specified above in accordance with type of substrate and manufactured masonry manufacturer's installation instructions.

3.03 CLEANING

- A. Clean manufactured masonry in accordance with manufacturer's installation instructions.

3.04 PROTECTION

- A. Protect finished work from rain during and for 48 hours following installation.
- B. Protect finished work from damage during remainder of construction period.

END OF SECTION

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METALS
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SECTION 05000

METALS

PART 1 - GENERAL

- 1.01 Requirements of General Conditions, Supplementary General Conditions and Division 1 apply to all work in this section.
- 1.02 Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work of this section where cited by abbreviations noted below.
- A. American Society for Testing and Materials. (ASTM, Latest Revision).
 - B. Building Welding Society's "Code for Welding in Building Construction". (AWS, Latest Revision).
 - C. Uniform Building Code. (UBC, Latest Edition).
 - D. American Institute of Steel Construction, Inc. "Manual of Steel Construction". (AISC, Latest Revision).
 - E. American Iron and Steel Institute. (AISI, Latest Revision).
- 1.03 Materials supplied under this Division shall be as specified or approved. Equivalency shall be established at least 10 days prior to bid. See the General and Supplementary General Conditions.

PART 2 - PRODUCTS

- 2.01 Scope. The work covered by this section consists of providing all miscellaneous metal and metal fabrications indicated on the Drawings or required to secure the various parts together to provide for a complete installation. The tabulations of items herein are not intended to be all-inclusive, and it shall be the Contractor's responsibility to provide all miscellaneous metal and metal work indicated, specified, or which can be reasonably inferred as necessary to complete the Work.
- 2.02 Quality Assurance - Welder's Qualifications. Welders shall be qualified in accordance with AWS requirements.
- 2.03 Submittals.
- A. Manufacturer's literature describing products including details and dimensions.

- B. Shop Drawings.
 - 1. Required for all fabricated metal products.
 - 2. Show at large scale construction of various parts, methods of joinery, thickness of metals, profiles of surfaces, reinforcing, anchorage and structural supports. Include information regarding concealed and exposed joints, welds and fastenings.
 - 3. Indicate material type, applicable ASTM or specified standard, and finish.
 - C. Samples. Only as requested by the Engineer.
- 2.04 Product Delivery, Storage and Handling.
- A. Deliver, store and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
 - B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area. Do not dump onto ground.
- 2.05 Basic Materials and Accessories.
- A. Ferrous Metals.
 - 1. Structural Steel Shapes. ASTM A-36, conforming to AISC specification.
 - 2. Engineering, Miscellaneous Steel Items. ASTM A-283.
 - 3. Steel Sheets. ASTM A-570, ASTM A-611.
 - 4. Steel Pipe. ASTM A-53, Grade B.
 - 5. Steel Tubing. ASTM A-500, A-501.
 - 6. Steel Plate. ASTM A-6.
 - B. Austenitic Metals
 - 1. Fabricated structural stainless steel shapes and bars. Type 304 Stainless Steel ASTM A 276. Type 316 Stainless Steel required where indicated on Drawings.
 - 2. Type 304 Stainless Steel sheet, strip, plate and flat bar. ASTM A 666. Type 316 Stainless Steel required where indicated on Drawings.
 - C. Structural Aluminum Shapes and Bars. Aluminum Associated standard alloy 6061 - T6 Alcad. Aluminum plate shall be Aluminum Standard Alloy 5086 - H34. Aluminum in contact with liquid shall be marine grade.
 - D. Fasteners.
 - 1. General.
 - a. Supply all angles, bolts, plates, lags, anchors, and other items to support properly and secure all items furnished in this Division.
 - b. All bolts, inserts and miscellaneous steel fasteners, shall be proper

size and type. Fasteners where embedded in concrete or exposed to moisture, shall be stainless steel unless noted otherwise.

2. Stainless Steel Anchors, Bolts, Nuts, Washers and Screws. All bolts, nuts, washers, screws, etc. on this project, materials shall be AISI Type 304.
 3. Expansion Bolts. Stainless steel construction required, material shall be AISI Type 316L and shall be McCulloch Industries "Kwik-Bolt Concrete Anchors", Wej-It Expansion Products, Inc.'s "Wej-It Concrete Anchors", Helti, Inc.'s "Kwik-Bolt Stud Anchor" or approved equal.
- E. Non-Shrink Grout. Combination of metallic aggregate and Portland Cement preformulated for job site mixing. Same as Sullivan Co.'s "Sulco"; Conrad B. Sovig Co.'s "Consov Iron Waterproofing"; Master Builder's "Embeco"; Grace Construction Materials "Vibro Foil"; or approved.
- F. Primer.
1. Ferrous Metal. Koppers Pug Primer, or approved.
 2. Galvanized Iron Primer. Pretreatment Koppers 30 metal conditioner and Koppers Primer, or approved.
 3. Aluminum in contact with concrete. Coat with zinc chromate primer.
- G. Welding Electrodes for Structural Steel. E-70.

2.06 Fabricated Products.

- A. Preparation.
1. Coordinate with other work supporting or adjoining miscellaneous metal and verify requirements for cutting out, fitting, and attaching.
 2. Verify sizes, designs and locations of items; do so at site whenever construction progress permits.
 3. All aluminum structures which will be attached directly to concrete structures shall first be appropriately coated with a corrosion inhibitor as suggested or required by the manufacturer of the aluminum product.
- B. General Requirements.
1. Fabricate items from materials noted and make true profiles shown.
 2. Miter corners and angles of frames and molding unless otherwise noted.
 3. Perform cutting, shearing, drilling, punching, threading, tapping as required for items of their adjacent work.
 4. Drill or punch holes; do not use cutting torch.
 5. Ensure shearing and punching leaves true lines and surfaces.
 6. Fabricate exterior items for assembly and installation on site without field-welding of joint.
 7. Ensure metal thickness and assembly details provide ample strength and stiffness.

- C. Fastening.
1. Provide fasteners and anchor assemblies required for complete fabrication, field assembly and erection.
 2. Conceal fastenings wherever practicable.
 3. Size internally threaded diameters to accommodate galvanized threaded bolts where galvanizing is required.
 4. Permanent Connections in Ferrous Metal Items. Employ welding wherever practicable; avoid bolts and screws.
 5. Exterior Items. Provide for bolted field joints.
 6. Pipe supports shall be standard pipe supports as manufactured by Materials Resources, or approved equal, or as shown on the plans as applicable.
- D. Welding.
1. Use electric shielded-arc process according to AWS code on steel, gas tungsten or gas metal arc process on aluminum.
 2. Maintain shape and profile of item welded.
 3. Prevent heat blisters, run throughs, and surface distortions.
 4. Welds normally exposed to view in finished work, make uniform and grind smooth.
 5. Exposed Welds. Remove burrs, flux, welding oxide, air spots and discoloration; grind smooth, polish or otherwise finish to match material welded.
 6. Field welding of interior items or exterior items encased in concrete will be permitted; field welding of exposed interior items will not be permitted.
 7. Unless otherwise noted, all assemblies to have each piece of assembly joined with continuous fillet weld, full length (or perimeter) of piece being attached. Effective fillet size to be metal thickness less 1/16".
- E. Bolted, Screwed, and Riveted Connections.
1. Use bolts for field connections only, and then only as noted. Countersink heads, finish smooth and flush.
 - a. Provide washers under heads and nuts bearing on wood.
 - b. Use beveled washers where bearing in on sloped surfaces.
 2. Where necessary to use screws for permanent connections in ferrous metal, use flat head type, countersink, fill screw slots and finish smooth and flush.
 3. Rivets. Countersink, center heads, machine-drive tight and finish flush and smooth.
 4. Evenly space exposed heads.
- F. Metal Connections. Materials shall be size and gauge shown on drawing.

2.07 Finishes.

- A. Preparation of Surfaces.
 - 1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing, hot phosphate treatment or painting.
 - 2. Completely eliminate burrs, rough spots, and pitting from normally exposed ferrous metal items.
- B. Galvanizing.
 - 1. Galvanize items after fabrication in largest sections practicable unless otherwise permitted or recommended by ASTM A-123.
 - 2. Where galvanizing is removed by welding or other assembly procedures, touch up abraded areas with molten zinc or zincrich paint.
 - 3. Perform galvanizing in accordance with following standards as applicable to item.
 - a. Hardware items including fasteners. ASTM A 153.
 - b. Items both under 1/8 inch thickness and fabricated from rolled, pressed and forged shapes, plates, bars, and strips. ASTM A 386.
 - c. Other fabricated items. ASTM A 123.
- C. Painting.
 - 1. Apply paint in accordance with paint manufacturer's specifications.
 - 2. Permit thorough drying before shipment.
 - 3. Spot paint abrasions and field connections after assembly.
 - 4. Aluminum surfaces embedded in concrete shall be coated with zinc chromate.
- D. Finish Schedule.
 - 1. Ferrous Metal.
 - a. Concealed. Clean, shop-apply one prime coat.
 - b. Exposed. Clean, shop-apply one prime coat.
 - 2. Ferrous Metal, Where Noted Galvanized. Clean, then hot-dip galvanize in accordance with galvanizing standards, chemically etch and shop-apply one prime coat.

PART 3 - EXECUTION

3.01 Inspection.

- A. Examine Areas to Receive Work and Verify Following:
 - 1. That setting conditions and dimensions are correct to receive items.
 - 2. That at stud or furred conditions, solid blocking or backing has been provided complete with spacer washers welded on.
- B. Do not start installation until unsatisfactory conditions have been corrected.

3.02 Installation.

- A. Install work plumb, true, rigid and neatly trimmed out.
- B. Do not cinch fastening through finish alone without spacer washers.
- C. Provide anchor bolts, concrete inserts or pre-drilled expansion bolts in fastening items into concrete.
- D. Protect dissimilar metals from contact with each other or with other materials causing corrosion.
- E. Fasten work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.
- F. Use nonshrink grout mixed in accordance with manufacturer's direction for setting frames, plates, sills, bolts and similar items.
- G. Protect metal from damage to surface, profile and shape.

3.03 Cleaning.

- A. Remove protective devices only when items will be safe from other construction operations or removal is required to permit related work.
- B. Clean prime-coated items as required for finish painting.

END OF SECTION

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WOOD AND PLASTIC
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SECTION 06100

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Wall, and roof framing; built-up structural members; wall and roof sheathing; preservative treatment; sill gaskets.
- B. Roof curbs and cants; blocking in wall and roof openings; wood furring and grounds; concealed wood blocking.

1.02 QUALITY ASSURANCE

- A. Perform Work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.

PART 2 - PRODUCTS

2.01 LUMBER MATERIALS

- A. Lumbee Grading Rules: WCLIB.
- B. Typical Framing: Douglas Fir or better species, No. 2 or better grade, Kiln Dried moisture content.
- C. Studding: Douglas Fir species, Standard or better grade, Kiln Dried moisture content.
- D. Columns: Douglas Fir Species, No. 1 or better grade, Kiln Dried
- E. Plywood Roof Sheathing: APA Rated Sheathing II, Roof Span Rating 32" minimum; Exposure Durability 1; 5/8" thick, 48 x 96, square edge.
- F. Plywood Wall Sheathing: APA Rated Sheathing Structural II, Span Rating 24; Exposure Durability 1, thickness 1/2", 48 x 96, square edge.

2.02 ACCESSORIES

- A. Fasteners: Galvanized steel for exterior, high humidity, and treated wood

locations, plain finish elsewhere.

- B. Joist Hangers: Galvanized steel, sized to suit framing conditions. Simpson or approved. Size and type as noted.
- C. Anchors: See Drawings.
- D. Sill Gasket on Top of Foundation Wall: Plate width, closed cell foam strip.
- E. Building Paper: No. 30 lb. asphalt felt.
- F. Waterproofing Membrane:
 - 1. W.P. Grace "Ice and Water Shield", 40 mil, self-adhesive.
 - 2. Location: As noted in Drawings.

2.03 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWWPA Treatment C1 using water borne preservative with 0.25 percent retainage.
- B. Wood Preservative (Surface Application): Colored, type, manufactured by Behr or approved.
- C. Shop preservative treat wood materials indicated on Drawings in accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.01 FRAMING

- A. Erect wood framing members in accordance with applicable code. Place members level and plumb. Place horizontal members crown side up.
- B. Place sill gasket directly on foundation.
- C. Frame double joist headers at floor and ceiling openings. Frame rigidly into joists. Frame double joists under wall studding.
- D. Curb all roof openings except where curbs are provided. Construct curb members of single pieces per side.

3.02 SHEATHING

- A. Secure wall sheathing with ends staggered, over firm bearing and nail with 8d at

Rough Carpentry
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6" o.c. at edges 12" o.c. "in-the-field". See Drawings for special nailings and blocking required at shear walls.

- B. Place approved moisture barrier over wall sheathing, weather lap joints and end laps, staple in place.
- C. Secure roof sheathing with ends staggered. Nail with 10d at b" o.c. at edges and 12" o.c. "in-the-field".

3.03 SITE APPLIED WOOD TREATMENT

- A. Site apply preservative treatment in accordance with manufacturer's instructions.
- B. Treat site-sawn cuts. Brush apply two coats of preservative treatment on untreated wood in contact with cementitious material, roofing and related metal flashings.
- C. Allow preservative to cure prior to erecting members.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items, other than shop prefabricated casework; hardware and attachment accessories.

1.02 QUALITY ASSURANCE

- A. Perform work in accordance with AWI quality.

PART 2 - PRODUCTS

2.01 EXTERIOR TRIM MATERIALS

- A. Softwood Lumber: Resawn texture cedar, K.D., grade C and better. Primed, finger jointed, 20 feet lengths.

2.02 EXTERIOR SHEET MATERIALS

- A. Soffits: Non-vented, Hardisoffit, Cementitious soffit panels, factory primed. Provide backing nailers for all edges.

2.03 ACCESSORIES

- A. Fasteners: Size and type to suit application; Hot dipped galvanized steel for exterior, high humidity and treated wood locations, plain finish elsewhere.

PART 3 – EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Prime paint surfaces of items or assemblies in contact with cementitious materials, before installation.

3.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Install trim with galvanized fasteners.

- C. Install prefinished paneling with nails, staples not allowed.

3.03 PREPARATION FOR FINISH

- A. Sand work smooth and set exposed fasteners. Apply wood filler in exposed fastener indentations.
- B. Finishing: Refer to Section 09900.

END OF SECTION

**DIVISION 7
THERMAL & MOISTURE PROTECTION**

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SECTION 07210

BUILDING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Batt thermal insulation for thermal and acoustical purposes in stud, joist spaces.

1.02 SYSTEM DESCRIPTION

- A. System performance to provide continuity of thermal barrier and vapor retarder at building enclosure elements.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation adhesives in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 FIBERGLASS BATTS FACED WITH VAPOR BARRIER

- A. Manufacturers:
 - 1. Owens - Coming Fiberglass.
 - 2. Certainteed.
 - 3. Or approved.
- B. Materials:
 - 1. Preformed glass fiber batts, full length, single piece where practical, non-reflective type.
- C. Location: Floors, walls and ceiling assemblies as shown in drawings.
- D. Vapor Barrier: Paper face at areas with finish material applied directly, Provide foil faced, flame spread 25 at area without finish material in direct contact,

2.02 ACCESSORIES

- A. Tape: Polyethylene self-adhering type, mesh reinforced, compatible with insulation.
- B. Insulation Fasteners: Per manufacturer's recommendation,

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that substrate, adjacent materials are dry and ready to receive insulation.
- B. Verify mechanical and electrical services within walls have been installed and tested.

3.02 FIBERGLASS BATTS

- A. Install batt insulation in accordance with manufacturer's instructions.
- B. Install batt insulation in exterior walls and root spaces without gaps or voids.
- C. Trim insulation ready to fit spaces. Use batts free of damage.
- D. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- E. Install insulation with factory applied membrane facing warm side of building spaces and in substantial contact with the unexposed surface of the ceiling, floor or wall finish. Lap ends and side flanges of membrane over framing members. Friction fit in place. Retain in place with staples.

3.03 CLEANUP

- A. Leave work area clean, free from scraps and debris.

END OF SECTION

SECTION 07310

COMPOSITION SHINGLES

PART 1 - GENERAL

1.01 RELATED WORK

- A. Metal flashing and trim. Section 07620.

1.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery.

1. Shingles to be delivered to job site in the manufacturer's original package and in a manner to avoid physical damage.
2. Clearly identify manufacturer, trade name, style and color shingles.
3. Deliver fasteners in manufacturer's original, unopened containers clearly identifying manufacturer and the contents.
4. Delivery underlayment in original, undamaged wrapping with manufacturer's label describing material and a trade name in legible condition.

B. Storage.

1. Store shingles in safe and dry area; keep free from moisture.
2. Store rolls of underlayment on ends and protect from the weather.
3. Protection.
 - a. Cover stored materials with tarpaulin or other suitable covering to prevent Soiling or exposure to weather.
 - b. Fasten coverings to prevent removal by wind.

1.03 JOB CONDITIONS

A. Environmental Requirements.

1. Apply shingles in dry weather.
2. Do not apply shingles when ambient temperature is below manufacturer's recommendations.

B. Protection.

1. Provide special protection or avoid heavy traffic on completed work.

1.04 GUARANTEE

- A. Prior to acceptance of work, general contractor and roof installer shall jointly furnish written guarantee for two years which covers repairs required to maintain roof, including flashing, in watertight conditions.

Composition Shingles
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- B. Limit to ordinary wear and tear by the elements or defects due to faulty materials and workmanship.
- C. Make repairs at no expense to Owner.

1.05 SUBMITTALS

- A. Samples of each color type of shingle.

PART 2-PRODUCTS

2.01 FIBERGLASS SHINGLES

- A. Manufacturers: 40-year warranty.
 - 1. GS Certainteed - "Landmark 40"
 - 2. Owens Corning - "Oakridge 40 Deep Shadow"
 - 3. GAF - "Timberline Ultra"
 - 4. Elk - "Prestique Plus"
 - 5. Malarkey - "Northwest-XL"
 - 6. Or approved equal

2.02 FELT UNDERLAYMENT

- A. Grace Ice and Water Shield underlayment membrane. Asphalt base Sheet, ASTM D-226-9T, Type II, #30.

2.03 FASTENERS

- A. Underlayment.
 - 1. Nails. Round solid cap head, minimum diameter 7/16".
- B. Shingles.
 - 1. Nails. Minimum 12 gauge, 3/8" diameter head, galvanized roofing nails.

2.04 ROOF COVERING CLASSIFICATION

- A. Minimum Classification. Class B.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine roof decks to determine suitability to receive roofing.
- B. Do not proceed with shingle work until conditions are suitable to receive roofing.

3.02 PREPARATION OF SURFACE TO RECEIVE ROOFING

- A. Remove any sharp projections that could injure new roofing.
- B. Sweep dust, dirt and debris, leaving surface to receive roofing clean.

3.03 PLACING UNDERLAYMENT

- A. Lay Ice and Water Shield (2) 36" wide rows starting at the roof edge with a 3.5" overlap. Install per manufacturer's installation requirements.
- B. Lay single thickness of underlayment felt parallel to eaves with double thickness at hips and ridges.
- C. Lap horizontal joints 2-1/2" and vertical joints 6" with vertical joints staggered.
- D. Fasten felts using nails, spaced 1' o.c. and along edges and 18" staggered throughout the field.
- E. Fasten felt to embedded nailer using nails.
- F. Lap felt not less than 4" under edges at built-in gutters, valleys, and metal flashings.
- G. Nail on second ply of felt in same manner as first ply, with edges of the second ply staggered not less than 6" with the first ply.
- H. Nail top edge 12" o.c.

3.04 LAYING COMPOSITION SHINGLES

- A. Mark underlayment with chalk lines parallel to eaves spaced to provide not less than 2" head lap.
- B. Lay eave starters to project beyond edge of sheathing 1/2" and secure in place.
- C. Apply 1" diameter spots of plastic cement over nail heads not covered by felt.
- D. Lay shingles so butt edges form straight lines, parallel to eaves.
- E. Fasten shingles using 4 nails per shingle to be located 5-3/4" up from lower edge of the tabs, 1" from each end of the single and above each cutout.
- F. Shingle Courses.
 - 1. Lay down starter course per manufacturer's recommendation.
 - 2. Lay down subsequent courses starting at the left rake edge and eave flush

Composition Shingles
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with the starter course.

3. Lay subsequent courses with 2" headlap from shingle to shingle and 5-5/8" exposure as recommended by manufacturer.

- G. At ridge finish with header course fastened using 2-1/2" nails and roofing cement in laps.

3.05 HAND TAB

- A. Provide continuous 1/4" bead of black plastic cement at each course, securing upper course to course below.

3.06 CLEANING

- A. Upon completion of work, remove excess materials and broken shingles from the premises.

END OF SECTION

SECTION 07620

METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01

SECTION INCLUDES

- A. Cap, root, sill flashings, etc.
- B. Fascias and scuppers.
- C. Gutters and downspouts.
- D. Counterflashings over base flashings, roof mounted equipment, vent stacks and roof hatches, and as shown.

1.02 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. SMACNA - Architectural Sheet Metal Manual.

1.03 STORAGE AND HANDLING

- A. Stack preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation.

1.04 RELATED SECTION

- A. Composition Shingles: Section 07310.

PART 2 - PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-coated Galvanized Steel: Grade Classification G90; 24 gage core steel, shop pre-coated with Polyvinylidene Fluoride (PVF2), Kynar 500, coating of selected color manufactured by Custom Built Metals, ASC Pacific, or approved.
- B. Warrantee. Provide manufacturer's 20-year warranty on the finish.

2.02

ACCESSORIES

Metal Flashing and Trim
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- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Underlayment: No. 30 asphalt saturated roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Sealant: Acrylic type, specified in Section 07900.
- E. Bedding Compound: Rubber-asphalt type.
- F. Plastic Cement: Asphaltic base cement.

2.03 COMPONENTS

- A. Fascia and rake flashing: See drawings for shape.

2.04 FABRICATION

- A. Form components true to shape, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.
- B. Fabricate cleats and starter strips of similar type sheet metals. See Details.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- D. Fabricate corners in one piece, 12-inch long legs; seam for rigidity, seal with sealant.
- E. Form sheet metal pans with upstand, and flanges. Fill pans watertight with plastic cement.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.02 INSTALLATION

- A. Conform to drawing details.

Metal Flashing and Trim
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- B. Install starter and edge strips, and cleats.
- C. Apply plastic cement compound between metal work and felt flashings.
- D. Fit components tight in place. Make comers square, surfaces true and straight in planes, and lines accurate to profiles.

END OF SECTION

SECTION 07810

SKYLIGHTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Skylights, curbs, and flashing.

1.02 REFERENCES

- A. AAMA/NWWDA 1600-90 - Voluntary Specification for Skylights.
- B. ANSI/ASTM E 330 - Structural Performance.
- C. AAMA 1503.1-88 -Condensation Resistance Factor- Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- D. NFRC - Certified Thermal Performance.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Provide skylight assemblies which will perform as indicated without failure or deterioration. Failure includes the following:
 - 1. Excessive deflection.
 - 2. Excessive water penetration.
 - 3. Excessive air infiltration.
 - 4. Failure of glazing.

1.04 SUBMITTAL

- A. Certification by manufacturer that products comply with requirements of contract documents.
- B. Shop drawings: Product literature to include the following:
 - 1. Section details of all typical members.
 - 2. Recommended installation procedures.
 - 3. Hardware description.
 - 4. Accessories.
 - 5. Glazing description
 - 6. Finish description.
 - 7. Warranty.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle skylights in a manner to avoid damage.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify field measurement prior to fabrication so as to provide adequate fabrication tolerance and coordinate with other work to allow proper fit.

1.07 WARRANTY

- A. Warranty: Provide written warranty by installer and manufacturer agreeing to repair or replace any defective product which fail to meet the specified performance requirements within two (2) years after substantial completion. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. CRYSTALITE, INC.
- B. VELUX-AMERICA INC.
- C. Or Approved.

2.02 SIZE AND TYPE

- A. 505, 48" X 48" Nominal Size, Fixed skylights with aluminum thermal break frame, insulated glass assembly.

2.03 MATERIALS

- A. Aluminum tubular system, shall be 6063-TS alloy of sufficient thickness to meet loading and deflections requirements.
- B. Aluminum flashing shall be .063 in thickness and in finish, matching other components.
- C. Aluminum shall be anodized.
- D. All fasteners shall be aluminum or stainless steel. Exposed fasteners shall be limited to perimeter.

- E. Structural rafters, and purlins shall be extruded aluminum with integral condensation system to drain to curbs and then to exterior by weep holes.
- F. All clamping fasteners to be stainless steel 1/4 x 20 screws.
- G. All welds to be accomplished at factory using the TIG process with filler metal of ER 5356.

2.04 GLASS AND GLAZING MATERIALS

- A. Standard 1" overall dual-sealed insulated glass unit.
- B. Gasketing: Each 1.G unit dry glazed with chloroprene gasket, no sealants.
- C. Glazing: Laminated, gasket filled Low-E, and tempered.

PART 3 - EXECUTION

3.01 EVALUATION

- A. Inspect skylight openings before installation. Do not install skylights if any detrimental conditions exist.

3.02 INSTALLATION OF SKYLIGHTS

- A. Comply with manufacturer's recommendations for installation of skylights, hardware and other components.
- B. Set units square, without warp or rack of frames or sash.
- C. Provide proper support and shims and anchor securely.
- D. Separate aluminum from dissimilar metals and coat dissimilar metals that are in drainage cavities, using one of the materials specified. Stainless steel, zinc cadmium and small areas of white bronze are not considered dissimilar metals.
- E. Coat all metals that come into contact with masonry, concrete and treated wood using one of the materials specified.
- F. Install joint sealers between sill members and the surface below, as indicated, to provide weather tight construction.
- G. Coordinate installation with wall flashing and/or weather membrane installation.
- H. Comply with requirements specified in Division 7 for installation of joint sealers.

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END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and joint backing.

1.02 SYSTEM DESCRIPTION

- A. System performance to achieve moisture [and air] tight joint seals.

1.03 SUBMITTALS

- A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and colors available.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 - PRODUCTS

2.01 SEALANTS

- A. One part Polyurethane Sealant (Type S): ASTM C920-02, Grade NS, Class 25, use NT; single component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected, Sonolastic NP-1, manufactured by Sonneborn, or approved.
 - 1. Elongation Capability, 1000 percent (ultimate)
 - 2. Service Temperature Range -40 to 180 degrees F
 - 3. Shore A Hardness Range 25 to 30
 - 4. Tensile strength 250 psi
- B. Acrylic Emulsion Latex: Single component, non-staining, non-bleeding, non-

- sagging. Stone color: Sonolac manufactured by Sonneborn or approved
1. Elongation Capability, 2-5 percent (ultimate)
 2. Service Temperature Range 2 - 160 degrees F
 3. Shore A Hardness Range 15 to 40

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056-00; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.

3.02 INSTALLATION

- A. Clean, prime, and seal joints in accordance with manufacturer's instructions.
- B. Install sealant in accordance with manufacturer's instructions.
- C. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.
- D. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- E. Install bond breaker where joint backing is not used.
- F. Apply sealant within recommended application temperature ranges. Consult

manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave.

3.03 LOCATION

A. All exterior joints, penetrations, windows and low perimeters, and as shown on Drawings: Sonolastic.

B. All interior, dissimilar material joints, window/trim juncture, door frame, etc., Sonolac.

END OF SECTION

DIVISION 8
DOORS & WINDOWS

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SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Hollow metal doors.
- B. Hollow metal door frames.
- C. Vision frames for hollow metal doors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Joint Sealers: Section 07900.
- B. Finish Hardware: Section 08710.

1.03 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies.
 - 1. Test Agency: Underwriters Laboratories.
 - 2. Door Assembly Fire Test.
 - a. Procedure: ASTM E2074-00.
 - b. Exposure: Rating as noted on Door and Hardware Schedule.
- B. Reference Standards.
 - 1. American National Standards Institute (ANSI).
 - a. ANSI A 115 series on door and frame preparation.
 - b. ANSI A 115.1, Performance test for standard steel doors, frames, anchors, hinge reinforcing and exit device reinforcing.
 - 2. American Society for Testing and Materials (ASTM).
 - a. ASTM A366, steel sheet, carbon, cold-rolled, commercial quality.
 - b. ASTM A 569, steel, carbon 0.15 maximum percent, hot-rolled sheet and strip, commercial quality.
 - c. ASTM E2074-00, fire tests of door assemblies.

1.04 REFERENCES

- A. See Plans for additional information regarding sizes, materials, etc.

1.05 SUBMITTALS

- A. Product Data: Manufacturer's descriptive literature and installation instructions.

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- B. Shop Drawings: Illustrations and schedule of all door, door frame and window frame sizes, types, materials, constructions, finishing, anchoring, accessories and preparation for installing hardware.
- C. Certificates: Manufacturer's certificates that materials meet specification requirements.

PART 2-PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Welded Frames and Doors.
 - 1. Curries Mfg., Inc.
 - 2. Steelcraft.
 - 3. Dean Steel.
 - 4. Or approved.

2.02 MATERIALS

- A. Steel Fabrications.
 - 1. Carbon Steel: Cold-rolled, ASTM A 366.
- B. Coating Materials.
 - 1. Primer: Manufacturer's standard rust inhibitive primer.
- C. Anchors, Fasteners, Hardware and Accessories.
 - 1. Manufacturer's standard.
- D. Core Filler Material.
 - 1. Manufacturer's Standard: Insulated core.
- E. Exterior Protection.
 - 1. All exterior hollow metal work - doors, door frames - to be galvanized.

2.03 FABRICATION

- A. General.
 - 1. Fabricate hollow metal work to be rigid, neat in appearance and free from defects, warp or buckle.
 - 2. Accurately form metal to required sizes and profiles.
 - 3. Clearly identify work that cannot be permanently factory-assembled before shipment to assure proper assembly at project site.
 - 4. Grind and dress exposed welds to form smooth, flush surfaces.
 - 5. Do not use metallic filler to conceal manufacturing defects.

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08110-3

- B. Frames.
 - 1. Welded Frames.
 - a. Frame Material.
 - 1) 16 gauge.
 - b. All joints to be die-mitered with integral tabs for reinforcement and interlocking of the jambs to be hear. Arc welded and ground smooth.
 - c. Spreader bars attached at bottom of frame.
 - d. Anchors: Wood stud anchor welded to frame by manufacturer, 4 per jamb.
- C. Doors.
 - 1. Curries Model 707 or approved.
 - a. Form interior and exterior face sheeting of 16 gauge metal.
 - b. Join door faces at vertical edges by continuous weld for full height of door. Grind, fill and dress all welds smooth.
 - c. Close top and bottom edges of door with steel channel minimum 16 gauge extending full width of door and spot welded to both faces.
 - d. Vision Frames.
 - 1) Manufacturer: Anemostat or approved.
 - 2) Model No.: FGS 75.
 - 3) Material: 18 gauge steel.
 - 4) Size: See door elevations.
 - 5) See Door Schedule for thickness, size, and type of glazing.
 - e. Finish: Enamel paint, color as selected by Architect.
 - f. Edge Clearances.
 - 1) Between doors and frame at head and jamb: 1/8 inch.
 - g. Preparation for Hardware.
 - 1) Reinforce adequately, drill and tap doors and frames for fully templated mortised hardware.
 - 2. Finish.
 - a. Dress tool marks and surface imperfections to smooth surfaces and remove irregularities.
 - b. Chemically treat and clean doors and frames.
 - c. Apply manufacturer's standard prime coating.

3.01 INSPECTION

- A. Assure that frame openings correspond to dimensions of frame furnished.
- B. Check that surfaces to contact frame are free of debris.
- C. Do not proceed with installation until satisfactory conditions are corrected.

Hollow Metal Doors and Frames
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3.02 INSTALLATION

- A. Frames: Install frames in accurate locations as indicated on drawings, rigid, plumb, level and true, accurately aligned with adjacent construction. Secure floor anchors to floor construction with approved type mechanical fastenings; anchor to adjoining construction with specified anchors and as detailed. Brace frames to retain position and continuously check alignment during construction of adjacent walls. Adjust frame locations as necessary using shims before fastening. Follow manufacturer's installation instructions.
- B. Installation of Doors: Hang doors in accurate locations as scheduled and as indicated. Hang to provide clearances specified hereinbefore, using hardware specified elsewhere. Upon completion of installation demonstrate that doors operate freely, without binding, and when closed with moderate force will latch properly.

3.03 ADJUSTMENT AND CLEANING

- A. Remove dirt and excess sealants or glazing compound from exposed surfaces.
- B. Touch-up marred or abraded surfaces to match original finish.
- C. Adjust moving parts for smooth operation.
- D. Remove debris from project site.

END OF SECTION

SECTION 08705

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. Hollow Metal Work: Section 08110.
- B. Painting: Section 09900.

1.02 WORK INCLUDED IN THIS SECTION

- A. All other hardware required for proper operation, fastening, and locking of movable parts shown on Drawings whether or not listed in Hardware Schedule.

1.03 APPLICATION

- A. The General Contractor shall install the finish hardware hereinafter specified. All mortised items are to be fitted and then removed and placed in their original package until painters have completed their work. Hardware is then to be fitted permanently in place. All hardware subject to hand usage during construction shall be properly wrapped for protection.
 - 1. Hardware installer to be approved by hardware supplier.

1.04 REGULATORY AGENCY REQUIREMENTS

- A. All hardware shall comply with applicable local and/or state fire and current building codes. Where doors carry a UL label for fire rating, all hardware applied to that door shall comply with that rating. Doors installed for smoke protection shall receive hardware as recommended by the NFPA, or as approved by Underwriter's Laboratories.

1.05 SUPPLIER'S HARDWARE SCHEDULE

- A. Submit an electronic copy to the Engineer of a complete vertical schedule of hardware, listing each opening, door size, hand, frame material and door label. State keying, material, finish and manufacturer's number for each item. Obtain Engineers approval before proceeding. Approval of schedule does not relieve Contractor of responsibility for furnishing all necessary hardware.

1.06 PRODUCT DELIVERY AND STORAGE

- A. Deliver to the job site all finish hardware except that which is to be delivered to other subcontractors as directed. A complete Hardware Schedule and installation pamphlets shall accompany the delivery.

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1. Deliver all hardware items complete with necessary parts for fitting and installation and as required for proper and perfect operation. Workmanship and finish of hardware shall be clear from blemishes and defects. Each item shall be properly wrapped in a separate package distinctly labeled and numbered for each and every opening for which it is intended and in accordance with the Hardware Schedule. All merchandise ordered from the factories must be brought in to the hardware supplier for final checking before sending to job site.

- B. Protect against theft, damage and discoloration.

1.07 TEMPLATE HARDWARE

- A. Make a template for hardware attached to door frames. Send prints or physical templates, together with Hardware Schedule, to door and frame manufacturer not later than two weeks after approval of Hardware Schedule.

1.08 SUBSTITUTIONS

- A. Conform to requirements of Instructions to Bidders, General and Supplementary Conditions. Include with requests specified item, design, catalog number and finish for each item on which approval is being requested.
 1. Blanket approvals by manufacturer's name only will not be given.

1.09 PROTECTION

- A. Protect other surfaces against damage and discoloration caused by work of this section.

1.10 DISTRIBUTOR

- A. All hardware shall be furnished direct by a factory authorized distributor.

PART 2 - PRODUCTS

2.01 RESPONSIBILITY

- A. The types listed are to be used as a guide for quality and operation and are not to be construed as a complete list. The detailing of the hardware requirements shall be the responsibility of the supplier.

2.02 FASTENINGS

- A. Furnish finish hardware with all necessary screws, bolts, or other fastenings of suitable size and type to anchor the hardware in position of heavy use and long life and as required to harmonize with hardware as to material and finish. Where

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required, furnish hardware with expansion shields, sex bolts, toggle bolts, or other approved anchors according to the material to which it is applied and as recommended by the manufacturer.

2.03 KEYING

- A. Key all locks to Engineers instructions and per Owner's requirements.
- B. Deliver all keys direct to Owner. Key system to include 7 pin IC cores.

2.04 FINISHES

- A. All hardware: #630 Stainless Steel.

2.05 HARDWARE MANUFACTURERS

- A. The numbers listed in the Hardware Schedule on the plans are taken from catalogs of the following manufacturers.

<u>HARDWARE ITEM</u>	<u>SPECIFIED</u>	<u>ACCEPTED</u>
Hinges	Stanley	McKinney
Locks, Privacy Locks	Schlage	Best, Dorma, Yale
Latchsets	Schlage	Best. Dorma, Yale
Closers	Sargent	LCN, Dorma, Norton
Wall Stops, Door Holders	Ives	Hager
Kick Plates	Ives	Hager
Weatherstrip, Smoke Gasket	Pemko	Zero
Panic Device	Sargent	Von Duprin, Dorma, Yale
Misc. Items	As Noted	As Noted

2.06 BUILDER'S HARDWARE PRODUCTS

- A. Lockset and Latchset Design.
 - 1. Design: All locksets and latchsets to have lever type design meeting handicap accessibility requirements: "Athens", D series or approved.
 - 2. Strikes to have extended lip where required to protect trim from being matted by latch bolt. All locks to have 2-3/4" backset (unless noted otherwise).
 - 3. Provide lead lining at lockset as required.
- B. Panic Device.
 - 1. Design: Rim type design except as noted.
 - 2. Provide complete installation with strikes as required.
 - 3. See hardware schedule for remote control of door 1.

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- C. Door Closers.
 - 1. 250 Series, size as recommended by door supplier. Check degree of opening for all closers.
 - 2. Adjust closers to meet accessibility requirements.

- D. Door Stops.
 - 1. Provide door stops for all doors.
 - 2. Stop numbers refer to types. Place door stops at point of contact. In certain locations it may be advantageous to place stop on the door.
 - 3. Provide floor stop in lieu of wall stop where required.

- E. Silencers.
 - 1. Type: GJ64 or GJ65.
 - 2. Furnish three for each single door and two for each leaf of pairs of doors.

- F. Kickplates.
 - 1. Material - 16 gauge, stainless steel.
 - 2. Size - 10" x door width less 2", except where listed.

- G. Hinges.
 - 1. All hinges shall be of the finish as specified above and of material indicated by catalog number.
 - 2. Provide all required fasteners, stainless steel where stainless steel hinges are specified.
 - 3. Size: 4-1/2" x 4-1/2".

- H. Thresholds and Door Seals.
 - 1. Provide threshold at the door openings of type as noted in the Hardware Schedule. All thresholds shall be provided with a positive anchoring device or lead expansion shields and anchor bolts and shall be set in caulking compound.

- I. Door Grills.
 - 1. Anemostat FDLS 18 gauge cold rolled steel, gray primer. Sizes as shown on Plans. Provide special security screw fasteners.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

- A. Verify that surfaces to receive finish hardware are properly prepared including necessary backing.

- B. Prior to starting work notify General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.

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3.02 INSTALLATION

- A. Install all hardware per manufacturer's directions for proper operation, fastening and locking of all movable parts shown on the drawings and as called for in schedule.
- B. Accurately locate, install square, plumb, and secure in accordance with manufacturer's directions and templates.
- C. Mount at the following heights above the floor unless otherwise shown on drawings.
 - 1. Top Butt: 5" from door top to butt top.
 - 2. Intermediate Butt: Equal distance between top and bottom of butts.
 - 3. Bottom Butt: 10" to butt bottom.
 - 4. Knob Locks: 38" to knob center.
 - 5. Dead Locks: 42" to cylinder center.
 - 6. Pulls: 42" above floor.
 - 7. All Others: Manufacturer's standard.
- D. Adjustments: Adjust moving parts to operate satisfactorily at time of final project acceptance and during guarantee period.
- E. Product Cleaning and Repairing: Including products of other sections, clean, repair and touch-up or replace when directed products which have been soiled, discolored or damaged by work of this section. Remove debris from project site upon work completion or sooner if directed.

END OF SECTION

DIVISION 9
FINISHES

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SECTION 09260

GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Gypsum board
- B. Metal corner beads
- C. Taped and sanded joint treatment
- D. Prime paint
- E. Spray texture.

1.02 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840-01. GA-201 - Gypsum Board for Walls and Ceilings. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board. GA-600 - Fire Resistance Design Manual.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD SYSTEM

- A. Manufacturers:
 - 1. Gold Bond
 - 2. Or Approved
- B. Gypsum Board Types:
 - 1. 5/8 inch thick “green” gypsum wall board, maximum permissible length; ends square cut, tapered edges; ASTM C36.

2.02 ACCESSORIES

- A. Fasteners: ASTM C1002-01 Type W nails. ASTM C1002-01 Type 512 hardened screws.
- B. Corner Beads: Metal
- C. Joint Material: ASTM C475-01, GA 201 and GA 216, reinforcing tape, joint compound, adhesive, water.

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- D. Control Joint: Zinc No. 093. Tape protected 1/4" wide. See Drawings for locations.
- E. Prime Paint: Refer to 09900. Required prior to spray texture.

2.03 SPRAY TEXTURE DECORATION

- A. Light orange peel texture at interior. Provide sample for Architect's review and approval.

PART 3 - EXECUTION

3.01 INSTALLATION - GYPSUM BOARD

- A. Install gypsum board in accordance with manufacturer's instructions.
- B. Fasten gypsum board to furring or framing with nails or screws.
- C. Place control joints consistent with lines of building spaces as indicated.
- D. Install gypsum board in accordance with GA 201 and GA 216 per manufacturer's instructions.
- E. Erect single layer fire rated gypsum board vertically with edges and ends occurring over firm bearing.
- F. Use screws when fastening gypsum board, galvanized at exterior.
- G. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum board with sealant.
- H. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials. Verify profile of trim with Architect prior to installation.

3.02 JOINT TREATMENT

- A. Tape, fill and sand exposed joints, edges and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32".
- C. Prime all surfaces with latex primer prior to spray texture.

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3.03 SPRAY TEXTURE DECORATION

A. Walls and Ceilings: Provide light orange peel texture at all gypsum board surfaces scheduled to receive paint finish. See Room Finish Schedule. Provide sample of texture to Architect for approval.

3.04 TOLERANCES

A. Maximum variation from true flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
1. Exposed exterior items and surfaces.
 2. Exposed interior items and surfaces.
 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces whether or not colors are designated in “schedules”, except painting the following is not required.
1. Factory finished surfaces, including painted mechanical and electrical equipment, except for pump, which should be painted.
 2. Structural Steel members, including decking, concealed by interior building finish.
 3. Nonferrous metal and stainless surfaces, except where specifically indicated to be painted.
 4. Prefinished or natural finish surfaces; e.g. acoustical panels, resilient flooring.
 5. Concealed surfaces in generally inaccessible areas, including elevator and duct shafts, concealed pipes and ducts.
 6. Surfaces scheduled to receive other finish material, including surfaces scheduled to receive special, high performance coating systems.
 7. Moving parts of operating units.
 8. Interior concrete floors, except as noted.
- C. Physical Hazards: Color mark physical hazards, safety equipment locations and fire and other protective equipment in accordance with OSHA (1910) and ANSI (z53) color code standards, as indicated
- D. Painting contractor to provide caulking and all primers.
- E. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

- F. Related Sections include the following.
 - 1. Section 06200 “Finish Carpentry”.
 - 2. Section 08110 “Hollow Metal Doors and Frames” for shop priming doors and frames.
 - 3. Section 09260 “Gypsum Board” for surface preparation for gypsum board.
 - 4. Painting of mechanical and electrical work is specified in the drawing.

1.03 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 - degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measures at a 60 - degree meter.
 - 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60 - degree meter.
 - 4. Semigloss refers to a medium-sheen finish with a gloss range between 30 and 65 when measured at a 60 - degree meter.
 - 5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60 - degree meter.

1.04 SYSTEM DESCRIPTION

- A. Surface preparation, prime and finish coats specified are in addition to shop-priming and surface treatments.
- B. “Paint” includes coating systems materials, primers, emulsions, enamels, stains, sealers, and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- C. Where item or surface is not mentioned, paint same as similar adjacent materials or surfaces.
- D. Where color or finish is not designated, Owner will select from manufacturer’s standard colors or finishes available.

1.05 SUBMITTALS

- A. Product Data: For each paint system specified.
 - 1. Manufacturer’s Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain block filters, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.08 PROJECT CONDITIONS

- A. Apply paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacture during application and drying periods.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products: Provide products meeting the listed requirements from one of the following manufacturers:
 - 1. Benjamin Moore
 - 2. Pittsburgh
 - 3. Rodda
 - 4. Or approved manufacturer.
- B. Provide products which meet the state VOC limitation requirements.

2.02 MATERIALS

- A. **Material Compatibility:** Provide primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. **Accessory Materials:** Commercial quality linseed oil, shellac, turpentine, mineral spirits, and other materials not specifically indicated but required to achieve specified finishes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. **Examine substrates, area, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.**
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. **Coordination of Work:** Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Owner about anticipated problems using the materials specified over substrate primed by others.

3.02 PREPARATION

- A. **General:** Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of weight of the item, provide surface applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. **Cleaning:** Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. **Surface Preparation:** Clean and prepare surfaces to be painted according to

manufacturer's written instruction for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete masonry block, and cement surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealant immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substrates. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up the same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminates. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

3.03 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Paint colors, surface treatments, and finishes as indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or

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- conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term “exposed surfaces” includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint all surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, non specular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturers written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer’s written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet black, or high-pile sheep’s wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

- D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- E. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Piping, pipe hangers, and supports.
 - 2. Heat exchangers.
 - 3. Tanks.
 - 4. Ductwork.
 - 5. Insulation.
 - 6. Motors and mechanical equipment.
 - 7. Accessory items.
- F. Electrical items to be painted include, but are not limited to, the following:
 - 1. Conduit and fittings.
 - 2. Switchgear.
 - 3. Panelboards.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evident of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- I. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of lumps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide satin finish for final coats.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.05 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide “Wet Paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced paint surfaces.

3.06 SCHEDULE - EXTERIOR SURFACES

- A. WOOD TRIM - PAINTED:
 - 1. One coat Exterior Wood Primer:
 - a. Benjamin Moore; Moorcraft Busan 100% acrylic primer exterior primer No. 166:
Applied at a dry film thickness of not less than 1.8 mils.
 - b. Pittsburgh Paints: 6-609 SpeedHide Exterior House & Trim Wood Primer 100 percent Acrylic Latex: Applied at a dry film thickness of not less than 1.6 mils.
 - c. Rodda Paint; Exterior Control Primer No. 701501; Applied at a dry film thickness of not less than 1.5 mils.
 - 2. Two coats acrylic latex enamel, semi-gloss:
 - a. Benjamin Moore; Moorcraft Super Spec Latex House & Trim No. 170: Applied at a dry film thickness of not less than 1.1 mils per coat.
 - b. Pittsburgh Paints: 6-609 Series Speed Hide Exterior House & Trim Semi Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils per coat.
 - c. Rodda Paint; Unique II Acrylic Semi-Gloss Enamel No. 542001x: Applied at a dry film thickness of not less than 1.5 mils per coat.
- B. STEEL - UNPRIMED:
 - 1. One coat exterior DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils.
 - b. Pittsburgh Paints: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-712). Applied at a dry film thickness of not less than 2.0 mils.
 - c. Rodda Paint: Metal Master Primer No. 508995X; Applied at a dry film thickness of not less than 2.0 mils.
 - 2. Two coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29).

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- Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901a; Applied at a dry film thickness of not less than 2.0 mils. per coat.

- C. STEEL - SHOP PRIMED:
 - 1. Touch -up with original primer.
 - 2. Two coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils. per coat.

- D. STEEL- GALVANIZED Handrails, Trash Enclosures:
 - 1. Touch-up with original primer.
 - 2. Two Coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC Waterborne Epoxy Metal Primer (M08/M09). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Aquapon Water Based Epoxy Primer. Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Ropon HS Primer No. 729381; Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - 3. Intermediate Coat: One Coat High Solids Epoxy:
 - a. Benjamin Moore Paints: Polyamide Epoxy Coating - High Build (M36/M39). Applied at a dry film thickness of not less than 4.0 mils per coat.
 - b. Pittsburg Paints: Aquapon High Build Polyamide Epoxy Coating (97- 130). Applied at a dry film thickness of not less than 4.0 mils. per coat.
 - c. Rodda Paint; Ropon High Solids Epoxy Enamel (759401x); Applied at a dry film thickness of not less than 5.0 mils. per coat.
 - 4. Topcoat: One Coat Aliphatic Acrylic Urethane
 - a. Benjamin Moore Paints: Aliphatic Acrylic Urethane Gloss (M74/M75). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitthane Ultra Gloss Urethane Enamel (95-812). Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Polycoat II No. 759101a; Applied at a dry film thickness of not less than 2.0 mils. per coat.

- E. STEEL - GALVANIZED, SHEET METAL FLASHING:
1. Clean and etch surface
 2. One Coat exterior acrylic DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitt-Tech Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-712). Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 508995x; Applied at a dry film thickness of not less than 2.0 mils. per coat.
 3. Two Coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils. per coat.
- F. ALUMINUM - MILL FINISH:
1. Clean and etch surface
 2. Two coats 100% Acrylic DTM paint, semi-gloss:
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901a; Applied at a dry film thickness of not less than 2.0 mils. per coat.
 2. Two coats 100% Acrylic DTM paint, semi-gloss:
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils. per coat.

3.07 SCHEDULE - INTERIOR SURFACES

- A. WOOD - PAINTED:
1. One coat latex wood primer sealer:
 - a. Benjamin Moore Paints: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer (252) Applied at a dry film thickness of not less than 1.5 mils.
 - b. Pittsburgh Paints; 6-855 SpeedHide Latex Enamel Undercoater:

- Applied at a dry film thickness of not less than 1.0 mil.
 - c. Rodda Paint; Lasyn Enamel Undercoat No. 503001x; Applied at a dry film thickness of not less than 1.5 mils.
 - 2. Two coats latex enamel, Semigloss:
 - a. Benjamin Moore Paints; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils per coat.
 - b. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil per coat.
 - c. Rodda Paint; Unique II Acrylic Semi-Gloss Enamel No.542001x: Applied at a dry film thickness of not less than 1.5 mils per coat.
- B. GYPSUM BOARD (DRY AREAS), GYPSUM BOARD SOFFITS**
- 1. One coat polyvinyl-acetate primer sealer:
 - a. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
 - b. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil
 - c. Rodda Paint; Heavy Body Scotseal No. 507801a; Applied at a dry film thickness of not less than 1.5 mils.
 - 2. Two coats latex enamel, eggshell:
 - a. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils per coat.
 - b. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils per coat.
 - c. Rodda Paint; Lasyn Eggshell Finish Wall Paint No. 533001x; Applied to achieve a dry film thickness of not less than 1.5 mils per coat
- C. GYPSUM BOARD (TOILET ROOMS AND WET AREAS):**
- 1. One coat polyvinyl-acetate primer sealer:
 - a. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils
 - b. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil
 - c. Rodda Paint; Heavy Body Scotseal No. 507801a; Applied at a dry film thickness of not less than 1.5 mils.
 - 2. Two Coats Semi-Gloss Acrylic Epoxy Finish
 - a. Benjamin Moore Paints; IMC Acrylic Epoxy Coating (M43/M44-84). Applied at a dry film thickness of not less 1.5 mils per coat.
 - b. Pittsburgh Paints; Aquapon Water BaseEpoxy (98-1 Series).

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- c. Applied at a dry film thickness of not less than 2.0 mils per coat
Rodda Paint; Aqua-Flint Water Reducible Epoxy Semi-Gloss.
Applied at a dry film thickness of not less than 1.5 mils per coat

D. STEEL - UNPRIMED:

- 1. One coat acrylic DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils
 - b. Pittsburgh Paints: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-172). Applied at a dry film thickness of not less than 2.0 mils.
 - c. Rodda Paint: Metal Master Primer No. 508995x; Applied at a dry film thickness of not less than 2.0 mils.
- 2. Two Coats acrylic DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901a; Applied at a dry film thickness of not less than 2.0 mils per coat.

E. STEEL - PRIMED:

- 1. Touch up with compatible primer
- 2. Two Coats Acrylic DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils per coat.

F. STEEL - GALVANIZED:

- 1. One coat exterior acrylic DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils
 - b. Pittsburgh Paints: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-712). Applied at a dry film thickness of not less than 2.0 mils.
 - c. Rodda Paint: Metal Master Primer No. 508995x; Applied at a dry film thickness of not less than 2.0 mils.
- 2. Two Coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.

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- b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-(floss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils per coat.
- G. ALUMINUM - MILL FINISH:
- 1. Clean and etch surface
 - 2. Two coats 100% Acrylic DTM paint, semi-gloss;
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film, thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Mater Semi-Gloss Finish No. 54890 1x; Applied at a dry film thickness of not less than 2.0 mils. per coat.

END OF SECTION

**DIVISION 11
EQUIPMENT**

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SECTION 11000

GENERAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes general requirements of installation of all equipment.
- B. Related Sections:
 - 1. 01330 Submittals.
 - 2. 01600 Product Requirements

1.02 QUALITY ASSURANCE

- A. Arrangement
 - 1. The arrangement of equipment shown on the drawings is based upon information available at the time of design and is not intended to show exact dimensions to a specific manufacturer. The drawings are for the most part diagrammatic and features of the drawings may require revision to meet actual installation requirements. Structural supports, foundations, connected piping, valves, and electrical connections specified may have to be altered to accommodate the equipment provided. No additional payments will be made for such revision and alterations.
- B. Qualifications
 - 1. Equipment manufacturer and system component manufacturers shall have a minimum of five (5) years experience in design and manufacture, and assembly of specified equipment and components, with an established record of successful operation of such equipment and components.
 - 2. Provide references from a minimum of three installations currently operating the same model equipment in continuous service for a minimum of two years under similar operating conditions. Reference information shall include location, service, contact person, and contact phone number.
- C. Field Service
 - 1. Manufacturers shall furnish the services of an authorized representative specially trained in installation of equipment. Representative shall visit the project site and perform tasks as necessary to certify installation and shall furnish a certificate of proper installation required in Section 01810.

1.03 APPROVED EQUALS

- A. All equipment and materials detailed or called for in this Division shall be as specified, or as pre-approved. For consideration as an "approved equal", complete detailed submittals (3 copies) must be received by the Engineer at least fourteen (14) days prior to the bid opening date.
- B. Pre-bid submittals shall include all technical information and diagrams as necessary to allow Engineer to evaluate the proposed substitution. Any/all differences between the specifications or specified equipment and the proposed substitution shall be clearly noted in the submittal. Approved substitute equipment models or manufacturers will be listed by addendum prior to bid opening.

1.04 SUBMITTAL BROCHURE AND SHOP DRAWINGS

- A. Within twenty (20) days after a Notice to Proceed has been issued, and in accordance with articles 6.24 and 6.25 of the General Conditions, Contractor shall prepare and assemble a single submittal brochure covering all major equipment items covered in this Division. Four (4) copies of the brochure are required to be submitted. One (1) copy will be "marked up" as necessary and returned to Contractor. Contractor is responsible to ensure the information is relayed to the subcontractors and suppliers as required.
- B. Submittals are required for each equipment or material item specified in this Division. Four (4) copies shall be submitted to the Engineer for approval before any ordering or installations.
- C. See also additional requirements for specific equipment under other sections of this Division.

1.05 OPERATIONS AND MAINTENANCE MANUALS (SEE ALSO DIVISION 1)

- A. Contractor shall submit O&M Manuals prior to 50% completion as determined by payments. Further payments in excess of 50% will not be made until O&M Manuals are furnished in acceptable form.
- B. Six (6) sets of approved, heavy-duty 3-ring bound O&M Manuals shall be furnished to the Engineer.
- C. Manuals shall include detailed operation instructions, periodic maintenance requirements and instructions, parts lists with ordering information, assembly diagrams, manufacturer name and place of business, local representative name and phone number, warranty information, and other information as required.
- D. See also additional requirements for specific equipment under other sections of this Division.

1.06 INSTALLATION AND START-UP OF EQUIPMENT

- A. The Contractor shall coordinate all construction and installation with work under other divisions.
- B. The Contractor shall establish limits of equipment supply and installation to be performed by the various trades and appropriate subcontractors.
- C. All items shall be furnished, wired and installed in accordance with manufacturer's recommendations and shall be complete and ready for operation. Components are to be routed to provide easy access for repair or replacement.
- D. Equipment Start-Up. Equipment start up with manufacturer representative shall be required for all equipment specified in this Section (Division 11) of the Contract Documents, unless otherwise directed by the Engineer. Manufacturer representative is required to verify proper installation and operation, perform start-up, and provide operator training as determined necessary by the Engineer (depending on the complexity of equipment operation). Manufacturer's representative shall complete and submit to Engineer, the three installation, start-up and instruction forms, located at the end of this Section, within 10 days after start-up, and normal operation has been achieved.

PART 2 - PRODUCTS

2.01 EQUIPMENT GUARDS

- A. Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of 14-gauge steel, ½ 13-15 expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts. Reinforced holes shall be provided. Lubrication fittings shall extend through the guards.

2.02 CAUTION SIGNS

- A. Equipment with guarded moving parts which operate automatically or by remote control shall be identified with sign reading: "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME".

2.03 LUBRICANTS

- A. Contractor shall provide for each item of mechanical equipment a supply of lubricant required for the first 30 days of operation. Lubricants shall be of the type recommended by the manufacturer and available through a local supplier. Contractor shall limit the number of different lubricants by consolidating them, with the manufacturer's approval, into the least number of differing types.

Contractor shall also provide a list of lubricants required in accordance with Section 01810.

PART 3 - EXECUTION

- 3.01 Install equipment in accordance with the manufacturer's recommendations unless otherwise specified.

END OF SECTION

SECTION 11211

DEEP WELL VERTICAL TURBINE PUMP, WATER LUBRICATED

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes requirements for a single deep well vertical turbine pump, water lubricated lineshaft, to be installed in existing building as indicated on plans.
- B. Related Sections:
 - 1. 11000 Equipment General Requirements
 - 2. 16000 Electrical Requirements

PART 2 - PRODUCTS

- A. Manufacturer.
 - 1. National Pump, 5 Stage
 - 2. Or equal as determined by Engineer.
- B. Service. Municipal Water Supply.
- C. Location. Over 16 inch well casing with a 12” screen.
- D. Capacity. 1560 gpm at 320 feet TDH with capacity to operate at non-overload conditions between 273 feet TDH and 361 feet TDH. Pump shall normally operate at 1560 gpm. Shutoff Head shall be 392 feet. Efficiency shall be at least 83%.
- E. Motor.
 - 1. Motor shall be premium 150 Hp minimum, 3 phase, 460 volt, 1800 rpm, capable of operating with a Variable Frequency Drive with a WP-1 enclosure. Motor shall be capable of full voltage starting, vertical hollow shaft squirrel- cage induction type; and shall be designed for 40 C ambient to Nema WP-1 specification with 1.15 service factor. Motor shall be squirrel cage induction design, NEMA design B, 1800 RPM vertical hollow shaft motor, with a non- reverse ratchet. Motor shall be of the proper size to drive the pump continuously over the complete head-capacity range without the load exceeding the service factor. The motor rating shall be such that at design it will not be loaded beyond nameplate rating and at no place on the pump curve shall the loading exceed the service factor. Motor shall be manufactured by US Electric, General Electric, or approved equal by the Engineer. Motor shall be fit with a 120V space heater.
 - 2. The connection between the motor and the pump shaft shall be through a coupling or clutch in the motor head complete with non-release protection to prevent the lineshaft from unscrewing in the event of phase reversal.

Deep Well Vertical Turbine Pumps

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3. A thrust bearing of ample capacity to carry the weight of all rotating parts, plus the hydraulic thrust, shall be incorporated into the motor as an integral part. The bearing shall be of such a size that the average life rating is no less than 5 years continuous operation.

F. Discharge Head

1. The discharge head shall be Class 30 Cast Iron, free of blow holes, sand holes and other detrimental defects, and shall be accurately machined with a rabbet fit for mounting the driver and supporting the pump column assembly. The base shall be round and machined flat for a gasketed and bolted fit to a separate 20" x 20" steel soleplate that can be grouted and bolted to the concrete foundation. Sole plate shall be provided to facilitate pump removal and replacement without disturbing the pump pad. A rubber seal shall be provided between the discharge head and the sole plate.

The discharge head shall incorporate a discharge elbow having an above ground flanged outlet designed for through bolting and to receive a 125# ASA 6 inch standard pipe flange.

2. Head design shall allow for the headshaft to couple above the stuffing box. The head shall be provided with the manufacturer's standard stuffing box arrangement or a mechanical seal. The stuffing box will be provided with a minimum of five John Crane 1340 packing rings and shall have a grease assembly. throttle bushing, cage rings, packing and provisions for discharge bleedoff. The packing gland shall be bronze secured in place with stainless steel studs and adjusting nuts. Stuffing box bearing shall be C-844 bronze. A rubber slinger shall be installed on the top shaft above the packing gland.
3. If a mechanical seal is used, provision must be made whereby the seal components can be removed without removing the driver from the discharge head.
4. A bronze bearing shall be placed directly below the seal, in the head, to eliminate any shaft "whip" which could damage the seal. Provision shall be made so that seal faces can be adjusted without disturbing motor or impeller setting.
5. The discharge head shall include a prelubrication arrangement that will allow wetting down of the lineshaft bearings before starting the pump.
6. The top column shaft through the stuffing box shall be of AISI 416 SS. It shall be of the two piece design with a coupling located between the pump and motor for ease of installation. An adjusting method shall be provided on the top of the headshaft to allow impeller adjustment. This method shall provide a positive locking device.
7. Discharge head shall have minimum 10" I.D. discharge.

G. Column Assembly

1. The lineshafts shall be of AISI 416 SS, turned, ground and polished. They shall be furnished in interchangeable sections not over 10' in length. The

Deep Well Vertical Turbine Pumps

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shaft shall be sized in accordance with the maximum recommended horsepower for a given size of shaft per AWWA, taking into account the effect of the hydraulic thrust on the pump equipment and the weight of the shaft and suspended rotating parts. To ensure accurate alignment of the shafts, they shall be straight within 0.005 in. Total indicator reading for a 10 ft. section.

2. The butting faces shall be machined square to the axis of the shaft, with the maximum permissible axial misalignment of the thread axis with the shaft axis 0.002" in 6 inches. The size of the shaft shall be no less than that determined by ASA Specification B58, Section 4.3 per Table 5.6, AISI C-1045 Lineshaft Selection, and shall be such that elongation due to hydraulic thrust will not exceed the axial clearance of the impellers in the pump bowls.
3. Lineshafts shall be provided with AISI Type 416 stainless steel surfaces or sleeves at the location of each lineshaft bearing.
4. The lineshaft bearings shall be of cutless rubber, spaced not more than 10' apart and mounted in cast iron bearing retainers threaded into the column couplings.
5. The outer column shall be of ASTM A 53 grade B steel pipe, sized such that the friction loss will not exceed 5 ft. per 100 ft., based on the rated capacity of the pump, and shall have a wall thickness as determined by AWWA Standards (Latest Editions). Column pipe shall be constructed of interchangeable sections not more than 10' in length, with the ends of each section faced parallel and machined with 8 straight threads per inch, permitting ends to butt and inuring alignment when connected by standard mill steel couplings. Top and bottom sections shall be no more than 5 ft. in length. The weight of the column shall be no less than that stated in ASA Specification B58.1, Section 5.1 "Standard Specifications for Discharge Column Pipe". The column size shall be 10" x 0.279W minimum construction, A53 Gr. B minimum, and such that the friction loss will not exceed 5' per 100 ft. based on the rated capacity of the pump. If possible, the column size shall also be such as to provide a velocity of not less than 4' per second at the rated capacity.

H. Pump Bowl Assembly

1. The pump bowls shall be of close grained, cast iron ASTM A48 Class 30, free of blow holes, sand holes and other detrimental defects, and shall be accurately machined. The top case will have a cutless rubber bearing. Series case bearings will be at least two times the shaft diameter in length. Bowls shall have vitreous enamel lined waterways to reduce friction losses and provide a maximum efficiency and wear protection. The intermediate bowls shall be provided with C-844 bronze bearings. The intermediate bowls shall have the provision to be fitted with replaceable wear rings in future repair cycles.
2. Impellers shall be of B584-836 cast bronze enclosed type, accurately machined, statically and dynamically balanced, and filed for optimum performance. They shall be securely fastened to the shaft with taper

Deep Well Vertical Turbine Pumps

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- bushings, lock nuts, or keys. They shall be adjustable vertically by an external means.
3. Closed impellers will have at least a 3/4" axial sealing (throttle) length where they seat in the series case to reduce internal circulation and provide longer operating life.
 4. Impeller skirt and series case throat area shall be thick enough to allow for machining and wear ring at time of repair.
 5. Pump shaft shall be of AISI Type 416 stainless steel, turned, ground, and polished. It shall be supported by bronze bearings above and below each impeller. The length of the top and bottom bearings shall be a minimum of 3 times the shaft diameter. The size of the shaft shall be no less than that determined by ADA Specification B17c, "Code for Design of Transmission Shafting".
- I. Suction Pipe and Strainer
1. The suction pipe shall be length as indicated on plans. Weight shall be as specified for outer column of equivalent size.
 2. A 304 stainless steel cone type strainer shall be provided having a net inlet area equal to at least 4 times the suction pipe area. The maximum opening shall not be more than 75% of the minimum opening of the water passage through the bowls and impellers.
- J. Coating
1. Bowl assembly OD, Discharge Head ID and Coumn Pipe ID and OD to be coated with 3M-134 Fusion Bonded Epoxy 10 to 12 mils thick. Two (2) coating touch up kits shall be included as part of the shipment. Coating surface preparations and application to be performed to coating manufacturers recommended procedures.
- K. Water Level Indicator Assembly. An air line of 1/4" PEX tubing shall be furnished of sufficient length to extend from the surface to the top of the bowl assembly.
- L. Testing. The pump bowl assembly shall be Non-witnessed tested per Hydraulic Institute Standards using a calibrated test motor. Pressure measuring instrumentation and flow measuring instrumentation must have current/valid calibration. Testing a minimum of seven points including closed valve, open valve and flow rates as near as possible to the stated design conditions. Acceptance of performance test to be based on Hydraulic Institute standards. Field Tests. Test will be made when well is placed in operation, and shall be extended over a 8 hour period to guarantee pump performance. Factory representative from pump manufacturer must be present for the entirety of the final testing.
- M. Approvals. Provide detailed brochures to Engineer for approval at least ten (10) days prior to bid opening. Information shall include complete performance curve data.
- N. Maintenance Brochure. Furnish Engineer, prior to 50% completion, five (5) sets

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of maintenance brochures for all equipment furnished.

PART 3 - EXECUTION

- 3.01 Installation and Operating Instructions. Installation of the pumps shall be done in accordance with the written instructions provided by manufacturer.

END OF SECTION

SECTION 11234

HYPOCHLORITE GENERATION SYSTEM EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

A. SCOPE

1. The disinfection system shall consist of an on-site sodium hypochlorite generating system.
2. Production of the sodium hypochlorite solution shall be automatic and on-demand, utilizing solar grade salt, water, and electrical power to produce a <1.0% hypochlorite solution.
3. Capacity shall be (5, 10, 15, 20) pounds of equivalent chlorine per day.
4. The sodium hypochlorite production system shall be a complete system including the electrolyzer cells, DC power supply, brine delivery system, and process controller mounted in an enclosed cabinet manufactured by Evoqua Water Technologies.
5. The on-site generating system manufacturer shall be the manufacturer of the anodes supplied with the electrolyzer(s).
6. In order to simplify spares, service, and quality control requirements, the complete disinfection system shall be manufactured and provided by the same manufacturer as the production unit.
7. The on-site generator manufacturer must be able to document a minimum of 1,000 electro-chlorination installations worldwide.
8. The hypochlorite generation skid shall be OSEC[®] L as manufactured by Evoqua Water Technologies / Wallace & Tiernan

PART 2 - PRODUCTS

2.01 GENERATOR ASSEMBLY

- A. An electrolyzer assembly with a capacity of 20 pounds of equivalent chlorine per day as <1.0% sodium hypochlorite solution.
- B. Cathodes and Anodes shall be manufactured from Titanium. Anodes shall be DSA type with precious metal oxide coating on a titanium substrate. Electrodes shall be

Hypochlorite Generation System
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- manufactured by the manufacturer of the OSHG system to ensure the electrodes are suitable quality and meet performance specifications.
- C. Electrolyzer shall consist of vertically oriented bi-polar electrodes.
 - D. The bi-polar electrolyzer assembly shall consist of a minimum of one cell compartment mounted in a horizontal electrolyzer.
 - E. Each electrolyzer compartment shall allow hydrogen removal to facilitate two-phase flow pattern. Hydrogen gas removal shall be vertical, while the electrolyte solution flow path shall be horizontal.
 - F. Multiple electrolyzer configurations shall utilize a modular approach. Each electrolyzer shall be added or removed in parallel to expand or reduce the total capacity as desired.
 - G. Each electrolyzer shall be capable of running independently with a dedicated power supply.
 - H. Hydrogen gas lift within each electrolyzer shall not exceed 3 inches vertically.
 - I. Power usage shall not exceed 2.2 to 2.5 KWH AC per pound of equivalent chlorine at a concentration of 0.7%.
 - J. Electrolyzer shall be able to meet the stated efficiencies operating with an inlet water temperature range of 41-86°F.
 - K. Electrolyte solution sample and drain valves shall be included.
 - L. Level switch and temperature switch shall be externally mounted to the hypochlorite outlet manifold to enable maintenance without intrusion to the electrolyzer assembly.
 - M. Electrolyzer assembly shall be pre-piped and mounted within the system cabinet. The cabinet assembly shall be wall mounted and have a footprint that does not exceed 29" wide x 46" high x 15" deep.

2.02 PROCESS CONTROLLER

- A. The entire generation process shall be controlled by a Wallace & Tiernan microprocessor complete with a capacitive-touch, 4.3" colored glass touch screen for easy and intuitive operation.
- B. Enclosure shall be NEMA 4X, IP66.
- C. Input voltage shall be 100-240 VAC, 1 phase, 50/60 Hz.

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- D. Control voltage shall be 24 VDC
- E. Controller shall be CE/CSA Listed.
- F. Operation and alarm readouts shall indicate system status. Status indicators to include:
1. Audible alarm contacts
 2. Power on
 3. DC Power supply
 4. Blower running
 5. Brine pump on
 6. Analog storage tank level transmitter
 7. DC Power supply failed
 8. Improper voltage
 9. Improper amps
 10. High electrolyte solution temperature
 11. Low electrolyzer solution level
 12. Overflow of storage tank
 13. Low storage tank level
 14. Air flow failed, blower failed
 15. External interlock for emergency shut down
 16. External interlock for hydrogen detection
- G. The following shall be provided as freely configurable volt-free outputs:
1. General Fault
 2. Dosing pump enable
 3. Audible Alarm
 4. Rectifier On/Off
 5. Hydrogen leak alarm (if used)
- H. The Following Panel sourced AC voltage outputs shall be provided
1. Brine Pump/Water Valve On/Off
 2. Blower On/Off
- I. The process controller shall be programmed and configured for the following discrete inputs:
1. Electrolyte Level switch (pre-wired from generator)
 2. Electrolyte Temperature switch (wired from generator)
 3. Rectifier Running (wired from power supply)
 4. Improper voltage (wired from power supply)
 5. Improper amps (wired from power supply)
 6. Blower air flow switch (field wired from transmitter)

J. The process controller shall be programmed and panel configured for the following Analog Inputs:

1. Tank Level Transmitter
2. Rectifier output voltage
3. Rectifier output current
4. Electrolyte outlet temperature

K. Intrinsic barriers shall be provided for the following supplied generator equipment.

1. Electrolyte Level Switch
2. Electrolyzer Outlet temperature switch

2.03 DC POWER SUPPLY

- A. Power for the electrolysis of brine shall be provided by a high efficient dual mode constant voltage and constant current output power supply. The on-site generation system shall consist of 4 power supplies running in parallel to a dedicated electrolyzer cartridge. —
- B. Input power shall be 100-240 VAC $\pm 10\%$ single phase at 50/60 Hz. Output to be constant current 32A and 15V DC.
- C. Power supply enclosure shall be rated to meet IP67/IP65 certifications suitable for indoor and outdoor operation.
- D. Power supply shall have automatic output overload protection
- E. Power supply shall be built to CE/CSA standards.
- F. The power supplies shall be mounted in the on-site generation cabinet.
- G. Power supply shall be Mean Well HLG-600H series with no exception.

2.04 BRINE PUMP

- A. Brine pump shall be peristaltic type controlled via the supply voltage from the on-site generation system power control system.
- B. The brine pump shall be sized to deliver flows of 1 gph (4 L/hr).
- C. Brine and water shall be combined within the system cabinet piping.

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- D. Water flow shall be established through a solenoid valve and controlled with a flow control purge meter.
- E. The system shall function to deliver a 3% brine solution to the electrolyzers during periods of operation.
- F. The brine pump shall be a Chem-Ad® VPP-DC.

2.05 SATURATOR

- A. Saturator shall be high-density polyethylene. Usable storage capacity shall be 900 pounds.
- B. The saturator shall include an automatic level control system to maintain a constant liquid brine level.
- C. Saturator shall be designed for storage of brine solution at ambient temperature and atmospheric pressure, and shall be suitable for indoor/outdoor installation.

2.06 HYPOCHLORITE STORAGE TANK

- A. Hypochlorite storage/hydrogen dilution tank, totally enclosed, with flanged drain, overflow, inlet and outlet connections, with air dilution inlet and outlet connections and blower suitably sized to dilute hydrogen to at least 25% below LEL.
- B. The following controls shall be included:
 - 1. Ultrasonic level transmitter control with 4-20 mA output for start-stop operation of the system; FM and CSA Intrinsically Safe; Wetted material shall be suitable for 1.0% hypochlorite solution.
 - 2. User-adjustable alarms:
 - a) Overflow (optional)
 - b) High storage level
 - c) System stop
 - d) System Start
 - e) Low storage level and metering pump disable
- C. Storage capacity: 250 gallons.

2.07 WATER SOFTENER

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- A. If the incoming water exceeds 17 mg/l in calcium hardness, a water softener will be provided to eliminate potential fouling of the electrodes, which impairs the efficiency of the electrolysis process.
- B. Softener shall be dual tank design with automatic change-over for regeneration, suitably sized for the system water requirements.

2.08 HYDROGEN DILUTION BLOWER

- A. Blower shall be provided to force ventilate the product tank reducing the concentration of Hydrogen gas in the tank and discharged from the system vent to below 25% of LEL, which is 1% in air.
- B. Air flow or blower failure shall automatically shut down the process controller.
- C. Fail safe air flow switch contacts shall be incorporated to ensure safe operation.
- D. On system shut down, the blower must remain active for a 15 minute duration.
chlorine.

2.09 HYDROGEN-IN-AIR DETECTOR & ALARM (OPTIONAL)

- A. Hydrogen detecting system shall continuously monitor the on-site hypochlorite equipment area for the presence of hydrogen gas in the ambient atmosphere.
- B. The system shall be a remote electrochemical sensor type consisting of sensor/transmitter and receiver.
- C. The gas detector shall be ranged for 0 to 4% gas concentration and shall have two independent alarm set points adjustable for 5% to 100% of range, with separate alarm LEDs and an integral audible alarm horn.
- D. LED readout of gas concentration in percent and a 4-20 mA proportional output signal shall also be available.

2.10 ANALYTICAL TITRATION KIT

- A. A titration kit to measure the product concentration and brine concentration shall be furnished with the OSEC system.

2.11 SPARE PARTS.-The intent of this Specification is to provide uninterrupted operation for

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a minimum period of two (2) years. To meet this objective, the hypochlorite generator manufacturer shall supply the following spare parts:

- Three (3) spun-bonded pre-filter cartridges
- Three (3) pleated brine filter cartridges
- One (1) anode union disconnect
- One (1) cathode union disconnect
- One (1) PVDF push-in fitting for brine connection
- One (1) brine pump
- One (1) C-80 cell

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The hypochlorite generator shall be installed in accordance with the manufacturer's recommendations as approved by the Engineer. Prior to start-up of the equipment, a field service engineer technician trained by the manufacturer shall inspect the assembled equipment, make necessary minor final adjustments and certify the equipment ready for operation.
- B. A certified electrician or OSEC representative shall approve the installation.

3.02 SERVICE

- A. Factory trained direct or authorized service contractor shall be available within 24 hours of notification.

3.03 TESTING AND CERTIFICATION

- A. After start-up and prior to final acceptance, the Contractor shall conduct Engineer witnessed performance demonstration tests on the mixed-oxidant generator.
- B. The field service representative will cause the mixed oxidant generator to perform all of its design functions. Tests will be scheduled with the Engineer at least two (2) weeks prior to the planned test date.
- C. The field service representative shall submit to the Engineer a written report stating that the equipment has been checked and is suitable for operation.

3.04 START UP AND TRAINING

- A. One full day of training shall be provided on-site to the operation staff after the equipment start-up.

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3.05 WARRANTY

- A. System shall be warranted for 12 months from date of start-up.
- B. Electrolyzer(s) shall be warranted for 24 months from date of start-up

END OF SECTION

SECTION 11275

WELL DEPTH MONITORING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Well Depth Monitoring Equipment for Location in New Well Building

1.02 RELATED SECTIONS

- A. Section 11000 - General
- B. Section 15000 - Mechanical
- C. Section 15100 - Plumbing
- D. Section 16730 - Telemetry System
- E. Section 16900 - Control Panel

1.03 QUALITY ASSURANCE

- A. Comply with governing codes and regulations.

1.04 SUBMITTALS

- A. Shop Drawings.
 - 1. Upon award of the Contract, Contractor shall submit, as soon as practical, five sets of Drawings, Calculations, manufacturer's literature describing product(s) including details, dimensions along with material and construction specifications for review by the Engineer.
 - 2. The Engineer shall return three sets indicating changes or approval.
 - 3. The review of shop drawings, etc., shall be understood to be only an acceptance of the character and concept and not to check detailed dimensions or serve to relieve Contractor of contractual responsibilities.
 - 4. The Contractor shall purchase materials or products, required under the Contract, only after the submittals have been reviewed and approved by the Engineer.
- B. Installation, Operation and Maintenance Manuals.
 - 1. The Contractor shall submit installation, operation and maintenance manuals to the Engineer for products and equipment requiring cleaning and/or maintenance. Five copies of the installation, operation and maintenance manuals are required. Each manual shall have a title page

Well Depth Monitoring Equipment
11750-2

which includes the name, address, and telephone number of the Contractor, Each manual shall contain the following information for each item covered:

- a. Manufacturer's name, address, telephone number, and nearest designated service representative.
- b. Identification number.
- c. Manufacturer's instructions regarding proper installation, operation and maintenance.
- d. A table stating various maintenance procedures to be performed and the recommended frequency of each maintenance procedure.
- e. Drawings of the equipment, including part names, numbers and technical specifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. All Well Depth Monitoring Equipment
 1. Load, transport, unload and store well depth monitoring equipment in such a manner that the equipment is kept clean and free from injury. Store above ground on platforms, skids or other supports and cover and protect from the elements.

PART 2 - PRODUCTS

2.01 WELL DEPTH MONITORING EQUIPMENT

- A. Scope
 1. Provide one new Sierra Control Systems, Inc., Series WD 22 Well Depth Monitor. Install air piping as detailed in the Contract Documents and as recommended by equipment manufacturer.
 2. Well Depth Monitor is a bubbler system that utilizes a compressor for air supply and a pressure transducer for monitoring backpressure.
 3. Include a digital display to show the depth of water. Adjustable limits shall be provided to set the drawdown alarm level, which can be used to shut off the well pump and a reset limit which will allow the pump to restart. (Drawdown reset). Limits shall have a digital sensor for connection and monitoring through the SCADA system provided.
 4. System pressure switch shall be used to indicate compressor failure or loss of air. Compressor failure and loss of air shall also have digital sensors that can be utilized for connection and monitoring through the SCADA system provided.
 5. Monitoring equipment shall be mounted in a NEMA 12 enclosure that can be wall mounted.
 6. Power requirements for equipment shall be 120V.
 7. Or approved equal by Engineer.

Well Depth Monitoring Equipment
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PART 3 - EXECUTION

3.01 WELL DEPTH MONITORING EQUIPMENT

- A. Provide and install all equipment indicated, as shown on plans or recommended by manufacturer.
- B. Provide One 2 hour period after completed installation of equipment to demonstrate well depth monitoring equipment operation and performance to maintenance staff. Authorized representative from equipment manufacturer must be present for demonstration period.

END OF SECTION

Manufacturer's Installation Certification Form
11750-4

MANUFACTURER'S INSTALLATION CERTIFICATION FORM:

Contract No: _____ Specification Section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the project manual, has been provided in accordance with the manufacturer's recommendations and that the trial operation of the equipment item has been satisfactory.

Comments: _____

Date: _____ Manufacturer: _____

Signature of Authorized Representative

Date: _____ Contractor: _____

Signature of Authorized Representative

Manufacturer's Instruction Certification Form
11750-5

MANUFACTURER'S INSTRUCTION CERTIFICATION FORM:

Contract No.: _____ Specification Section: _____

Equipment name: _____

Contractor: _____

Manufacturer of equipment item: _____

The undersigned manufacturer certifies that a service engineer has instructed the wastewater treatment plant operating personnel in the proper maintenance and operation of the equipment designated herein.

Operations Check List (check appropriate spaces)

Start-up procedure reviewed _____

Shutdown procedure reviewed _____

Normal operation procedure reviewed _____

Others: _____

Maintenance Check List (check appropriate spaces)

Described normal oil changes (frequency) _____

Described special tools required _____

Described normal items to be reviewed for wear _____

Described preventive maintenance instructions _____

Described greasing frequency _____

Others: _____

Manufacturer: _____

Date _____

Signature of Authorized Representative

Date _____

Signature of Owner's Representative

Date _____

Signature of Contractor's Representative

Installed Motor Test Form
11750-6

INSTALLED MOTOR TEST FORM:

Motor Equipment Number _____ Date of test _____
Equipment Driven _____
MCC Location _____ Ambient temp. _____ deg. F

Resistance:

Insulation resistance phase-to-ground megohms:

Phase A _____, Phase B _____, Phase C _____

Current at Full Load:

Phase _____	Current, amps _____
Phase _____	Current, amps _____
Phase _____	Current, amps _____

Thermal Overload Device: Manufacturer/catalog # _____ Amperes _____

Circuit breaker (MCP) setting: _____

Motor Nameplate Markings:

Mfr _____ Mfr type _____ Frame _____ HP _____
Volts _____ Phase _____ RPM _____ **Service factor _____
Amps _____ Freq _____ Ambient temp rating _____ deg. C
Time rating _____ **Design letter _____
(NEMA 1-10.35) (NEMA MG-1.16)
Code letter _____ Insulation class _____
Pump Efficiency: _____ Required Efficiency: _____ Measured Efficiency: _____

CERTIFIED _____ Date _____
Contractor's Representative

WITNESSED _____ Date _____
Owner's Representative

**Required for 3-phase squirrel cage induction motors only.

Installed Motor Test Form
11750-1

DIVISION 13
SPECIAL CONSTRUCTION
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SECTION 13420

INSTRUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Flow Meter

1.02 RELATED SECTIONS

- A. Section 02315 - Excavation and Fill
- B. Section 02510 - Water Pipe and Installation
- C. Section 02515 - Water Pipe Appurtenances
- D. Section 16730 - Telemetry System
- E. Section 16900 - Control Panel

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO).
 - 1. H-20 Loading Standards.
- B. American Concrete Institute (ACI).
 - 1. 318 - Building Code Requirements for Structural Concrete.
 - 2. 517 - Accelerated Curing of Concrete at Atmospheric Pressure.
- C. American Society for Testing Materials (ASTM).
 - 1. A82 - Specification for Steel Wire, Plain for Concrete Reinforcement.
 - 2. C33 - Specification for Concrete Aggregates.
 - 3. CI50 - Specification for Portland Cement.
 - 4. C330 - Specification for Lightweight Aggregates for Structural Concrete.
 - 5. C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - 6. C858 - Specification for Underground Precast Concrete Utility Structures.
- D. American Waterworks Association (AWWA).
 - 1. AWWA C-550 - Protective Epoxy Interior Coating for Valves and Hydrants.
 - 2. C-704 - Propeller-Type Water Meters for Water Applications.

1.04 QUALITY ASSURANCE

- A. Comply with governing codes and regulations.
- B. Precast plant shall be certified by the National Precast Concrete Association.

1.05 SUBMITTALS

- A. Shop Drawings.
 - 1. Upon award of the Contract, Contractor shall submit, as soon as practical, three sets of Drawings, Calculations, manufacturer's literature describing product(s) including details, dimensions along with material and construction specifications for review by the Engineer.
 - 2. The Engineer shall return two sets indicating changes or approval.
 - 3. The review of shop drawings, etc., shall be understood to be only an acceptance of the character and concept and not to check detailed dimensions or serve to relieve Contractor of contractual responsibilities.
 - 4. The Contractor shall purchase materials or products, required under the Contract, only after the submittals have been reviewed and approved by the Engineer.

- A. Installation, Operation and Maintenance Manuals.
 - 1. The Contractor shall submit installation, operation and maintenance manuals to the Engineer for products and equipment requiring cleaning and/or maintenance. Five copies of the installation, operation and maintenance manuals are required. Each manual shall have a title page which includes the name, address, and telephone number of the Contractor, Each manual shall contain the following information for each item covered:
 - a. Manufacturer's name, address, telephone number, and nearest designated service representative.
 - b. Identification number.
 - c. Manufacturer's instructions regarding proper installation, operation and maintenance.
 - d. A table stating various maintenance procedures to be performed and the recommended frequency of each maintenance procedure.
 - e. Drawings of the equipment, including part names, numbers and technical specifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Flow Meter
 - 1. Load, transport, unload and store flow meter in such a manner that the meter is kept clean and free from injury. Store above ground on platforms, skids or other supports and cover and protect from the elements.

PART 2 - PRODUCTS

2.01 FLANGE MAGNETIC DRIVE METER

- A. Manufacturer
 - 1. Endless and Houser Model Promag 50
 - 2. Or approved equal.
- B. 10" unit designed for potable water, installed as detailed on plans. Electromagnetic flowmeter furnished with NEMA 4X Ecograph T Paperless Recorder. Meter will measure flowrate in piping, totalize volume and transmit a signal of 4-20 mA DC. Wall mount recorder inside well pump building. Manufacturer to provide sufficient length of cable for connecting meter to recorder. Signal shall be utilized for SCADA system, to transmit to remote locations via the system provided.
- C. Transmitter shall have a 24 character, 2 line alphanumeric LCD display to indicate instantaneous flow rate and totalized flow information.
- D. Meter shall be capable of performing the following functions from the panel on the transmitter; rate indication totalization, flow averaging, span and zero adjustment, meter rescale and recalibration, self-test, signal transmission to SCADA system provided.
- E. Paperless recorder shall provide 6 universal inputs to record all measuring signals. Layout shall include a multi-colored display, digital, bar graph and curve display. System shall be enabled to allow network integration and remote data transmission via Ethernet, modem, and USB. Inputs shall be galvanically isolated from the system. A Readwin 2000 PC software package shall be contained in the scope of supply for professional, tamperproof data processing.

PART 3 - EXECUTION

3.01 MAGNETIC DRIVE FLOW METER

- A. Meter shall be capable of being horizontally, vertically or inclined installed.
- B. Install meter in accordance with manufacturer's installation instructions.
- C. Mount recorder on wall inside pump building. Protect from dissimilar metals.
- D. Provide concrete support blocking for meter.

END OF SECTION

DIVISION 9
FINISHES

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SECTION 09260

GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.03 SECTION INCLUDES

- A. Gypsum board
- B. Metal corner beads
- C. Taped and sanded joint treatment
- D. Prime paint
- E. Spray texture.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840-01. GA-201 - Gypsum Board for Walls and Ceilings. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board. GA-600 - Fire Resistance Design Manual.

PART 2 - PRODUCTS

2.04 GYPSUM BOARD SYSTEM

- A. Manufacturers:
 - 1. Gold Bond
 - 2. Or Approved
- B. Gypsum Board Types:
 - 1. 5/8 inch thick “green” gypsum wall board, maximum permissible length; ends square cut, tapered edges; ASTM C36.

2.05 ACCESSORIES

- A. Fasteners: ASTM C1002-01 Type W nails. ASTM C1002-01 Type 512 hardened screws.
- B. Corner Beads: Metal
- C. Joint Material: ASTM C475-01, GA 201 and GA 216, reinforcing tape, joint compound, adhesive, water.

Gypsum Board Systems
09260-2

- D. Control Joint: Zinc No. 093. Tape protected 1/4" wide. See Drawings for locations.
- E. Prime Paint: Refer to 09900. Required prior to spray texture.

2.06 SPRAY TEXTURE DECORATION

- A. Light orange peel texture at interior. Provide sample for Architect's review and approval.

PART 3 - EXECUTION

3.03 INSTALLATION - GYPSUM BOARD

- A. Install gypsum board in accordance with manufacturer's instructions.
- B. Fasten gypsum board to furring or framing with nails or screws.
- C. Place control joints consistent with lines of building spaces as indicated.
- D. Install gypsum board in accordance with GA 201 and GA 216 per manufacturer's instructions.
- E. Erect single layer fire rated gypsum board vertically with edges and ends occurring over firm bearing.
- F. Use screws when fastening gypsum board, galvanized at exterior.
- G. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum board with sealant.
- H. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials. Verify profile of trim with Architect prior to installation.

3.04 JOINT TREATMENT

- A. Tape, fill and sand exposed joints, edges and corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32".
- C. Prime all surfaces with latex primer prior to spray texture.

3.03 SPRAY TEXTURE DECORATION

- A. Walls and Ceilings: Provide light orange peel texture at all gypsum board surfaces scheduled to receive paint finish. See Room Finish Schedule. Provide sample of texture to Architect for approval.

3.05 TOLERANCES

- A. Maximum variation from true flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION
SECTION 09900

PAINTING

PART 1 - GENERAL

1.07 RELATED DOCUMENTS

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

1.08 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
1. Exposed exterior items and surfaces.
 2. Exposed interior items and surfaces.
 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces whether or not colors are designated in "schedules", except painting the following is not required.
1. Factory finished surfaces, including painted mechanical and electrical equipment, except for pump, which should be painted.
 2. Structural Steel members, including decking, concealed by interior building finish.

3. Nonferrous metal and stainless surfaces, except where specifically indicated to be painted.
 4. Prefinished or natural finish surfaces; e.g. acoustical panels, resilient flooring.
 5. Concealed surfaces in generally inaccessible areas, including elevator and duct shafts, concealed pipes and ducts.
 6. Surfaces scheduled to receive other finish material, including surfaces scheduled to receive special, high performance coating systems.
 7. Moving parts of operating units.
 8. Interior concrete floors, except as noted.
- G. Physical Hazards: Color mark physical hazards, safety equipment locations and fire and other protective equipment in accordance with OSHA (1910) and ANSI (z53) color code standards, as indicated
- H. Painting contractor to provide caulking and all primers.
- I. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- J. Related Sections include the following.
1. Section 06200 "Finish Carpentry".
 2. Section 08110 "Hollow Metal Doors and Frames" for shop priming doors and frames.
 3. Section 09260 "Gypsum Board" for surface preparation for gypsum board.
 4. Painting of mechanical and electrical work is specified in the drawing.

1.09 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 - degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measures at a 60 - degree meter.
 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60 - degree meter.
 4. Semigloss refers to a medium-sheen finish with a gloss range between 30 and 65 when measured at a 60 - degree meter.
 5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60 - degree meter.

1.10 SYSTEM DESCRIPTION

- A. Surface preparation, prime and finish coats specified are in addition to shop-priming and surface treatments.

- B. “Paint” includes coating systems materials, primers, emulsions, enamels, stains, sealers, and fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- C. Where item or surface is not mentioned, paint same as similar adjacent materials or surfaces.
- D. Where color or finish is not designated, Owner will select from manufacturer’s standard colors or finishes available.

1.11 SUBMITTALS

- A. Product Data: For each paint system specified.
 - 1. Manufacturer’s Information: Provide manufacturer’s technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

1.12 QUALITY ASSURANCE

- A. Source Limitations: Obtain block filters, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.07 DELIVERY, STORAGE, AND HANDLING

- C. Deliver materials to the Project Site in manufacturer’s original, unopened packages and containers bearing manufacturer’s name and label, and the following information:
- D. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.09 PROJECT CONDITIONS

- A. Apply paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or

to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacture during application and drying periods.

PART 2 - PRODUCTS

2.03 MANUFACTURERS

- A. Products: Provide products meeting the listed requirements from one of the following manufacturers:
 1. Benjamin Moore
 2. Pittsburgh
 3. Rodda
 4. Or approved manufacturer.
- B. Provide products which meet the state VOC limitation requirements.

2.04 MATERIALS

- A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Accessory Materials: Commercial quality linseed oil, shellac, turpentine, mineral spirits, and other materials not specifically indicated but required to achieve specified finishes.

PART 3 - EXECUTION

3.08 EXAMINATION

- A. Examine substrates, area, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Owner about anticipated problems using the materials specified over substrate primed by others.

3.09 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of weight of the item, provide surface applied protection before surface preparation and painting.
 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instruction for each particular substrate condition and as specified.
 1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Cementitious Materials: Prepare concrete, concrete masonry block, and cement surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - c. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - d. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
6. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealant immediately on delivery.

7. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substrates. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up the same primer as the shop coat.
8. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminates. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

3.10 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Paint colors, surface treatments, and finishes as indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint all surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, non specular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 5. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturers written

- instructions, sand between applications.
6. Omit primer on metal surfaces that have been shop primed and touchup painted.
 7. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 8. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet black, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- J. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- K. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
 2. Heat exchangers.
 3. Tanks.
 4. Ductwork.
 5. Insulation.
 6. Motors and mechanical equipment.
 7. Accessory items.
- L. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
 2. Switchgear.
 3. Panelboards.
- M. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evident of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- N. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage.

Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

- II. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of lumps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide satin finish for final coats.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.11 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.12 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide “Wet Paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced paint surfaces.

3.13 SCHEDULE - EXTERIOR SURFACES

- A. WOOD TRIM - PAINTED:
 - 1. One coat Exterior Wood Primer:
 - a. Benjamin Moore; Moorcraft Busan 100% acrylic primer exterior primer No. 166:
Applied at a dry film thickness of not less than 1.8 mils.
 - b. Pittsburgh Paints: 6-609 SpeedHide Exterior House & Trim Wood Primer 100 percent Acrylic Latex: Applied at a dry film thickness of not less than 1.6 mils.
 - c. Rodda Paint; Exterior Control Primer No. 701501; Applied at a dry film thickness of not less than 1.5 mils.
 - 2. Two coats acrylic latex enamel, semi-gloss:

- a. Benjamin Moore; Moorcraft Super Spec Latex House & Trim No. 170: Applied at a dry film thickness of not less than 1.1 mils per coat.
 - b. Pittsburgh Paints: 6-609 Series Speed Hide Exterior House & Trim Semi Gloss Acrylic Latex Paint: Applied at a dry film thickness of not less than 1.5 mils per coat.
 - c. Rodda Paint; Unique II Acrylic Semi-Gloss Enamel No. 542001x: Applied at a dry film thickness of not less than 1.5 mils per coat.
- B. STEEL - UNPRIMED:
- 1. One coat exterior DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils.
 - b. Pittsburgh Paints: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-712). Applied at a dry film thickness of not less than 2.0 mils.
 - c. Rodda Paint: Metal Master Primer No. 508995X; Applied at a dry film thickness of not less than 2.0 mils.
 - 2. Two coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901a; Applied at a dry film thickness of not less than 2.0 mils. per coat.
- C. STEEL - SHOP PRIMED:
- 3. Touch -up with original primer.
 - 4. Two coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils. per coat.
- D. STEEL- GALVANIZED Handrails, Trash Enclosures:
- 5. Touch-up with original primer.
 - 6. Two Coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC Waterborne Epoxy Metal Primer (M08/M09). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Aquapon Water Based Epoxy Primer. Applied at a dry film thickness of not less than 2.0 mils. per coat.

- c. Rodda Paint; Ropon HS Primer No. 729381; Applied at a dry film thickness of not less than 2.0 mils. per coat.
- 7. Intermediate Coat: One Coat High Solids Epoxy:
 - a. Benjamin Moore Paints: Polyamide Epoxy Coating - High Build (M36/M39). Applied at a dry film thickness of not less than 4.0 mils per coat.
 - b. Pittsburg Paints: Aquapon High Build Polyamide Epoxy Coating (97- 130). Applied at a dry film thickness of not less than 4.0 mils. per coat.
 - c. Rodda Paint; Ropon High Solids Epoxy Enamel (759401x); Applied at a dry film thickness of not less than 5.0 mils. per coat.
- 8. Topcoat: One Coat Aliphatic Acrylic Urethane
 - a. Benjamin Moore Paints: Aliphatic Acrylic Urethane Gloss (M74/M75). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitthane Ultra Gloss Urethane Enamel (95-812). Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Polycoat II No. 759101a; Applied at a dry film thickness of not less than 2.0 mils. per coat.

G. STEEL - GALVANIZED, SHEET METAL FLASHING:

- 1. Clean and etch surface
- 2. One Coat exterior acrylic DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitt-Tech Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-712). Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 508995x; Applied at a dry film thickness of not less than 2.0 mils. per coat.
- 3. Two Coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburg Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils. per coat.

H. ALUMINUM - MILL FINISH:

- 1. Clean and etch surface
- 2. Two coats 100% Acrylic DTM paint, semi-gloss:
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0

- mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901a; Applied at a dry film thickness of not less than 2.0 mils. per coat.
 - 3. Two coats 100% Acrylic DTM paint, semi-gloss:
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils. per coat.

3.14 SCHEDULE - INTERIOR SURFACES

A. WOOD - PAINTED:

- 1. One coat latex wood primer sealer:
 - a. Benjamin Moore Paints: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer (252) Applied at a dry film thickness of not less than 1.5 mils.
 - b. Pittsburgh Paints; 6-855 SpeedHide Latex Enamel Undercoater: Applied at a dry film thickness of not less than 1.0 mil.
 - c. Rodda Paint; Lasyn Enamel Undercoat No. 503001x; Applied at a dry film thickness of not less than 1.5 mils.
- 2. Two coats latex enamel, Semigloss:
 - a. Benjamin Moore Paints; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils per coat.
 - b. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex: Applied at a dry film thickness of not less than 1.0 mil per coat.
 - c. Rodda Paint; Unique II Acrylic Semi-Gloss Enamel No.542001x: Applied at a dry film thickness of not less than 1.5 mils per coat.

B. GYPSUM BOARD (DRY AREAS), GYPSUM BOARD SOFFITS

- 1. One coat polyvinyl-acetate primer sealer:
 - a. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils.
 - b. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil
 - c. Rodda Paint; Heavy Body Scotseal No. 507801a; Applied at a dry film thickness of not less than 1.5 mils.
- 2. Two coats latex enamel, eggshell:
 - a. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils per coat.

- b. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel: Applied at a dry film thickness of not less than 1.25 mils per coat.
- c. Rodda Paint; Lasyn Eggshell Finish Wall Paint No. 533001x; Applied to achieve a dry film thickness of not less than 1.5 mils per coat

C. GYPSUM BOARD (TOILET ROOMS AND WET AREAS):

- 1. One coat polyvinyl-acetate primer sealer:
 - a. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils
 - b. Pittsburgh Paints; 6-2 SpeedHide Interior Quick-Drying Latex Sealer: Applied at a dry film thickness of not less than 1.0 mil
 - c. Rodda Paint; Heavy Body Scotseal No. 507801a; Applied at a dry film thickness of not less than 1.5 mils.
- 2. Two Coats Semi-Gloss Acrylic Epoxy Finish
 - a. Benjamin Moore Paints; IMC Acrylic Epoxy Coating (M43/M44-84). Applied at a dry film thickness of not less 1.5 mils per coat.
 - b. Pittsburgh Paints; Aquapon Water BaseEpoxy (98-1 Series). Applied at a dry film thickness of not less than 2.0 mils per coat
 - c. Rodda Paint; Aqua-Flint Water Reducible Epoxy Semi-Gloss. Applied at a dry film thickness of not less than 1.5 mils per coat

D. STEEL - UNPRIMED:

- 1. One coat acrylic DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils
 - b. Pittsburgh Paints: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-172). Applied at a dry film thickness of not less than 2.0 mils.
 - c. Rodda Paint: Metal Master Primer No. 508995x; Applied at a dry film thickness of not less than 2.0 mils.
- 2. Two Coats acrylic DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901a; Applied at a dry film thickness of not less than 2.0 mils per coat.

E. STEEL - PRIMED:

- 1. Touch up with compatible primer
- 2. Two Coats Acrylic DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29).

- Applied at a dry film thickness of not less than 2.0 mils per coat.
- b. Pittsburgh Paints: Pitt Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
- c. Rodda Paint; Metal Master Semi-Gloss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils per coat.

F. STEEL - GALVANIZED:

- 1. One coat exterior acrylic DTM primer:
 - a. Benjamin Moore Paints: Acrylic Metal Primer M04; Applied at a dry film thickness of not less than 2.0 mils
 - d. Pittsburgh Paints: Pitt-Tech Int/Ext Primer/Finish DTM Industrial Enamel (90-712). Applied at a dry film thickness of not less than 2.0 mils.
 - e. Rodda Paint: Metal Master Primer No. 508995x; Applied at a dry film thickness of not less than 2.0 mils.
- 2. Two Coats exterior DTM Semi-Gloss Finish
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Master Semi-(floss Finish No. 548901x; Applied at a dry film thickness of not less than 2.0 mils per coat.

G. ALUMINUM - MILL FINISH:

- 1. Clean and etch surface
- 2. Two coats 100% Acrylic DTM paint, semi-gloss;
 - a. Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.
 - b. Pittsburgh Paints: Pitt-Tech Interior/Exterior Satin DTM Industrial Enamel (90-474) Applied at a dry film, thickness of not less than 2.0 mils per coat.
 - c. Rodda Paint; Metal Mater Semi-Gloss Finish No. 54890 1x; Applied at a dry film thickness of not less than 2.0 mils. per coat.

END OF SECTION

**DIVISION 16
ELECTRICAL**

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SECTION 16050

BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.01 Description

- A. Furnish labor, supervision, permits, materials and equipment to complete the work required in Division 16 and by the contract documents.
- B. It is the intention of this Section of the Specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown on the Plans.

1.02 Contract Documents

- A. The Contract Documents are complimentary, and what one affecting this Division requires shall be binding as if repeated herein.
- B. Separation of this Division from other Contract Documents shall not be construed as complete segregation of the work.
- C. Electrical work shall include both this Division and Division 17.
- D. See Division 11 for additional Control Wiring requirements.

1.03 Codes

- A. Meet requirements of State of Oregon Electrical Specialty Code, Oregon Administrative Rules Chapter 437, American Society of Testing and Materials (ASTM) Federal Specifications, American National Standards Institute (ANSI), National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Underwriters Laboratory (UL), National Electrical Code, National Electrical Safety Code, all rules and regulations of the local serving utility, National Board of Fire Underwriters and Uniform Building Code or Building Officials Code Administrators (BOCA). All Codes, rules, and regulations current or latest edition adopted by authorities having jurisdiction at time of permit.
- B. Code requirements shall be considered a minimum guide for the work. Where contract documents require work materials in excess of Code minimum, install work as called for in contract documents.

1.04 Permits, Licenses And Taxes

- A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection. Division 16 Contractor shall make all necessary arrangements for installation of electrical services indicated on plans.
- B. Division 16 Contractor shall pay all communications, security and power company fees and/or costs for power installation, regardless if provided overhead, underground or rerouted.

1.05 Layout And Coordination

- A. See General Conditions.
- B. Before starting work, carefully examine all Drawings to become thoroughly familiar with conditions governing work on this project. Verify elevations, measurements, rough-in requirements of equipment and its installation location before proceeding with the work. Install equipment with access as required by NEC.
- C. Prior Installation. Any electrical work installed prior to approval of coordination drawings shall be at the Contractor's risk. Subsequent relocations required to avoid interferences shall be made without additional expense to the Owner. In case interference develops, the Engineer will decide which work shall be relocated, regardless of which was installed first.
- D. The existence of any wires, conduits, pipes, ducts or other service facilities is shown in a general way only. The Contractor is responsible for making the exact determination of the location and condition of these facilities.
- E. The Drawings indicate outlet and equipment locations, directions and locations of branch circuit wiring and homeruns. Verify all locations with actual field conditions.
- F. The horsepower of motors and apparatus wattages indicated on the plans and in the panel schedules are estimated requirements of equipment furnished under other Divisions of this contract and bid shall be based on these sizes. Overload elements, contactors, circuit breakers, fuses, conductors, etc., shall be furnished to suit actual equipment installed. Advise Engineer of any equipment changes affecting electrical circuits.
- G. The location of utilities indicated on the plans is taken from existing public records. The Contractor must determine the exact location and elevation of public utilities. The Contractor shall ascertain whether any additional facilities other than those

shown on the Drawings may be present.

- H. The general directions and location of homeruns are indicated on Drawings and are to be extended to panels as though routes were completely shown. No homeruns or branch circuits are to be combined. Items which are installed other than as shown on Drawings and without receiving prior written approval will be ordered removed and installed as shown without additional cost to Owner.
- I. Owner shall not be responsible for any loss of unanticipated costs that may be suffered by the successful bidder as a result of such bidder's failure to fully inform himself in advance in regard to all conditions pertaining to the work and character of the work.
- J. Coordinate work with other crafts employed on the project. Should rearrangement or relocation of equipment be necessary, provide for approval the simplest layout possible for that particular portion of the work. Under no condition are beams, girders, footing or columns to be cut for electrical items unless so shown on Plans or written approval is obtained from the Architect or Engineer.
- K. Special attention shall be given for the following items and all conflicts shall be reported to the Engineer before installation for decision and correction:
 - 1. Door swings; switches shall be located on the "strike" side of the door.
 - 2. Location of radiators, grilles, pipes, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
 - 3. Within the limits indicated on the drawings, the maximum practicable space for operation, repair, removal and testing of equipment shall be provided.
- L. Outlet locations shown on the drawings are approximate. Contractor shall study the building drawings in relation to spaces and equipment surrounding each outlet so that the lighting fixtures are symmetrically located according to ceiling tile and room layout. When necessary, with the Engineer's approval, outlet shall be relocated to avoid interference with structural features of the building.
- M. Call to the attention of the Engineer any error, conflict or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until clarification of same has been made.
- N. Supplementary Details and Plans may be supplied as required and they will become a part of the Contract Documents. The Architect or Engineer reserves the right to make minor changes prior to installation of specific electrical systems in the location of the conduits, outlets, etc., from those shown on the plans without extra charge to the Owner.
- O. Arrange work to reduce interruption of any existing service to minimum. When interruptions are unavoidable, consult Owner or Utility involved and agree in

writing, with copy to the Architect, upon a mutually satisfactory time and duration.

- P. Software Integrator (PLC / SCADA system programmer). The Contractor shall communicate with the Software Integrator throughout the project so that the Integrator can schedule to be present on site when that task is needed. Contractor shall coordinate with the Integrator so that all project equipment is working, calibrated and tested before the Integrator arrives on site to install the software.

1.06 Substitution Requests

- A. Substitution of Equipment. (Prior To Bid).
1. Bids shall be based only upon the materials, construction and equipment specifically identified in the bidding documents, except as hereinafter provided.
 2. If Contractors wish to use items of equipment other than those named in their base bid, Contractor shall apply in writing to the Engineer for approval of substitution at least 10 days prior to opening of bids, submitting with his request for approval complete descriptive and technical data on the items he proposes to furnish.
 3. Equipment and materials proposed for substitution shall be similar in design and equal in quality and function to those specified.
 4. Submittal shall be in triplicate with identification of the item to be substituted and clearly marked with all pertinent data depicting proper characteristics of proposed item.
 5. Contractor's description of his proposed substitution shall specifically note all differences between the item specified and the proposed substitution.
 6. If the Engineer approves any proposed substitution, such approval will be set forth in an Addendum or in writing to the person submitting equipment for approval.
 7. Where a substitution alters the design or space requirements indicated, Contractor shall include all items of cost for the revised design and construction including cost of all allied trades.
 8. Unless requests for changes in base bid specifications are received and approved prior to the opening of bids, as defined above, the successful Contractor will be held to furnish specified items under his base bid. After Contract is awarded, changes in specifications will be made only as defined under Substitution of Equipment. (After bid).
- B. Substitution of Equipment or Materials. (After Bid).
1. After execution of the Contract, substitution of equipment or makes other than those specifically named in the Contract Documents will be approved by the Engineer for the following reasons only:
 2. That the equipment proposed for substitution is equal to and/or superior to equipment named, in construction, efficiency and utility, and further that the equipment named in the specifications cannot be delivered to the job in

time to complete the work in proper sequence to work of other Contractors, due to conditions beyond the control of the Contractor.

3. To receive consideration, requests for substitutions must be accompanied by documentary proof of equality or difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment.
4. In case of a difference in price, the Owner shall receive all benefit of the difference in cost involved in any substitution and the Contract altered by Change Order to credit Owner with any savings so obtained.

1.07 Submittals: Shop Drawings And Material Lists

- A. In addition to the requirements of General Conditions, submit manufacturers data and Shop Drawings and Material Lists as required by individual sections of Division 16.
- B. Before commencing work and within 30 days after award of contract, furnish six (6) copies of complete Shop Drawings and Material Lists to the Architect or Engineer.
- C. Include only information on exact equipment installed; not complete "line" of manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with black arrow, underlining or circling. Contractor is not to use red. Diagrams for systems to be complete Drawings for specific system installed. "Typical" line diagrams not acceptable unless properly marked to indicate exact system for this project.
- D. Single Submission. Data and shop drawings shall be supported and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission.
- E. Shop Drawings. Shop drawings shall include complete construction details, dimensions, material descriptions, diagrams or pictures showing physical characteristics, performance and test data, description of operation, installation methods, wiring diagrams and any other data or information necessary for a complete evaluation. (Note: do not re-draw the contract drawings. The drawings to be submitted under this subsection are all the supplemental drawings and manufacturers' specification drawings which are not included in the contract drawings.) Shop drawings are in addition and supplemental to the contract drawings.
- F. Identification. In addition to the requirements of Special Provisions, submittals shall be identified by the name of the system and applicable specification paragraph number.

- G. Delivery Prior to Approval. No item of material or equipment shall be delivered to the site or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.
- H. Compliance. Should the Contractor fail to comply with the requirements of these provisions, the Engineer reserves the right to select any or all items of materials and systems. Selection shall be final and binding upon the Contractor. Materials so selected or approved shall be used in the work at no additional cost to the Owner.
- I. Departures. If departures from the contract drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings. Where such departures require raceways or equipment to be supported otherwise than as shown, the details submitted shall include loadings and type and kind of frames, brackets, stanchions, or other supports necessary. Approved departures shall be made at no additional cost to the Owner.
- J. Electrical Diagrams. A complete electrical connection diagram for each item of equipment furnished under Division 16, which has electrically controlled components having more than one automatic or manual control device, shall be submitted for approval. Wiring diagrams shall identify each component, and one diagram shall show all interconnected or interlocked components. It is understood that the contract electrical drawings do not have to be submitted or copied for inclusion in this submittal.
- K. Contractor agrees that submittals processed by the Engineer are not change orders; that the purpose of submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.
- L. Late submittals will not be considered an excuse for time extension for the project.
- M. Data not in conformity with these requirements will be returned for resubmittal.
- N. Organization:
1. Assemble Shop Drawings and submittal data in hard cover loose-leaf ring binder. Provide cover with permanently attached typewritten or printed label with name of project, job number and heading reading "ELECTRICAL SUBMITTAL DATA".
 2. Organize data in each set in basic categories listed in index for Division 16. Provide submittal data with typewritten index having same sequence, numbering and wording as index for Division 16. In addition, provide divider sheets between each section with identifying tabs having same

designations as index. Organize material in each section in same order and identify with same number and wording as paragraphs of specification section.

3. Submit neat, clean copies of data, 8-1/2 inch by 11-inch size. Accordion fold required drawings to 8-1/2 inch by 11-inch size and include in submittal binder.

1.08 Electrical Equipment Operation And Maintenance Manuals

- A. In addition to the requirements of the General Conditions, submit manuals as required by individual Section of Division 16.
- B. Provide all electrical equipment and control information. The purpose of this manual is to provide one comprehensive document that illustrates and describes all the electrical equipment and instrumentation installed in the plant.
- C. For final acceptance of Division 16 work, provide to the Architect or Engineer six (6) copies of complete electrical operating and maintenance manuals for servicing of all equipment installed.
- D. Information included must be exact equipment installed, not complete "line" of manufacturer. Where sheets show equipment installed as well as other equipment, identify installed equipment with black arrow, underlining or circling. Contractor is not to use red. Diagrams for each system to be complete Drawings for specific system installed. "Typical" line diagrams not acceptable unless properly marked to indicate exact system for this project.
- E. Information shall include all revisions noted in shop drawings. Copies of stamped drawings are not acceptable.
- F. Provide General Contractor's name, contact person, telephone/fax numbers, include similar information for the sub-contractors.
- G. Include all electrical devices provided under all Divisions. Coordinate with other Division Contractors. The Contractor shall coordinate with the Division 17 contractor and the Software Integrator to include pertinent documentation from their responsibilities in this submittal.
- H. Manuals and documentation shall include calibration curves of every sensing device and a programming documentation sheet for every programmable device. The programming documentation sheet shall show the final operational value of every programmable parameter of every device. The purpose of this sheet is to provide maintenance personnel with a convenient source of information for programming the parameters of a replacement device should the old device fail.
- I. Organization:

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1. Assemble Shop Drawings and submittal data in hard cover loose-leaf ring binder. Contractor shall insert printed spine and cover title sheets to match font style and size of the rest of the plant O&M manual set. Coordinate with the General Contractor.
2. Organize data in each set in basic categories listed in index for Division 16. Provide submittal data with typewritten index having same sequence, numbering and wording as index for Division 16. In addition, provide divider sheets between each section with identifying tabs having same designations as index. Organize material in each section in same order and identify with same number and wording as paragraphs of specification section.
3. Submit neat, clean copies of data, 8-1/2 inch by 11-inch size. Accordion fold required drawings to 8-1/2 inch by 11-inch size and include in submittal binder.

1.09 Project Record Drawings

- A. Maintain at the site one complete set of full-sized original prints for recording installed conditions (As-Builts). Keep record Drawings clean, undamaged and up to date as work progresses. Accurately indicate electrical work as actually installed with indications of all deviations, additions and omissions in red ink. Locate all buried exterior raceways or cables by actual dimensions from walls, center-lines or fixed points of reference.
- B. The purpose of these Record drawings is to provide the Engineer with an easy to read, complete record of the installation so that at the end of the project the Engineer can revise the original contract drawings to represent the actual installation. Color-coded and highlighted notes shall be used if these would make the Record Drawings easier to read.
- C. At the completion of the work, Contractor shall furnish the Engineer this original set of marked-up drawings. Final payment to the Contractor will not be authorized until these drawings have been submitted to and accepted by the Engineer.

1.10 Certificates

- A. For final acceptance of Division 16 work, provide certificate of approval from the applicable regulatory and permitting agencies certifying that the electrical work has been inspected and that the work conforms with the minimum requirements of the State Electrical Codes.

1.11 Warranty

- A. See Division 1.

PART 2 - PRODUCTS

2.01 Materials

- A. Unless otherwise specified, all material to be new of recent manufacture, carrying full factory warranty, UL approved or approved by local inspection authority.
- B. All like materials shall be by the same manufacturer throughout the project.
- C. All material shall be new and bear manufacturer's name, model number, electrical characteristics and other identification and shall be the standard product of manufacturer regularly engaged in production of similar material.
- D. Access Panels:
 - 1. Provide access panels of adequate size for equipment requiring service and installed above plaster or gypsum board ceilings, behind walls or in furring.
 - 2. Furnish complete with correct frame for type of building construction involved. Size, number and location of access panels is not necessarily shown on Drawings.
 - 3. Use no panel smaller than 12 inches by 12 inches for simple manual access, nor smaller than 16 inches by 20 inches where personal must pass through.
 - 4. Access panels shall maintain ceiling fire rating.
 - 5. Acceptable Manufacturers: Milcor A, K, L, or M panels or equivalent Bilco or Potter - Roemer as required by construction.

PART 3 - EXECUTION

3.01 Excavation/Trenching

- A. Provide trenching, backfilling, compaction, repaving or other site restoration as required by the work done in this Division.
- B. Determine location of all existing underground gas, water, sewer, telephone and electric lines. Locate accurately on ground surface and for depth of same before excavation. Uncover by hand digging. Contractor shall be responsible for any damage or interruptions to these utilities, caused by himself, and other costs incurred by these interruptions.
- C. Do not undermine footings or bearing walls.
- D. Use power-digging equipment only in direction away from existing facilities.
- E. Exercise standard safety precautions in excavation near power cables by using insulated handles, rubber gloves and footwear, etc.
- F. Do not place backfill until installation to be covered has been tested, inspected and approved.
- G. Minimum conduit burial depth shall be 24 inches, unless otherwise noted.

- H. Install a detectable six inch wide yellow vinyl tape with letter “Caution: Buried Electrical Line Below” 18 inches above all buried services conduit and wire not under structures.
- I. Backfill:
 - 1. Backfill material for all trenches under paved areas shall be coarse sand or crushed rock, installed in layers not to exceed six inches and compacted to 95% of maximum density at optimum moisture content to preclude subsequent settlement.
 - 2. The top 18 inches of trenches in landscaped or grassed areas shall be backfilled with native soil and tamped.
- J. Conduits piercing a building waterproof membrane shall be provided with flanges, using two neoprene washers, one washer on each side of membrane, between each flange and membrane.
- K. All underground conduits which enter the building penetrating poured-in-place slabs:
 - 1. Shall be sloped to drain away from the building and shall be water sealed to prevent moisture from passing through the conduit into the building. All joints to be threaded and taped or glued to prevent entry of water into the conduits.
 - 2. Shall be poured-in-place, or provide with watertight conduit sleeves and rubber seals, Link-seal system by Thunderline Corporation or equivalent.
 - 3. Shall be rigid galvanized steel a minimum of 12-inches under the slab and 6-inches above the slab.

3.02 Cutting

- A. Perform or arrange and pay for required cutting of concrete, masonry, wood, structural framing, etc.
- B. Cutting or channeling of underpinning or structural members is not permitted without prior permission of the Engineer.
- C. No weakening of structural parts is permitted and the Contractor will correct any work impaired.

3.03 Patching

- A. Where trenching is done through existing paving, walks, curbs, etc., the Contractor is responsible to patch and repair these structures to original condition.
- B. Patch all openings in and through concrete and masonry with dry pack.
- C. In new work, patch and refinish all finished surfaces damaged by this contractor to match adjacent surface.

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- D. Where new electrical work is installed in the existing building, patch and refinish surfaces damaged to match existing. Refinishing to be as directed by the Architect or Engineer.
- 3.04 Framing And Blocking
- A. Structural framing will be done by the Contractor.
 - B. Blocking required for sole use of electrical work such as fastening and support of outlet boxes, fixtures, panels, conduit, etc., will be by the Electrical Contractor.
- 3.05 Housekeeping Pads
- A. Provide concrete housekeeping pad under all floor-mounted equipment (including but not limited to: Motor Control Centers, transformers, pumps, switchboard, etc.).
- 3.06 Protection
- A. Cap or plug all raceway openings during construction.
 - B. Protect all completed work against dirt, water or chemical damage, mechanical accident or injury.
 - C. Equipment found damaged or in other than new condition will be rejected as defective.
- 3.07 Sleeves
- A. Where conduit passes through masonry or concrete, install sleeves during construction of same.
 - B. Where conduit must by necessity pass through beams or columns, install sleeves located as directed by Engineer.
- 3.08 Identification
- A. Label complete electrical system to indicated use of each item of equipment or load served.
 - B. Identification of Disconnecting Means: Provide identification of disconnects in accordance with Section 110-22 and Section 240-83 of the National Electrical Code.

- C. Identification of Conductors and Components for Distribution Systems Operating at Two or More Different Voltages: Identify components in accordance with Section 210-4(d) of the National Electrical Code. Required labeling shall be by Micarta plate.
- D. Provide black laminated white core engraved nameplates with lettering not less than 3/16 inch high attached to the outside of junction boxes larger than 4-11/16 inch; surface mounted cabinets, panelboards, time switches; disconnect switches, starters, contactor, relays; subdistribution and branch circuit panelboards, dry transformers and other items indicating equipment or load served. At flush mounted cabinets, panelboards, time switches and similar items mount nameplate on inside of door at finished areas and on outside of door at mechanical, storage rooms and other non-public spaces. Attach nameplates with epoxy glue.
- E. Flush mounted devices with stainless steel or plastic finish plates requiring identification to be engraved with lettering not less than 1/8 inch high with black color filling.
- F. Provide typewritten circuit schedules for panelboards, cross-connect panels and terminal cabinets. Schedules shall be covered with minimum of 0.018-inch thick clear rigid plastic installed in permanently attached metal frame holder located on inside face of door. Schedules to use final assigned room names/numbers, loads not plan designations.
- G. When making modifications to existing equipment or panelboards, provide labels as indicated in this section. Provide new typewritten circuit schedules for all modified panelboards.
- H. At Main Distribution Panels provide black laminated white core engrave nameplates attached to panel exterior with epoxy glue. Size of nameplate and lettering as directed. Label distribution breakers, main breakers, sub-breakers and panel sections to identify all components and voltage and phase of system. In addition, provide master nameplate indicating project name, date, Architect (when applicable), Electrical Engineer, and Electrical Contractor. Lettering minimum of 1/4 inch high. Provide half-sized electrical one-line diagram (s) framed and mounted on wall near main distribution panel (s).
- I. At buildings having multiple services provide additional engraved nameplate at each service indicating location of additional services.

3.09 Installation

- A. Wiring Requirements: Install wiring complete to every outlet with all devices shown and/or required. All wiring to be in raceways and concealed throughout finished areas unless specifically noted otherwise. For the purpose of electrical

specifications, all areas, with the exception of boiler rooms, mechanical rooms and mechanical spaces, are to be considered as finished areas.

- B. Provide raceway connections between outlets, outlets and panels and equipment and panels as shown on Drawings. Size raceways according to governing codes unless otherwise noted.
- C. Locations:
 - 1. Verify all locations with actual field conditions, and plans to avert possible installation conflicts.
 - 2. Coordinate work with that of other trades to assure symmetrical placing of fixtures in respect to ceiling tile, grilles, etc.
 - 3. Cabinets: Where electrical outlets occur in face, decks or base of cabinets or in walls above counters, carefully coordinate with details and arrangements of same.
 - 4. Any work, which is incorrectly installed without prior verification with General Contractor, Architect, Engineer and Drawings, will be ordered removed and relocated and any damage to other work shall be repaired at no cost to the Owner.
 - 5. In general, locate outlets as indicated in symbol schedule on Drawings.
- D. All mounting heights shown on drawings are from finish floor to centerline unless otherwise shown. Mounting heights at non-typical locations shown with (+) sign and height required noted adjacent to outlet. Outlets located in concrete block, brick or tile walls are to be adjusted in height to coordinate with modular joints of the materials.

3.10 Painting

- A. Painting in general will be covered under another Division of this specification, except items furnished under this Division that are scratched or marred in shipment or installation and/or require custom painting.
- B. Install equipment with manufacturer's standard finish and color unless otherwise specified. Refinish any marred or oxidized items restored to manufacturer's factory finish.
- C. Required surfaces or equipment with no standard finish; clean off grease and scale. Restore to smooth finish. Give one coat of primer, two coats finish.
- D. Paint and color as selected by Architect or Engineer.
- E. All exposed conduits on painted walls shall be painted to match wall and trim colors. Conduit labels shall be neatly affixed and shall not be painted over.

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- F. All electrical equipment and conduit exposed in finished areas and on exterior walls shall be painted to match surrounding surfaces.
- G. Contractor shall coordinate the timing of painting requirements.
- H. Refer to architectural specifications for methods and materials.

3.11 Future Provisions

- A. Provide pull line in each empty conduit provided for future installation of wiring.
- B. At all systems such as fire alarm, clock and program, intercom, etc., where future stations are to be fed from adjacent outlets or terminal cabinets, all conductors required for complete installation of additional units are to be provided to nearest outlet or terminal cabinet as required. In general, all wiring installed so it will not be necessary to remove existing conductors and repull additional wiring to install additional units. All spare conductors properly labeled and terminated in outlet boxes or at terminals in terminal cabinets.

3.12 Continuity Of Service

- A. Keep outages to occupied areas to a minimum and prearrange all outages with Owner, Engineer and utilities involved. Requests for outages shall state the specific dates and hours and the maximum durations, with the outages kept to these specified times. When power interruptions will last longer than 5 minutes and cover more than 10% of the building, or affect public areas, they shall be performed on the weekend between 1 and 5 AM.
- B. Contractor shall coordinate with Owner or Engineer so that work can be scheduled not to interrupt operations, normal activities, building access, etc. Coordinate work with other crafts for proper scheduling.
- C. No circuits shall be turned off without prior approval from Owner or Engineer. Coordinate with the operations, normal activities, building access, etc. Coordinate work with other crafts for proper scheduling.
- D. This contractor shall be liable for any damages resulting from unscheduled outages or for those not confined to the preapproved times. Include all costs for overtime labor as necessary to maintain electrical services in the initial bid proposal. Temporary wiring and facilities, if used, shall be removed and the site left clean before final acceptance. Requests for outages must be submitted at least (5) days prior to intended shutdown time.

3.13 Demolition And Salvage At Existing Structures

- A. Contractor shall make all necessary adjustments to the electrical system required

to meet code, accommodate installation of the new work, and for demolition and removal at existing structures.

- B. Remove all existing fixtures, controls, clocks, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless specifically shown as retained or relocated on the drawings. If existing walls, ceiling, floors, etc. are moved, extend existing devices, fixtures, and circuiting to the new location.
- C. Disconnect all existing mechanical equipment scheduled for removal or relocation as described in specifications and shown on the Plans. Remove abandoned raceways and cables. Re-label panels and motor controls centers to reflect changes.
- D. If existing junctions boxes will be made inaccessible, or it abandoned outlets serve as feed through boxes for other existing electrical equipment that is being retained, new conduit and wire shall be provided to bypass the abandoned outlets. If existing conduits pass through partitions or ceilings which are being removed or remodeled, new conduit and wire shall be provided to route around the ceiling or wall and maintain service to the existing load.
- E. Extend circuiting and devices in all existing walls to be furred out.
- F. Locations of items shown on the drawings as existing are partially based on as-built and other drawings which may contain errors. The Contractor shall verify the correctness of the information shown prior to bidding and provide such labor and material as is necessary to accomplish the intent of the contract documents. The plans may shown some demolition conditions, but are not intended to shown all of them.
- G. All materials accumulated during the demolition process are the Owners property and shall be removed from the job site as directed by the Owner.

3.14 Safety

- A. The Drawings and the specifications do not include design or construction details or instructions relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work.
- B. The Contractor shall provide necessary shoring, railing, barricades, protective

devices, safety instructions and procedures to perform the work safely and to comply with State Safety Requirements and OSHA requirements.

3.15 Cleanup

- A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, wiring devices, cover plates, light fixtures, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

3.16 Asbestos Bearing Materials

- A. If during the course of his work, the Contractor observes the existence of asbestos or asbestos bearing materials, the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Architect, determine a further course of action.

3.17 Polychlorinated Biphenyls (Pcb's)

- A. If during the course of his work, the Contractor observes the existence of polychlorinated biphenyls (PCB's), the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Architect, determine a further course of action.

3.18 Testing.

- A. Test the entire electrical installation to assure compliance with code and proper system operation.
 - 1. Circuit Tests. The Contractor shall test all wiring and connections for continuity and ground before any fixtures or other loads are connected. Tests shall be made with a 500 volt DC "Megger" type tester. If tests indicate faulty insulation (less than 2 megohms) such defects shall be corrected and tested again. Contractor shall provide all apparatus and material required to make tests and shall bear all expense of required testing.
 - 2. Load Balancing. Checks shall be made for proper load balance between phase conductors and make adjustments as necessary to bring unbalanced phases to within 15% of average load.
 - 3. Ground Testing. Measure the OHMIC value of the Electric Service Entrance metallic "System Ground" with references to "Earth Ground" using the "Multiple Ground Rod" method and suitable instruments. Maximum resistance to ground shall be less than 10 ohms. If this resistance cannot be obtained with the ground system shown, notify the Engineer immediately for further instruction. Certify in writing to the Engineer that the grounding test has been made and that the requirements of this portion

have been met for the "System Ground".

4. Motor Tests. Check all motors for proper rotation and for actual load current. Submit tabulation of motor circuits.
- B. Materials and instrumentation shall be provided by the Contractor.
- C. The Contractor shall notify the Engineer ten (10) working days prior to performance of any test.
- D. The Contractor shall certify in writing that the above tests have been completed and shall provide documentation of test data.

3.19 Instruction Of Owner Employees

- A. Instruct operation and maintenance personnel selected by Owner's representative at a single designated time in operation and maintenance of the entire electrical system and its components.
- B. Electrical Contractor shall provide one 8-hour working day of instruction to Owner designated personnel. Software Integrator shall provide one 8-hour working day of instruction to Owner designated personnel after all equipment is fully operational and functional. The time for this instruction shall be scheduled shortly after start-up and at mutually agreed times. Contact Engineer for coordination.
- C. Specific sections elsewhere in this Division may require additional training.
- D. On completion of instructions, obtain from Owner certification in writing that demonstration had been given and instructions had been understood.

3.20 Demonstration Of Completed Electrical System And Controls

- A. At the point of substantial completion of the project, the Electrical Contractor shall provide necessary personnel to demonstrate the essential features of the following electrical systems:
 1. Service entrance equipment.
 2. Motor Control Center and all related items such as controls, alarms, software, PLC and PC equipment, etc.
 3. Lighting system.
 4. Heating system.
 5. Ventilation.
 6. Pumps, pump station, blowers, mixers, and related controls and alarm.
 7. Instrumentation
- B. Demonstrate each system once after all malfunctions have been corrected.
- C. Time. Demonstration shall be held upon completion of all systems at a date agreed upon in writing by the Owner or his representative. This time shall be in addition

to the instruction allowances provided.

- D. Attending Parties. The demonstration shall be held by the Contractor and Electrical Subcontractor in the presence of the Owner or his designated representative, Electrical Engineer, Project Engineer, and the Equipment Manufacturer's representative.
- E. Demonstration.
 - 1. Demonstrate the functions and locations of each system, and indicate its relationship to the Riser Diagram in the Drawings.
 - 2. Demonstrate by "start-stop operation" and "automatic operation", how to work the controls, how to reset protective devices or replace fuses, and what to do in case of emergency.
 - 3. All systems shall be exercised through operational tests in order to demonstrate achievement of the specified performance. Operational tests depend upon completion of work specified elsewhere in these Contract Documents. The scheduling of tests shall be coordinated by the Contractor among all parties involved so that the tests may proceed without delays or disruption by uncompleted work.
- F. Certificate of Complete Demonstration. Submit a Job Completion Form found at the end of this Section. Provide documentation of all test data.

3.21 Payment For Work.

- A. Payment for work under this Division shall be covered and included as part of the Basic Bid on the project, or as outlined under any schedules.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 Summary

- A. Provide a complete grounding system for all electrical equipment in accordance with NEC Article 250 and established safety practices.
- B. Provide grounding grid at pad-mounted transformers.
- C. Provide a main grounding electrode consisting of a bare No. 4 copper grounding electrode conductor connected to a concrete-encased electrode. Concrete-encased electrode provided by others. See detail on Architectural Drawings.
- D. Provide a complete grounding electrode system. All building electrodes must be tied into this system per 250.50 of the NEC. These building electrodes are: the main concrete-encased electrode, any metal underground water pipe that is in direct earth contact for at least ten feet, and the metal frame of the building where effectively grounded.
- E. The grounding electrode system is to include, but is not limited to: grounding conductors, fitting connectors and all other devices and material as required rendering the system complete.

1.02 Related Work In Other Sections

- A. Providing conductors, Section 16120, Conductors and Cables.
- B. Providing raceways, Section 16130, Raceways and Boxes.

1.03 Quality Assurance

- A. UL listed.

PART 2 - PRODUCTS

2.01 Materials

- A. Ground connectors: Bronze clamp type. All clamp accessories such as bolts, nuts and washers shall also be bronze to assure a permanent corrosion resistant assembly. Bolts used to fasten lugs to enclosures must be case hardened and sized for lug hole and hole drilled into enclosure. O-Z Gedney, Burndy, IlSCO or approved.

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- B. Ground rod clamps: Exothermic welding type or one piece cast bronze with safety set screw. Cadweld "G" series, Copperweld 6500 series, or approved.
- C. Ground rods: Copper or steel core copper covered, minimum 5/8 inch by 10'-0". Copperweld 9400 series, or approved.
- D. All ground cable splices and joints to be made with an exothermic welding process that shall provide a weld with current-carrying capacity not less than that of the conductors welded. Soldered connections not to be used.

PART 3 - EXECUTION

3.01 Installation

- A. Install in accordance with NEC Article 250.
- B. Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of electrical equipment to be bonded together to limit any difference of potential voltage. Metallic raceway systems may be considered the equipment grounding system where specifically noted or where approved in the NEC. Equipment grounding conductors must be installed in all non-metallic conduit systems. All load side equipment to have the neutral system isolated from the equipment grounding system. The equipment grounding system must provide a low impedance path from the equipment back to the source equipment-grounding bar. This equipment-grounding bar to be connected to the system neutral at the source by a main bonding jumper sized per NEC 250.28, 250.102, and 250.168. The equipment grounding conductors to be sized at least as large as required by NEC 250.122.
- C. The grounding electrode system to connect to the service neutral, if required, or to the system grounded conductor if a neutral is not required. The electrode system may terminate on the equipment-grounding bar at the main service where a properly sized main bonding jumper has been installed. Water system bonding must utilize the proper size water pipe bond clamp to match the size of the water pipe.
- D. Electrical Equipment Grounding (Safety Ground):
 - 1. Ground non-current carrying metal parts of electrical equipment enclosures, frames, man-holes, conductor raceways or cable trays to provide a low impedance path for line-to ground fault current and to bond all non-current carrying metal parts together.
 - 2. Equipment grounding conductor to be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded, Size ground conductors per NEC 250.122 unless larger conductors are shown on drawings.
 - 3. Grounding conductors to be identified with green insulation. Where green insulation is not available, on larger sizes, black insulation to be used and

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4. suitably identified with green tape at each junction box or device.
 4. Install metal raceway couplings, fittings and terminations secure and tight to ensure good ground continuity. Provide grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure, at concentric knock-outs, or at concentric or eccentric knockouts for circuits of over 250v to ground.
 5. Lighting fixtures to be securely connected to equipment grounding conductors. Outdoor lighting standards to have a factory installed ground lug for terminating the ground wire.
 6. Motors to be connected to equipment grounding conductors with a conduit ground bushing and with a bolted solderless lug connection on the metal frame. A separate equipment-grounding conductor to be run with each motor branch circuit.
 7. Bonding to be provided to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.
 8. All plug-in receptacles to be bonded to the boxes, raceways and grounding conductor.
 9. Equipment grounding conductors to be provided for all lengths of flexible metallic conduit. All equipment provided with two conductor cords to be rewired to provide a three-conductor type "S" cord and grounding attachment plug caps.
- E. Neutrals throughout the system to be solidly grounded to one point at the system source.
- F. Lighting and power panelboard to be grounded by connecting a conductor to the grounding stud and to the incoming and outgoing feeder conduits grounding bushings. Each grounding-type bushing to have the maximum ground wire accommodation available in standard manufacturer for the particular conduit size. Connection to the bushing to be with wire of this maximum size.
- G. The grounding stud of each secondary voltage dry type, three phase transformer to be connected separately to the grounding lug on the panelboard serving the transformer. Connection to be by means of an insulated conductor run in conduit, sized as shown on the drawings.
- H. Provide a No. 6 green coded insulated conductor from each telephone terminal board to the closest effectively grounded water pipe or structural steel.
- I. When included as part of the project, the central equipment for the fire detection and alarm system is to have its grounding terminal connected to the ground lug on the panelboard serving the system by means of a No. 6 green coded insulated conductor, run in 3/4 inch metal conduit, utilizing a ground clamp.

END OF SECTION

SECTION 16120

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 Description

- A. Provide conductors, cables, connectors, lugs, cable ties and terminations for all systems.
- B. Related work in other sections includes:
 - 1. Providing raceways and boxes, Section 16130, Raceways and Boxes.

1.02 Quality Assurance

- A. UL listed.
- B. Federal Specifications J-C-30.

1.03 Submittals

- A. Submit product data sheets for primary service conductors, terminators and load break elbows per Section 16050.

1.04 Product Delivery, Storage And Handling

- A. Deliver conductors and cables in complete coils with UL label and bearing manufacturer's name, wire size and type of insulation.
- B. Store and handle material so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.
- C. Deliver conductors No. 10 and smaller in manufacturer's original unopened and undamaged cartons with labels legible and intact.

PART 2 – PRODUCTS

2.01 Secondary service entrance conductors: Copper 600 volt type "THW", "THHN", or "XHHN" stranded, unless otherwise noted. Sizes as shown on Drawings.

2.02 Feeder conductors:

- A. Copper, 600 volt, type "THW", "THHN" or "XHHW" unless otherwise noted, sizes as shown on drawings.

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- B. Aluminum conductors are acceptable as panelboard feeders as shown on drawings for copper sizes #2/0 AWG and above only.
- C. Drawings are based on copper conductors, contractor to provide a list of conductor and conduit sizes to the Engineer for review for all aluminum conductors to be used. List to be provided prior to ordering material.

2.03 Branch circuit conductors:

- A. Copper, minimum size No. 12 AWG. Conductors No. 12 and No. 10 AWG shall be soft drawn, solid copper. Conductors larger than No. 10 AWG to be stranded, soft-drawn copper. Use type "THW", "THWN", or "THHN". Special conductor types where noted or required by code.

2.04 Splices, connections, terminations and cable ties:

- A. Conductors No. 6 or larger, spliced, taped or terminated with solderless hydraulically applied crimp type connectors unless otherwise noted. T&B, Burndy or approved. Splices to be covered with heat shrink tubing of insulation value equal to wire insulation and wrapped with Scotch No. 33 electrical tape, half lapped.
- B. Connectors: Conductors smaller than No. 6 made with 3M Company Hyflex No. 212 and No. 310, Ideal Wing-Nut, "T&B" Piggys, or approved spring connectors.
- C. Lugs: Conductors No. 6 and larger, except on molded case circuit breakers, two hole, long barrel pressure tool set Thomas & Betts No. 54,000 series, Burndy "Hydent", Anderson Electric VCEL, or approved.
- D. Terminal Strips: All Other Systems: Molded base screw terminals "Buchanan" medium Duty Cat. 525 with tubular clamp flat base for direct mounting with center designation strip and W.H. Brady wire markers.
- E. Cable ties: Thomas & Betts "Ty-Raps" of size and length required.
- F. Color identification for feeder conductors: Brady B-500, vinyl cloth pipe banding tapes, Scotch Vinyl Plastic Electrical Tape No. 35, or approved.
- G. Fluorescent lighting fixture ballast channel tap connectors: Electro-Products Division 3M Company "Scotchlock 567".
- H. Cable and conductor identification: W.H. Brady wire markets.

PART 3 - EXECUTION

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3.01 Inspection

- A. Determine raceways are complete and clean of all foreign matter before installing conductors.

3.02 Delivery, Storage and Handling.

- A. Deliver to site in new standard coils or reels with approved tag denoting length, wire size, insulation type and manufacturer's name.
- B. Suitably protect from dirt, weather, and damage during storage and handling.

3.03 Wire Pulling.

- A. Do not pull wire until all work of any nature is completed which might damage insulation or fill conduit with foreign material. Conduits shall be clean and dry before pulling wire.
- B. Do not use mechanical means to pull #8 or smaller wires.
- C. Exercise care in avoiding injury to wire or insulation during pulling.
- D. Identify wires or circuits with wire markers after pulling. For all control wiring and telemetering systems, wire markers in junction boxes and at solenoids shall bear same numbers as terminal blocks. Keep accurate up-to-date as-built records.

3.04 General Installation

- A. Circuiting. Install branch circuiting exactly as shown. Conduit may be routed at Contractor's best judgment unless directed otherwise. Home runs are diagrammatic for clarity, and may be grouped as desired. Size conduits accordingly with capacity for 25% future fill.
- B. Feeder conductors: Wires shall be factory color-coded by integral pigmentation. Colored plastic tape permitted on No. 6 and larger where integral pigmentation impractical. Apply tape in spiral half-lap over exposed portions in manholes, boxes, panels, switchboards and other enclosures.
- C. Branch circuit conductors: Identify with factory color conductors with separate color for each phase and gray or white for neutral.
- D. All circuit conductors shall be identified with circuit number at all terminals, intermediate outlets, disconnect switches, circuit breakers, motor control centers, etc. Both ends of a given conductor shall be identified alike.
- E. Install wire in conduit runs after concrete and masonry work is complete and after

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- moisture is swabbed from conduits.
- F. Apply pressure tool set lugs with tool specifically designed for application of lugs by lug manufacturer.
 - G. Leave six-inch single wire pigtails for connection of fixture leads and devices to branch circuits.
 - H. Make splices and taps only where specifically shown or approved in approved junction or splice boxes.
 - I. Neatly bundle and tie with cable ties conductors in panel gutters, wire gutters, motor control centers, dimmers, etc. where multiple conductors run in accessible wireways. Spacing as required to neatly group and support conductors.
 - J. Cable feeder and service conductors at switchboards and panel gutters. Feeder conductors cabled together as a group for one feeder and not combined in same cabling with other feeders. Cabled conductors supported from devices built into switchgear and not supported from terminals or lugs.
 - K. Install control conductors in separate raceways unless otherwise noted.
 - L. Install conductors carrying different voltages in separate raceways unless noted otherwise. Where installed in common wireways or gutters, identify neutral per NEC Article 200.
 - M. Quantity of conductors shown in any one raceway is not to be increased without specific permission of Engineer.
 - N. Raceway for low voltage NEC Class II wiring will be required only in walls, air plenums, inaccessible ceiling, and areas where conductors might be exposed to physical damage. Cables approved for use in air plenums and non-combustible ceilings will be accepted in lieu of conduits in plenums or non-combustible ceilings. Cables installed in cable tray shall be approved for such use.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 Description

- A. Provide all raceways, fittings, outlet boxes, junction boxes, pull boxes and special boxes required for complete project. Install all systems in raceways unless specifically noted otherwise.
- B. Not all conduits are shown. Where not specifically indicated, Contractor shall be responsible for sizing conduit per applicable codes for number of conductors.
- C. The Division 16 Contractor shall furnish and install all plant raceways, including instrumentation and signal raceways. Conduits shown are schematic and adjustments made to accommodate field conditions. Coordinate with equipment suppliers and other disciplines to verify correct style, size, location, etc. of conduit is installed. Coordinate with Division 17 Contractor for final connections.
- D. Related work in other sections includes.
 - 1. Providing conductors, Section 16120, Conductors and Cables.
 - 2. Providing boxes, Section 16140, Wiring Devices and Floor Boxes.
 - 3. Providing supporting devices, Section 16070, Seismic Supporting Devices.

1.02 Quality Assurance

- A. UL listed.

1.03 Product Delivery, Storage And Handling

- A. Deliver raceways with UL label and bearing manufacturer's name on each length.
- B. Store and handle raceways and boxes so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.
- C. Cap raceway ends until used.
- D. Deliver fittings in manufacturer's original unopened and undamaged packages with labels legible and intact.

PART 2 - PRODUCTS

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- 2.01 Rigid galvanized steel and IMC conduit:
- A. Rigid galvanized conduit: Rigid steel zinc coated, manufactured in accordance with UL-6, ANSI, and Federal Specifications WW-C-540 standards.
 - B. Intermediate Metal Conduit (IMC): Zinc coated galvanized steel to comply with UL-1242, Type I and ANSI Standards.
 - C. Application:
 - 1. Employed for runs embedded in concrete, concrete block, underground, wet or damp locations, where subject to mechanical injury, and where exposed within eight feet of floor.
 - 2. Make threads watertight with bituminous sealer (solvent type cut back) before assembly where installed underground, in moist locations or where exposed to weather.
 - D. Fittings: Threaded iron or steel only, Thomas & Betts or O-Z/Gedney in sizes up to 1-1/2 inch plastic insulating type O-Z/Credney type "A", or "T&B" 220 Series; sizes above 1-1/2 inch insulated metallic bussings O-Z/Gedney type "B" and "T&B" 1220 Series.
- 2.02 Rigid Stainless Steel conduit: Solid stainless steel.
- A. Application: Required in most outdoor marine or corrosive environments or as specified.
 - B. Fittings: Threaded stainless steel. Erickson couplings, watertight split couplings (OZ or equivalent) permitted so long as all components are of the same stainless steel alloy and are waterproof.
- 2.03 Electrical metallic tubing (EMT): Steel zinc coated, to comply with ULI-797 and ANSI Standards.
- A. Application:
 - 1. Dry locations only. May be used in framed construction, furred ceilings and above suspended ceilings.
 - 2. May be exposed in unfinished areas where not subject to damage.
 - B. Fittings: Connectors and couplings to be case steel. Preinsulated connectors and couplings up to one (1) inch trade size may be compression, indenter or setscrew type. Fittings above one (1) inch trade size shall be compression type. All connectors shall have insulated throats. Thomas & Betts, Steel City or approved.
- 2.04 Liquidtight flexible metal conduit: Zinc steel core with smooth gray abrasion resistant,

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liquidtight, polyvinyl chloride cover (with integral ground wire wound in steel core), to comply with UL 360 and ANSI Standards. Anaconda Sealtite type U.A. Electro Flex L4, Alflex Ultratite UL or EF or approved.

- A. Application: For connection to equipment. Minimum size 3/4-inch for motor connections. Use 3/8-inch only for fixture and control wiring. Provide sufficient length of flexible conduit to avoid transmission of vibration.
- B. Fittings: "Thomas & Betts" Supertite or approved.

2.05 Flexible metal conduit, to comply with UL360, ANSI Standards, and Federal Specification WW-6-566.

- A. Application:
 - 1. Permitted only in dry locations where flexibility is required in length not over 18 inches.
 - 2. Minimum size required 1/2 inch, unless noted otherwise.
 - 3. Where flexibility is not required, flexible metal conduit is not to be used without written permission of the Architect or Engineer.
- B. Fittings: Screw-in-type factory preinsulated "Thomas & Betts".

2.06 Non-metallic conduit: Polyvinyl chloride schedule 40 heavy wall UL listed for underground and exposed applications in accordance with National Electrical Code to comply with NEMA TC2. Canon Electrical Products, PWC or approved.

- A. Application:
 - 1. Permitted for runs embedded in concrete or underground in wet or damp locations.
 - 2. All conduit offsets and bends made with factory fittings.
 - 3. All 90 degree ells and conduit entrances into buildings to be with rigid galvanized conduit.
 - 4. PVC conduit installed under roadways or areas subject to heavy traffic shall be provided with a minimum of 36" cover.
 - 5. Galvanized rigid elbows shall be used for angles larger than 30 degrees where the conduit size is greater than one inch.
 - 6. Provide a ground wire sized per code in all PVC conduits. Conductor quantities indicated in conduits do not include ground wires unless otherwise noted.

2.07 Wireways: All steel with screw covers. Parts coated with rust inhibitor and finished in color to match adjacent distribution equipment. Where located separate from distribution and control equipment, finish standard industrial gray enamel.

2.08 Surface raceways:

Raceways and Boxes
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- A. Allowed only upon prior approval by Architect or Engineer.
- B. Surface mounted "Raceway" type, size and with number, spacing and type of outlets shown on Drawings. Provide raceways with all connectors, end fittings and miscellaneous items required for complete installation. Finish standard gray or beige as selected. Wiremold Co., Mono System or approved.
- C. Install parallel to building surfaces.

2.09 Seals and Fittings:

- A. Conduit plugs: Ideal "Conduloc" sizes 1/2 inch through one inch and T&B, Push Penny Plugs Series 1470 for 1-1/4 inch and larger, or approved for sealing conduits during construction. Steel City PL-200 series screwdriver slot threaded meter plugs or Killark Cat. No. CUP-O through CUP-9 for permanent plugs.
- B. Floor and wall entrance fittings: O-Z/Gedney Electrical Mfg. Co. Type "FSK" entrance seal.
- C. Expansion fittings: O-Z/Gedney Electrical Mfg. Co. Type 'E' expansion coupling with bonding jumper for up to four inch of movement.
- D. Conduit seals: Vertical or horizontal type Crouse Hinds type "EYS" or approved.

2.10 Pull lines: Polyline as manufactured by "Greenlee" or approved.

2.11 Underground Marking Tape:

- A. Power: 6" wide, yellow, low density polyethylene, 4-mil thickness. Imprinted with "CAUTION STOP DIGGING BURIED ELECTRIC LINE BELOW" and current date. Somerset "Protect-A-Line" or approved.
- B. Telephone/Data: Similar to Power tape except green.

2.12 Boxes

- A. Outlet boxes: Steel City, National, or approved, steel boxes as best suited for purpose intended and as follows:
 - 1. Lighting outlets: Four-inch octagon with 3/8-inch fixture studs.
 - 2. Switch and receptacle outlets: Four inch square with proper device cover.
 - 3. Telephone/Data: Four inch square by minimum 2-1/8 inch deep. See Telephone/Data specification for additional requirements.
 - 4. Gang boxes: One piece pressed steel minimum 1-1/2 inch deep by four inches high by length required with proper device covers.
 - 5. Masonry outlets: Standard boxes as specified above with square cornered

Raceways and Boxes
16130-5

- tile wall covers with raise of depth required for specific conditions encountered. Steel City 52-C-49 and 72-C-49 series or approved.
 - 6. Utility boxes: Allowed only with special permission of Engineer.
 - 7. Special outlet boxes: See other section of specification for special outlet boxes.
- B. Device covers for outlet boxes: Raised pattern, 3/4 inch minimum raise at plaster work, all other covers with raise equal to total wall material thickness. Surface boxes with 1/2 inch raise and rounded edges. Steel City, Raco or approved.
- C. Extension rings: 1-1/2 deep. Steel City, Raco or approved.
- D. Pullboxes
- 1. Pullboxes: Galvanized steel (indoors) or cast metal (exterior or damp locations) construction, conforming to National Electrical Code, with screw-on cover.
 - 2. Flush Mounted Pullboxes: Provide overlapping covers with flush-head retaining screws, finished in light grey enamel.
 - 3. Box volumes shall meet NEC for size and number of entering conduits.
- E. Junction boxes: Minimum four inch square by 1-1/2 inch deep. In finished areas provide with two gang device cover and matching blank finish plate.
- F. Weatherproof Outlet Boxes:
- 1. Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket and corrosion proof fasteners.
 - 2. Weatherproof boxes to be constructed to have smooth sides, gray finish.
 - 3. Boxes used in contact with soil shall be cast iron alloy with gasketed screw cover and watertight hubs.
 - 4. Weatherproof Plates: Cast metal, gasketed, for switches and receptacles provide spring-loaded doors.
- G. Weatherproof Junction and Pullboxes:
- 1. Provide galvanized sheet steel junction and pullboxes, with screw-on covers; of the type, shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- H. Knockout Closures: Provide three (3) piece punched-steel knockout closures.

PART 3 - EXECUTION

3.01 Installation

A. General Installation:

1. In general, install raceways concealed in construction except where shown otherwise on the Drawings or unless specifically approved by Architect or Engineer.
2. Unless otherwise noted, size raceways in accordance with Table in Appendix C of NEC for type "THW" conductors regardless of type of conductor specified.
3. Two or more conduits using the same routing: Mount on channel support system. Unistrut or approved.
4. Provide pull line and cap off watertight each empty conduit provided for future installation of wiring.
5. Conduit stubbed from a concrete slab or wall to serve an outlet under a table or to supply a machine shall have a rigid conduit coupling flush with the surface of the slab. Provide plug where conduit is to be used in future.
6. Allow minimum of 6 inches clearance at flues, steam pipes, and heat sources. Do not run conduits beneath boilers or heating units.
7. Dissimilar Metals: Avoid contact with pipe runs of other systems.

B. Lengths and Bends:

1. Maximum number of bends in any run shall be the equivalent of three (3) 90 degree bends (270 degrees total). Maximum length of any run shall be 100 feet, except as allowed in underground installations.
2. Junction and pull boxes shall be provided to maintain these limits. Do not locate pull boxes or junction boxes in finished areas unless specifically shown or special permission is obtained from Architect or Engineer.

C. Exposed raceways:

1. In finished areas run parallel with or at right angles to building structural lines and closely follow surfaces wired over. Conduits offset at panels, outlets, junction boxes, etc. Conduit 1-1/2 inch and larger suspended at locations as directed by Architect or Engineer.
2. In accessible void and furred spaces, conduit may be run in a direct line between outlets with long sweep bends and offsets closely following surfaces wired over. Suspend conduit 1-1/4 inch and larger to be run to allow maximum access to space and located as directed by Architect or Engineer.
3. For exposed runs, attach surface mounted conduit with clamps. Where conduit runs along the inside of exterior walls, mount to channel-type strut at required spacing.

D. Concealed raceways:

Raceways and Boxes
16130-7

1. At inaccessible areas, raceways may be run in a direct line with long sweep bends and offsets. In cavity walls, run conduit in hollow spaces and do not chase interior or exterior masonry.
 2. At accessible areas above lift-out or accessible ceiling areas, run conduit on top or bottom of lower cords or trusses or on underside of roof. Vertical extensions for wiring to ceiling outlets and fixtures kept to minimum length.
- E. Raceways in Concrete Slabs:
1. Do NOT install conduit larger than one inch maximum in concrete slabs unless specifically shown or approved.
 2. Conduits in above grade slabs shall be located in the middle of the slab. Conduit installed in any concrete slab shall have a minimum two (2) inch cover. The maximum size, spacing, and location of conduits in post-tensioned slabs shall be subject to approval by the structural engineer. Conduits larger than one inch shall not be run in slabs.
 3. Space no less than 8" on center and as far apart as possible where converging at panelboard locations.
 4. Do not interfere with placement of re-bar. Place raceway under rebar layer. Spacing not less than eight (8) inches on center, or as required and as wide as possible where converging at panels, etc. Adequately secure raceway, boxes, inserts, etc. by mechanical means or suitable adhesive prior to pour.
 5. Cap and securely support conduits prior to concrete pour.
 6. Stub-Ups:
 - a. Install rigid galvanized conduit with threaded coupling set flush with finished floor. Seal with flush, threaded pipe plug.
 - b. Where stub-up extends above floor, install conduit at such depth that no curved section of the elbow is exposed.
- F. Expansion Joints:
1. All conduits crossing expansion joints where cast in concrete shall be provided with expansion-deflection fittings, equivalent to OZ/Gedney AXDX, installed per manufacturers recommendations.
 2. All conduits three inches and larger where not cast in concrete shall be rigidly secured to the building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across the joint, equivalent to OZ/Gedney AXDX, installed per manufacturer's recommendations.
 3. All conduits less than three inches where not cast in concrete shall be provided with junction boxes securely fastened on both sides of the expansion joint, connected together with 15 inches of slack (a minimum of 15 inches longer than the straight line length) flexible conduit with copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits three inch and larger, may be installed.
- G. Underground raceways:

Raceways and Boxes
16130-8

1. Use galvanized rigid steel or Schedule 40 PVC with galvanized rigid steel elbows and risers.
 2. Maximum length of any run shall be 300 feet, less 50 feet for each equivalent 90-degree bend.
 3. Install underground marking tape buried 6-8 inches below grade, directly above conduit.
 4. Run in a direct line with long sweep bends.
 5. Raceways inside of building run below slab in gravel fill.
 6. Burial Depth — Secondary Service:
 - a. Rigid Galvanized: Minimum 24-inches below finish grade, unless noted otherwise.
 - b. PVC: Where installed under roadways or areas subject to heavy traffic provide a minimum of 36-inches of cover. All other locations, minimum 30-inches below finish grade, unless noted otherwise.
 7. Burial Depth — Primary Service: Minimum 48-inches below finish grade or as required by serving utility.
 8. All underground raceways to be made water-tight with sealed threads or couplings.
 9. Rigid Galvanized conduit shall be coated entire length with coal-tar material (Koppers Bitumastic 515) or with PVC jacket (15 mil. Minimum).
- H. Penetrations, Seals & Plugs
1. All 90 degree ells and conduit entrances into buildings to be with rigid galvanized conduit. Coat with coal-tar material (Koppers Bitumastic 515)
 2. Provide conduit seals at exits and entrances from hazardous locations (i.e. Chlorine storage or distribution rooms), freezer rooms and other locations as required by NEC Article 500.
 3. Conduit penetrations of the electrical room walls and floor must “float” via backer rod or fiberglass and caulked air tights.
 4. Provide conduit plugs at all raceway openings during roughing-in to prevent entrance of foreign matter.
 5. Provide floor or wall entrance fittings at all points where raceways enter or exit below finish grade at tunnels, basements or trenches.

 6. Any conduit leaving the building envelope (e.g., site lighting, roof mounted HVAC equipment, etc.) to be 3/4-inch minimum and must slope downward. Seal conduits at interior side of building. Pack non-hardening duct sealing mastic around wires in the raceway.
- I. Boxes
1. Verify location of all outlet boxes with actual field conditions and plans to avert possible installation conflicts. Architect or Engineer reserves the right to make minor changes prior to installation without cost to the Owner. Coordinate work with that of other trades.
 2. Boxes for receptacle outlets at counters and toe spaces to be mounted

Raceways and Boxes
16130-9

horizontally.

3. Extension rings: Do not add more than one to any box with maximum depth of box and extension ring not to exceed three inch unless specifically indicated otherwise.

3.02 Identification

- A. Any raceway not wholly contained in one room and whose full length is not clearly visible shall be labeled at each end, junction, size change, or any other place where a label would clarify its identity. The label shall be of the form "Cxxx" where the 'xxx' is a unique number (i.e. — C132, C001, C576). A unique number shall be used for each raceway and shall be displayed and noted on the Record Drawings (As-Builts). The labeling means shall be a machine printed nylon wrap-around wire-tie style tag made for the purpose of labeling pipe or conduit. Other means of labeling may be submitted to the Engineer for approval. Hand-written indelible ink labels are not acceptable.

3.03 Cleaning

- A. Complete raceways system before pulling-in conductors.
- B. Remove all foreign matter from raceways and blow out or vacuum smaller conduits and pull mandrel through larger conduits prior to installing conductors.

3.04 Painting

- A. All exposed conduits on painted walls to be painted to match wall and trim colors.

END OF SECTION

SECTION 16140

WIRING DEVICES AND FLOOR BOXES

PART 1 - GENERAL

1.01 Description

- A. Provide all wiring devices and finish plates as required unless specifically indicated otherwise.
- B. Related work in other sections includes:
 - 1. Providing identification, Section 16050, Basic Electrical Materials and Methods.
 - 2. Providing conductors, Section 16120, Conductors and Cables.
 - 3. Providing boxes, Section 16130, Raceways and Boxes.

1.02 Quality Assurance

- A. American National Standards Institute (ANSI): 467 Grounding and Bonding Equipment (ANSI/UL467). 498 Attachment Plugs and Receptacles (ANSI/UL498). C73 Series Dimensions of Attachment Plugs and Receptacles.
- B. Federal Specification (FS): Electrical Power Connector, Plug, Receptacle and Cable Outlet. W-C-596D, E and F. Switches, Toggle (toggle and lock), Flush Mounted WS 896-E.
- C. National Electrical Manufacturer's Association (NEMA): WD 1-79 General Purpose Wiring Devices.
- D. National Fire Protection Association (NFPA): NFPA 70 National Electrical Code.
- E. Underwriters' Laboratory (UL): UL-20 Standard for Snap Switches.

1.03 Submittals

- A. Submit product data sheets per Section 16050, Basic Electrical Materials and Methods.
- B. Submit operation and maintenance data per Section 16050, Basic Electrical Materials and Methods.

Wiring Devices and Floor Boxes
16140-2

- 1.04 Product Delivery, Storage And Handling
- A. Deliver with UL label and bearing manufacturer's name in manufacturer's original unopened and undamaged cartons with labels legible and intact.
 - B. Store and handle material so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

PART 2 - PRODUCTS

- 2.01 Acceptable manufacturers: Arrow-Hart, General Electric, Hubbell, Leviton, Pass & Seymour or approved.
- 2.02 Switches: Specification Grade, Quiet Type, Minimum rating 120/277 volt, 20 amp unless otherwise noted. Finish gray.
- A. Toggle and lock switches: Federal Specifications as listed in Quality Assurance.
 - 1. Single Pole Switch: Arrow-Hart 1991 or approved.
 - 2. Double Pole Switch: Arrow-Hart 1992 or approved.
- 2.03 Receptacles: Specification Grade. Conform to Federal Specifications as listed in Quality Assurance. Finish gray.
- A. Duplex, double parallel slot 20 ampere, 120 volt, typical locations, Arrow-Hart 5362 or approved.
 - B. Ground fault circuit interrupter receptacle: 20 ampere, duplex, double parallel slot, Arrow-Hart GF5362 or approved.
- 2.04 Finish plates:
- A. At surface wiring, raised galvanized industrial type. National Association of Electrical Distributors 12000 Series.
 - B. At all typical location: Stainless steel type 302, minimum thickness .035 inches, brushed finish. Arrow-Hart or approved.
 - C. Damp location receptacle finish plates: Stainless steel, type 302 horizontal plate. Arrow-Hart 4501 or approved.
 - D. Wet locations (exterior) receptacle finish plate: UL listed to be weatherproof while in use. Cover base to be constructed of heavy duty noryl and cover to be constructed of lexan. Thomas & Betts. Perfect Line Weatherproof cover or approved.
 - E. Telephone and Data: Blank coverplate, finish to match receptacle.
 - F. Special Plates: See Drawings or other sections of Specifications.

- G. Plate Securing Screws: Metal with heads finished to match finish plate.

PART 3 - EXECUTION

3.01 Inspection

- A. Determine outlet boxes, raceways and conductors are properly installed and outlet boxes are cleaned of all foreign matter before installing devices and finish plates.
- B. Inspect each wiring device for defects.

3.02 Installation

- A. Install wiring devices in accordance with NECA “Standard of Installation”.
- B. Do not install devices or finish plates until final painting is complete.
- C. Switches:
 - 1. Install switches with the OFF position down.
 - 2. Do not group or gang switches in outlet boxes unless they can be so arranged that voltage between adjacent switches does not exceed 300 volts, or installed in boxes equipped with permanently installed barriers between adjacent switches.
- D. Receptacles:
 - 1. Install a separate green or bare wire between the receptacle strap grounding (green) screw and a screw into the outlet box. Self-grounding strap not approved as grounding means.
- E. Finish Plates:
 - 1. Install devices and finish plates thumb with building lines.
 - 2. Use jumbo size plates for outlets installed on masonry walls.
 - 3. Do not install finish plates until final painting is complete.

3.03 Identification

- A. Switches: Where 2 or more switches are ganged and where indicated, identify each switch with approved legend engraved on wall plate.
- B. Receptacles: Identify the panelboards and circuit number from which served. For nylon faceplates, engrave panel and circuit number on face and highlighted in contrasting color. For stainless steel plates use machine printed, pressure sensitive, abrasion resistant label tape on face of plate and durable wire markers or tags within outlet box.

3.04 Testing

Wiring Devices and Floor Boxes
16140-4

- A. Operate each wall switch with circuit energized and verify proper operation.
 - B. Verify that each receptacle devices is energized.
 - C. Test each receptacle for proper polarity.
 - D. Test each drive for ground continuity.
 - E. Test each ground fault circuit interrupter operation with both local and remote fault simulations according to manufacturers recommendations.
- 3.05 Cleaning
- A. Internally clean device, device outlet box and enclosure.
 - B. Replace stained or improperly painted finish plates or devices.

END OF SECTION

SECTION 16150

SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 Description

- A. Provide safety and disconnect switches as indicated on the drawings, in the specification, and where required by the National Electrical Code (even though not indicated on drawings).

1.02 Related work in other sections includes:

- A. Providing identification, Section 16050, Basic Electrical Materials and Methods.

1.03 Quality Assurance

- A. Federal Specifications (FS): WS-865 Safety Switches
- B. National Electrical Manufacturer's Association (NEMA): ICS-1978 Industrial Controls and Systems. KS-1975 Enclosed Switches
- C. National Fire Protection Association (NFPA): NFPA 70 National Electrical Code.

PART 2 – PRODUCTS

2.01 General

- A. Disconnects shall include enclosure, nameplate, mounting stands, brackets, hardware, and accessories for a complete installation. The disconnect voltage, amperage rating, number of poles, and other configuration options shall be suitable for the equipment served.
- B. Connect to all equipment noted or as scheduled on the Drawings, and provide all cords, cord caps, circuit protection, disconnect switches and necessary devices required for proper connection of equipment.
- C. All control devices furnished by mechanical subcontractor are to be set in place by subcontractor unless otherwise noted. Control wiring between starters pneumatic electric switches, electrically operated control components, etc. provided by electrical subcontractor unless indicated otherwise.

Safety and Disconnect Switches
16150-2

2.02 Disconnects

- A. Enclosed safety switches shall be horsepower rated in conformance with Table III of Fed. Spec. W-S-865. Switches shall disconnect all ungrounded conductors.
- B. Disconnect switches shall be heavy duty with a non-teaseable, positive, quick-make/quick-break mechanism. Switches shall be provided with electrical characteristics as required by the system voltage and the load served. Disconnect switches for fractional horsepower, 120, 208 and 240 volt single phase motors may be motor rated toggle switches.
- C. Switches shall have the visible blades line terminal shields and arc suppressors.
- D. The operating handle shall have positions that are easily recognizable and capable of being padlocked in either the “on” or “off” position. The operating handle shall accept three 3/8-inch shackle padlocks to lock the disconnect in the desired position.
- E. Switches shall be provided with a door interlock that prevents the door from opening when the operating handle is in the “on” position, and prevent closing the switch when the door is open. The switch shall also be provided with a defeater to permit authorized personnel to open the door and inspect the switch when “on,” or to operate the switch with the cover open.
- F. Where specified, the switch mechanism shall be provided with one auxiliary contact that opens before the switchblades. This auxiliary contact shall be rated B150 per NEMA ICS 2-125. Line and load lugs for copper wire shall be set screw or compression type.
- G. Switches (fuse, non-fused, or circuit breaker type) to be of same manufacturers as switchgear and panelboards.
- H. Switches shall bear the manufacturer’s nameplate showing the switch type, catalog number, and ampere and horsepower ratings. In addition, each switch shall clearly identify the equipment served.
- I. Fusing:
 - 1. Disconnect switches shall be fusible or non-fusible. Equip all fusible disconnects with dual element fuses required by the equipment served. Coordinate fuse sizes at the time equipment is connected. Adjust fuse sizes if necessary to accommodate actual equipment installed. In no case shall fuses be sized small than the starter heaters on motor circuits.
 - 2. Fuse clips for all switches shall accept Class-R or Class-L fuses, if required.
 - 3. Fusible switches shall be equipped with Class R fuses. Circuit breakers shall be thermal magnetic type.
- J. Enclosures:

Safety and Disconnect Switches
16150-3

1. Indoor: Enclosures shall be NEMA 1 unless noted otherwise.
2. Outdoor or in Wet Environment: Enclosure shall be NEMA 3R unless noted otherwise.
3. Water or Wastewater treatment areas: Enclosure shall be NEMA 4X unless noted otherwise.
4. Otherwise, enclosures for switches shall be as required for conditions encountered (i.e. — Explosion proof).

2.03 Acceptable products: GE, Square-D, Cutler-Hammer/Westinghouse or approved equal.

PART 3 - EXECUTION

3.01 Inspection

- A. Verify exact location and method of connection to each piece of equipment prior to roughing-in. Where rough-in requirements are different from that shown on the Drawings, verify with Engineer before proceeding.
- B. Determine voltage and phase of each item before connecting, and if characteristics are not proper for energy available immediately notify Engineer.
- C. Verify location of all control devices with mechanical Drawings and temperature control subcontractor.
- D. Examine location of all equipment to assure adequate clearance for operation and connection.
- E. Obtain drawings from mechanical subcontractor and equipment suppliers to insure proper connections.

3.02 Installation

- A. Disconnect switches required by code shall be installed whether or not specifically shown on the drawings. Disconnect switches for refrigeration equipment and multiple motor HVAC equipment shall be fusible type.
- B. Connect motors to provide proper direction of rotation.
- C. Make connections to equipment in accordance with manufacturer's instructions and NEC requirements.
- D. Test all circuits for fusing, continuity and control.
- E. Coordinate work with other subcontractors.

END OF SECTION

SECTION 16160

CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.01 Description

- A. This section includes the furnishing and installing of electrical cabinets and enclosures as shown on the Plans or as specified.
- B. Provide terminal cabinets for Alarm systems, control systems, Telephone, Intercom and other systems as shown on Drawings.
- C. Related work in other sections includes:
 - 1. Providing identification, Section 16050, Basic Electrical Materials and Methods.
 - 2. Providing terminal strips and cable ties, Section 16120, Conductors and Cables.

1.02 Quality Assurance

- A. UL50 Cabinets and Boxes

1.03 Submittals

- A. Submit shop drawings showing all dimensions and details per Section 01300.

1.04 Product Delivery, Storage And Handling

- A. Deliver cabinets with UL label and bearing manufacturer's name. Panel exterior trims and box delivered separately with trims factory packaged to prevent damage during delivery and storage on the site.
- B. Store and handle cabinets so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

PART 2 - PRODUCTS

2.01 Materials

- A. Construction: In accordance with Section 16470, Branch Circuit Panelboards. Equipped with locking door, concealed flush hinges, flush lock, and catch assembly. All locks keyed alike to be compatible with panelboards. Size as indicated on Drawings.

Cabinets and Enclosures
16160-2

- B. Panel finish: Per Section 16470.
- C. Plywood back: Provide full width full-length medium density plywood back in terminal cabinet for mounting terminal strips.
- D. Terminal strips:
 - 1. Below 50 volts: Screw terminal type.
 - 2. Above 50 volts: 250 volt screw terminal type with barriers between each set of terminals and individual terminal points for each conductor.
- E. Identification: Identify terminal strips with permanent numbers. Identify conductors terminating on terminal strips with permanent labels attached to the conductor at the terminal strip.
- F. Wiring Diagrams: Provide wiring diagram on inside of each cabinet door showing units and conductors connected to cabinet.
- G. Provide barriers in cabinets as required to separate conductors of different systems.
- H. Enclosures located in water or wastewater treatment areas or areas otherwise exposed to rain or weather shall be enclosed in NEMA 4X enclosures. The electrical equipment enclosure shall be two-door stainless steel. Acceptable product: Hoffman A74H7224SSLP, or approved equal.
- I. Acceptable manufacturers: Square D, Circle AW, I.T.E. Imperial, GE, GTE Sylvania, or approved.

PART 3 – EXECUTION

3.01 Inspection

- A. Examine area to receive cabinet to assure adequate clearance.

3.02 Installation

- A. Install in accordance with manufacturer's instructions and NEC.
- B. Cable conductors in cabinet and fan out neatly to enter directly opposite terminals.
- C. Conduit shall be securely fastened to all cabinets with galvanized locknuts and bushing. Provide rain tight hubs as required for enclosure type.
- D. The electrical equipment enclosure shall be anchored to the concrete slab with stainless steel fasteners.
- E. All equipment attached to the electrical equipment enclosure shall be adequately

Cabinets and Enclosures
16160-3

braced and backed.

3.03 Adjustment And Cleaning

- A. Adjust exterior trims as required to fit properly against wall finish or box.
- B. Clean all foreign matter from interior and exterior of cabinet and touch-up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16210

ENTRANCE EQUIPMENT AND METERING

PART 1 - GENERAL

1.01 Description

- A. This section shall include the furnishing and installing of all necessary equipment for a new electrical service complete as shown on the Plans and specified. The work in this section includes cable plowing and installation of conduit (i.e. trenching, laying pipe, backfilling, pulling of service line, and making the necessary connections).
- B. Provide secondary service entrance and metering equipment as specified herein and as shown on the Plans.

1.02 Related work in other sections includes:

- A. Providing identification, Section 16050, Basic Electrical Materials and Methods.
- B. Providing conductors, Section 16120, Conductors and Cables.
- C. Providing raceways, Section 16130, Raceways and Boxes.
- D. Providing Service Entrance & power distribution, Section 16420, Motor Controls.

1.03 Quality Assurance

- A. Underwriters Laboratories, Inc., listing and/or approval.
- B. National Electrical Code with state and local amendments.
- C. Serving utility requirements and guidelines.

1.04 Submittals

- A. Submit complete shop drawings with dimensions, components and internal connections per 16050, Shop Drawings and Material Lists, Basic Electrical Materials and Methods.
- B. Submit operation and maintenance data per 16050, Electrical Equipment Maintenance Manuals, Basic Electrical Materials and Methods.

Entrance Equipment and Metering
16210-2

- 1.05 Product Delivery, Storage And Handling
- A. Deliver with UL label and bearing manufacturer's name.
 - B. Store equipment where protected against damage from work of other trades and weather/moisture.
- 1.06 Coordination
- A. Coordinate all aspects of the incoming electrical utility service with the serving utility representative.

PART 2 - PRODUCTS

- 2.01 Disconnect: Provide service entrance disconnect in combination with flush-mounted meter base *where required for installation*.
- 2.02 Distribution: Provide combination Control Panel and Power Distribution that is Service Entrance Rated (if Service Entrance Disconnect is not provided). See panel schedule for load requirements.
- 2.03 Metering Equipment
- A. Flush mounted meter base manufactured in accordance with current standards for Safe Meter Sockets UL ANSI-414 or ANSI-C12.7 and conforming to all requirements of the serving utility. Provisions for test and bypass facilities and number of terminals as required by serving utility. Verify all requirements. See site plan.
 - B. Acceptable manufacturers: Circle AW or approved.
- 2.04 Current Transformer (CT) Enclosure:
- A. 200 amp or less: CT Enclosure is not typically required, service is direct metered. Verify all requirements with serving utility.
 - B. Greater than 200 amp: Provide CT Enclosure sized as required for designed service. Current transformers and terminals provided by serving utility and installed by Electrical Contractor. Verify all requirements with serving utility.
 - 1. Enclosure to be constructed from code gage, galvanized steel. Enclosure shall have mounting studs for current transformer mounting (by utility), mounting holes on back and an internal grounding lug.
 - 2. Enclosure cover shall be suitable for installation (indoor/outdoor). Handle shall fold against cover when not in use. Provision shall be made for both a utility seal and a padlock to secure the cover to the enclosure.

Entrance Equipment and Metering
16210-3

3. Enclosure shall be painted with ANSI 49 gray enamel paint and shall be UL 414 listed, and be NEMA 3R rated for exterior installations.
4. Acceptable manufacturers: Circle AW or approved.

PART 3 - EXECUTION

3.01 Inspection

- A. Examine area to receive entrance equipment to assure adequate clearance for installation and coordinate architectural requirements.

3.03 Installation

- A. Install all equipment in accordance with manufacturer's written instructions and NEC.
- B. Install panels, cabinets and equipment level and plumb, parallel with structural building lines. Cover shall fit neatly, without gaps, openings or distortion.

3.04 Adjustment And Cleaning

- A. Tighten bus connections and mechanical fasteners.
- B. Clean all foreign matter from interior and exterior of entrance equipment and touch-up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16281

OVERCURRENT PROTECTION DEVICES

PART 1 - GENERAL

1.01 Description

- A. This Section shall include furnishing and installing fuses and circuit breakers as shown on the Plans or specified.

- B. Related work in other sections includes:
 - 1. Providing identification, Section 16050, Basic Electrical Materials and Methods.
 - 2. Providing conductors, Section 16120, Conductors and Cables.
 - 3. Providing raceways, Section 16210. Raceways and Boxes.
 - 4. Providing switchboards, Section 16430. Switchboards
 - 5. Providing branch circuit panelboards, Section 16470. Branch Circuit Panelboards

- C. Quality Assurance
 - 1. American National Standards Institute (ANSI).
 - a. C37.16 Preferred Ratings, Related Requirements, and Application Recommendations for Low Voltage Power Circuit Breakers and AC Power Circuit Protectors.
 - b. C37.17 Trip Devices for AC and General-Purpose DC Low- Voltage Power Circuit Breakers.
 - c. C97.1 Low Voltage Cartridge Fuses 600 Volts or Less.
 - 2. Federal Specifications (FS).
 - a. W-C-375B/GEN Circuit Breakers, Molded Case; Branch Circuit and Service, Federal Supply Classification (FSC) 5925.
 - b. W-C-375/ (1 through 20) Circuit Breakers, Molded Case, Branch Circuit and Service (FSC) 5925.
 - c. W-F-1814 Fuse Cartridge, High Interrupting Capacity. (FSC) 5920.
 - 3. Institute of Electrical and Electronic Engineers, Inc. (IEEE).
 - a. 20-73 Low Voltage AC Power Circuit Breakers Used in Enclosures (ANSI C37.13-73).
 - 4. National Electrical Manufacturer's Association (NEMA).
 - a. FU-1 Low Voltage Cartridge Fuses.
 - 5. Underwriters' Laboratories (UL).
 - a. UL 489-72 Molded Case Circuit Breakers and Circuit Breaker Enclosures.
 - b. UL 198 E Class R Fuses.
 - c. UL 198.2 High Interrupting - Capacity Fuses, Current Limiting Type.

Overcurrent Protection Devices
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- d. UL 869 Service Disconnects.
- 6. National Fire Protection Association (NFPA).
 - a. NFPA 70 National Electrical Code.

1.02 Product Delivery, Storage And Handling

- A. Deliver with UL label and bearing manufacturer's name.

PART 2 - PRODUCTS

2.01 Fuses

- A. Feeder, Branch Circuit and Service Entrance Fuses: 600 amperes and below, UL Class J or RK1 current limiting type, 600 volt 200,000 ampere interrupting capacity.
- B. Motor and Inductive Circuit Fuses: UL class RK5 time delay current limiting type, 600 volt, 200,000 ampere interrupting capacity.
- C. Control Circuit Fuses: UL Class J or R current, limiting type, 600 V.

2.02 Molded Case Circuit Breakers

- A. Branch Breakers:
 - 1. Connection to Bus: Bolt-on.
 - 2. Thermal-magnetic, molded case, with inverse time current overload and instantaneous magnetic tripping unless otherwise shown.
 - 3. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
 - 4. Multi-pole breaker shall have a common internal trip. No handle ties between single pole breaker.
 - 5. Contacts: T-rated, for heavy duty switching applications.
 - 6. Breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than ten (10) times the breaker trip rating to prevent repeated arcing shorts resulting from frayed appliance cords.

PART 3 - EXECUTION

- A. Fuse Installation
 - 1. Label each switch to indicate type and rating of fuse installed.
 - 2. All fuses shall be selected to provide selective system coordination.
 - 3. Provide 10 percent (3 minimum) spare fuses of each size and rating used.

- B. Circuit Breaker Installation
 - 1. Label each breaker located in switchboard or separate enclosure to indicate load served.
 - 2. Adjust settings on breakers to operate properly under actual field conditions and to provide selective system coordination.

END OF SECTION

SECTION 16460

TRANSFORMERS

PART 1 - GENERAL

1.01 Description

- A. Provide dry transformers at locations as indicated for deriving and 120/240-volt single-phase energy from 480-volt service voltage.
- B. Related work in other sections includes:
 - 1. Providing identification, Section 16050, Basic Electrical Materials and Methods.
 - 2. Providing grounding, Section 16060, Grounding and Bonding.
 - 3. Providing conductors, Section 16120, Conductors and Cables.
 - 4. Providing raceways, Section 16130, Raceways and Boxes.

1.02 Quality Assurance

- A. Requirements of regulatory agencies: UL, National Electrical Code.
- B. Reference standards:
 - 1. National Electrical Manufacturers Association (NEMA).
 - 2. American Standards Manufacturers Association (ASMA).
 - 3. Institute of Electrical and Electronics Engineers (IEEE).
- C. Factory Certified Test Data.

1.03 Submittals

- A. Submit shop drawings and product data sheets in accordance with Section 16050, Basic Electrical Materials and Methods.
- B. Submit factory certified test data prior to shipment. Group testing data acceptable for transformers 75 KVA and less. All test procedures in accordance with latest NEMA Standards. Test data certified by Registered Professional Engineer covering following: Ratio, polarity, core and copper losses, sound level.

1.04 Product Delivery, Storage And Handling

- A. Deliver with UL label and bearing manufacturer's name.
- B. Lift transformer using eyes, yokes and skids provided by manufacturer.
- C. Do not store transformer exposed to weather.

- D. Physically protect transformer against damage from work of other trades.
- E. Cover transformer with suitable material to avoid damage to finish.

PART 2 - PRODUCTS

2.01 Dry type transformer:

- A. Efficiency: Meet minimum efficiency standards as stipulated by the Code of Federal Regulations (CFR) 10 CFR-Part 431 and NEMA TP-1.
- B. Enclosed adequately ventilated, two winding.
- C. Insulation Type HF: UL approved for 220° C (150° C rise) for full load and temperature rise thus:
 - 1. NEMA average temperature rise of 115° above 40° C ambient.
 - 2. NEMA hot spot temperature rise of 145° C above 40° C ambient.
- D. Coils: Copper or aluminum wound continuous without splices with ample air ducts to provide cooling. Spacers must be materials guaranteed to withstand 220° C temperature. All terminations securely anchored with solderless connectors mounted on a terminal board in lower part of enclosure.
- E. Capacity (kva): As noted on Drawings.
- F. Primary winding: Voltage and phase as indicated on Drawings.
 - 1. Through 25 KVA, two (2) 5 percent taps below normal primary voltage.
 - 2. 30 KVA and larger, four (4) 2-1/2 percent taps below and two (2) 2-1/2 percent taps above normal primary voltage, unless otherwise indicated.
- G. Secondary windings: Voltage and phase as indicated in drawings.
- H. Mounting: Wall or floor as indicated.
- I. Minimum 4% impedance.
- J. Nameplate on transformer to indicate the following:
 - 1. Manufacturer's name
 - 2. Primary and secondary voltage.
 - 3. Class of insulation.
 - 4. Transformer identification "TR-A" etc.
 - 5. Temperature rating.
 - 6. Full load KVA at 115° C rise. (KVA as indicated in the transformer schedule).
 - 7. Serial number.

Transformers
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- 8. Catalog number.
 - 9. Impedance.
 - 10. Wiring Diagram

 - K. Sound control: Sound ratings for transformer to be factory certified for specific transformer supplied and approved by Engineer prior to shipment with tests conducted according to NEMA and American Standards ASA C89.1 procedures with maximum sound rating above a 23 decibel ambient.

 - L. Size: Physical dimensions of transformer to be proper for space available.

 - M. Acceptable manufacturers: Sorgel, Heavy Duty, International Transformer Corporation, GE, or approved.
- 2.02 Enclosure.
- A. Mounting:
 - 1. 10 KVA and below: Suitable for wall mounting.
 - 2. 15 through 75 KVA: Interchangeable mounting for floor, wall or ceiling as shown.

 - B. Material:
 - 1. Base: 11 gauge steel minimum.
 - 2. Remainder: 0.065-inch steel minimum.

 - C. Construction: Self-bracing, drip-proof, rodent-proof.

 - D. Outdoor Enclosures: Weatherproof and tamperproof.

PART 3 - EXECUTION

3.01 Inspection

- A. Inspect equipment upon receipt to determine if any damage has occurred during shipment. Remove covers or panels; make an internal inspection for injury or displacement of parts, loose or broken connections, cracked porcelain, dirt or foreign materials and for the presence of free water or moisture.

- B. Examine area to receive transformer to assure adequate space clearance.

3.02 Installation

- A. Core and coil shall be completely isolated from enclosure by means of vibration absorbing mounts. There shall be no metal-to-metal contact between core and coil and enclosure.

Transformers
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- B. On units 500 KVA and smaller, vibration isolating system shall be designed to provide for continual securement of core and coil unit to enclosure. Sound isolating system requiring removal of all tie down facilities not acceptable. This contractor shall be responsible for correction of excessive hum conditions.
- C. After placement of transformer in permanent location, remove shipping bracing and hold down bolts and check grounding between core coil assembly and case.
- D. Grounding.
 - 1. Visibly ground core and coils to frame of transformer cubicle with flexible grounding strap of code size.
 - 2. Secondary Neutral: Connect to nearest effectively grounded structural metal member or water pipe, per NEC 250-30.
- E. Locate transformers as required to provide ventilation in accordance with NEC.
- F. At locations where transformers are mounted on wood floors provide transformer with metal bottom or provide metal plate on floor below transformer.

3.03 Adjustment And Cleaning

- A. Adjust transformer taps after system is in operation to provide proper secondary voltage.
- B. Clean all foreign matter from interior and exterior of transformer case and coils, and touch-up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16470

BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.01 Description

- A. Provide branch circuit and sub-distribution panelboards with components as indicated.
- B. All panelboards and breakers to be fully-rated, Series rated panel boards and breakers are not acceptable.
- C. Related work in other sections includes:
 - 1. Providing identification, Section 16050, Basic Electrical Materials and Methods.
 - 2. Providing grounding, Section 16060, Grounding and Bonding.
 - 3. Providing cable ties and lugs, Section 16120, Conductors and Cables.

1.02 Quality Assurance

- A. American National Standards Institute (ANSI).
 - 1. 67 Panelboards (ANSI/UL 67).
 - 2. C37.20 Switchgear Assemblies Including Metal-Enclosed Bus (ANSI/IEE C37.20).
- B. Institute of Electrical and Electronics Engineers (IEEE).
 - 1. Std. 141-76 Electric Power Distribution for Industrial Plants.
 - 2. Std. 241-74 Electric Systems for Commercial Buildings.
- C. National Fire Protection Agency (NFPA).
 - 1. NFPA 70 National Electrical Code.
- D. Underwriters' Laboratory (UL).
 - 1. U.L. 67 Panelboards.
 - 2. U.L. 869 Service Disconnects.
- E. NEMA Standards for Panelboards.

1.03 Submittals

- A. Submit complete shop drawings with dimensions, components and internal connections in accordance with Section 16050, Basic Electrical Materials and Methods.

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- B. Submit operation and maintenance data in accordance with Section 16050, Basic Electrical Materials and Methods.

1.04 Product Delivery, Storage And Handling

- A. Deliver with UL label and bearing manufacturers name. Panelboard exterior trim separately packed to prevent damage during delivery and storage on site.
- B. Store and handle panelboards so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

PART 2 - PRODUCTS

2.01 Branch Circuit Panelboards:

- A. Type:
 - 1. NQOB for 120/208-volt panelboards with bolted breakers having minimum interrupting capacity of 22,000 amperes RMS symmetrical, unless noted otherwise at the bottom of the panel schedules. Breaker trip sizes and number of poles as indicated on the Drawings.
 - 2. NEHB for 277/480 volt panelboards with bolted type "EH" breakers having minimum interrupting capacity of 14,000 amperes RMS symmetrical, unless noted otherwise at the bottom of the panel schedules. Breaker trip sizes and number of poles as indicated on the Drawings.
- B. Bussing:
 - 1. Copper or aluminum.
 - 2. Tap Arrangement: Phase sequence type, permitting a two (2) or three (3) pole breaker to be installed at any location.
 - 3. All bolts used to connect current-carrying parts together shall be accessible for tightening from the front of the panel.
 - 4. Wiring terminals: Compression or set screw type for copper conductors; bolted to bus.
- C. Construction: Flush or surface mounted as indicated with following:
 - 1. Door with lock all keyed alike. National No. 68-226 flush panel.
 - 2. Flush mounted panels: Concealed mounting hardware for exterior trim and door. No exposed fastenings or holes permitted. Flush mounted panel located side by side are to be of same length unless otherwise indicated. Flush panels of depth greater than available wall thickness provided with box type exterior trims with edges returned to wall. Depth of return as required making up difference in depth between panel and available wall depth. Panelboards 400 amp or less shall not exceed 6" depth.
 - 3. Surface mounted panels: Completely metal enclosed. Exposed trim fastenings and hardware permitted. Surface mounted panels located side by

Branch Circuit Panelboards
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side to be same height and depth.

4. Gutters minimum of five inch with six inch required at feeder end of panel or where feeder runs inside of gutters. Separate feeder lugs and terminals for each feeder connection with lugs as specified in Section 16120, Conductors and Cables. Split door split bus panels provided with two- inch separation of sections.

D. Circuit Breakers

1. Multiple breakers common trip.
2. Combination breaker and ground fault interrupter: 10,000 amps or 20,000 IC rated, bolted connection.
3. Breakers for panel switched lighting to be labeled "SWD" for multiple operations.
4. Location of circuit breakers in panels: Install circuit breakers in panels at locations as indicated in the panel schedules.
5. Main breaker, when so equipped, shall be individually mounted separate from branch breakers. Where used as service disconnect, breaker and panelboard shall be listed for use as service entrance equipment.
6. Branch circuit breakers shall be bolt-on.
7. Provide circuit breaker handle guards to prevent accidental shut-off of equipment for breakers supplying obviously constant circuits for clocks, time switches, refrigeration, freezers, sound systems, fire alarm and other like systems as directed.

E. Identification:

1. Panelboards: In accordance with Section 16050. Locate nameplates attached to top center of interior trim. Nameplate to indicate panel, voltage and phase characteristics such as Panel 2AA, 120/208 volt, three phase. Panel labeling to correspond to distribution system labeling.
2. Circuit breakers: Number circuit breakers as indicated in panel schedules. Numbers engraved and filled in interior trim or permanently attached metal numbers equal to Wilson Heard markers or plastic numbers. Adhesive backed printed numbers not approved. Other methods of numbering as approved by Engineer.
3. Provide typewritten circuit schedules for panelboards, cross-connect panels and terminal cabinets. Schedules shall be covered with minimum of 0.018-inch thick clear rigid plastic installed in permanently attached metal frame holder located on inside face of door. Schedules to use final assigned room names/numbers, loads not plan designations.

F. Panel finish:

1. All panels shall be provided with a rust-inhibiting phosphatized primer coating approved by the paint manufacturer.
2. At all finished areas factory finish to match adjacent surfaces. Rodda Baking Enamel.
3. In unfinished or utility areas standard factory industrial gray.

Branch Circuit Panelboards
16470-4

4. Paint sides, top and front of surface mounted panels.

2.02 Lugs:

- A. In accordance with Section 16120, Conductors and Cables.
- B. Provide double or feed thru lugs at panels where feeders are extended to additional panels.
- C. Provide double capacity neutral lugs for all panelboards having an isolated bus.
- D. Provide oversized lugs as required for aluminum panel feeders to accommodate sizes shown in feeder schedule on drawings.

2.03 Weatherproof Enclosures: All exterior mounted panelboards shall be provided with a minimum rated NEMA 3R enclosure.

2.04 Acceptable Manufacturers: Square-D, GE, Cutler-Hammer, or approved. For electronic grade panelboard suppression/filter system: GE, Current Technologies, Liebert, or approved.

PART 3 - EXECUTION

3.01 Inspection

- A. Examine area to receive panelboard to assure adequate clearance for panelboard installation.

3.02 Installation

- A. Install panelboard in accordance with manufacturer's written instructions.
- B. Furnish and install three spare one-inch conduits from the top of each recessed panel, to an accessible point above the ceiling.
- C. Conduit shall be securely fastened to all panelboards and sheet metal outlet, junction, and pull boxes with galvanized locknuts, and one bushing installed in accordance with standard practice. The full number of threads shall project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be made up sufficiently tight to draw each into firm electrical contact with the box.
- D. Do not install exterior trims until finish painting is completed. Clean interior of panel (construction dust, paint over-spray, etc.) prior to installation of exterior trim.
- E. Keys: Collect all panel keys. Combine all keys on one key ring and submit at time of substantial completion.
- F. No low voltage wiring (less than 120 volt) to be installed in panel enclosures.

Branch Circuit Panelboards
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- G. Breaker handle guards shall be provided on each circuit supplying obviously constant loads to prevent accidental shutting off. Such loads are refrigeration, contactor controlled circuits, freeze protection, etc.
- H. Care shall be taken to terminate ground conductors from isolated ground receptacles only on the isolated ground bus in a panel. Do not terminate bonding conductors on an isolated ground bus.
- I. Bolt panelboards to wall structure as required for appropriate seismic zone. Provide adequate backing as required.

3.03 Adjustment And Cleaning

- A. Tighten feeder and circuit breaker connections as recommended by the manufacturer.
- B. Adjust interior trim to fit tight against exterior trims.
- C. Clean all foreign matter from interior and exterior of panelboards and touch-up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16471

FEEDER AND BRANCH CIRCUITS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all feeders shown on the Drawings and indicated by Panel Schedules and One-Line Diagram.
- B. Provide branch circuits to all outlets, devices, motors, appliances and electrical equipment unless otherwise noted.
- C. Related work in other sections includes:
 - 1. Providing raceways, Section 16130, Raceways and Boxes.
 - 2. Providing conductors, Section 16120, Conductors and Cables.
 - 3. Providing identification, Section 16050 Basic Electrical Materials and Methods, and Section 16120, Conductors and Cables.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Feeder Circuits
 - 1. Conceal feeders in all finished areas and run either overhead or underground unless specifically indicated otherwise.
 - 2. All feeder conductors to be continuous from origin to panel or equipment without splice in intermediate pull or splice box. Unless otherwise indicated each feeder raceway to contain only those conductors constituting a single feeder.
 - 3. Feeder raceways to enter directly opposite terminal lugs where possible.
 - 4. Make conductor length for parallel feeders identical.
 - 5. Provide feeder conductor identification and lugs in accordance with 16120.
- B. Branch Circuits
 - 1. Install branch circuit wiring in raceways throughout project unless otherwise indicated.
 - 2. Verify roughing-in requirements prior to installation of branch circuits. See equipment schedules, Architectural, Mechanical and Structural Drawings for equipment locations.
 - 3. See Section 16050, General Methods and Materials, Basic Electrical

Feeder and Branch Circuits
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Materials and Methods, for general installation requirements.

- C. Underground circuits where installed inside of the building below concrete slabs of a minimum of two inches may be installed in PVC raceway with two foot of rigid conduit at entrances and exists though concrete slabs. Provide grounding conductors in accordance with code or as indicated on Panel Schedules. Installation to be in accordance with Oregon Administrative Rule (OAR) 918- 290-03 (2)-1990.

END OF SECTION

SECTION 16500

LIGHTING FIXTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide lighting fixtures of type and wattages indicated on Drawings by letter and number shown adjacent to lighting outlet symbol. A fixture typical for location is to be installed at every lighting outlet unless otherwise indicated.
- B. Provide fixtures complete with lamps, ballasts, reflectors, diffusers, lenses, shielding, hangers, poles and accessories, concrete pole bases and fittings.
- C. Related work in other sections includes:
 - 1. Providing concrete bases for poles, Section 03300.
 - 2. Providing conductors and connectors, Section 16120, Conductors and Cables.
 - 3. Providing raceways and fittings, Section 16130, Raceways and Boxes.
 - 4. Providing fire rated enclosures at light fixtures.

1.02 QUALITY ASSURANCE

- A. UL listed or CSA certified for application.

1.03 SUBMITTALS

- A. Submit a complete list of fixtures, lamps and ballasts with catalog numbers, manufacturer's drawings, photographs or catalog sheets for approval prior to ordering fixtures. Submittal to be in accordance with 16050, Shop Drawings and Materials Lists.
- B. Submit operation and maintenance data in accordance with 16050, Electrical Equipment Maintenance Manuals.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver fixture in manufacturer's original unopened packages with labels legible and intact.
- B. Deliver with UL label and bearing manufacturer's name.
- C. Deliver poles wrapped and protected from damage.

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- D. Store and handle so as not to subject materials to corrosion or mechanical damage and in manner to prevent damage from environment and construction operation.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Fixture types: See light fixture schedule on drawings for fixture types and acceptable manufacturers.
- B. No sockets having fiber insulating liners will be permitted.
- C. Polystyrene lenses and lenses less than 0.125 inches nominal thickness shall not be permitted unless noted otherwise.
- D. Provide fixtures with ACL, damp or wet label if required for the applications indicated.
- E. All recessed fixtures shall be free of light leaks.

2.02 LAMPS

- A. All lamps of each type and color shall be by the same manufacturer.
- B. Incandescent: 125 volt rated, inside frosted type or special types shown or specified.
- C. Fluorescent lamps: 265 ma F32 type having a medium bi-pin base and T8 bulb. Color temperature of 3500K with a CRI of 80 and 2900 lumens, designed to operate on electronic instant start ballasts specifically designed for T8 lamps.
- D. Compact fluorescent: Tri-phosphor coated, color temperature of 3500K.
- E. LED: 10W minimum with a CRI of 80, 48 lumens/watt and color temperature of 3000K.
- F. HID
 1. Mogul base, lamp as required to match ANSI specification of ballast provided.
 2. Verify burning position.
 3. Lamps in open fixtures mounted at less than 15 feet shall be of the safety type in which the arc will automatically extinguish if the outer glass envelope is broken.
 4. Metal Halide: Phospor coated, color temperature of 3000K or 3200K
- F. Provide two (2) extra lamps of all types, based on initial lamping quantity.

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16500-3

- G. Acceptable manufacturers: General Electric, Phillips, Osram/Sylvania or approved.

2.03 BALLASTS

- A. Fluorescent: Instant start, Full Light Output Generic Electronic Ballast. UL listed (Class P) and CSA certified, Class A sound rating. Provide constant light output over operating ranges of 200 volts to 320 volts. Total harmonic distortion to be less than 10 percent. Average lamp crest factor to be below 1.5 and to withstand line transients as defined in ANSI/IEEE C62.41 Category A. Power factor to be 90 percent or above. Ballast to meet requirements of FCC Rules and Regulations, Part 18, Class A. Acceptable manufacturers: Advance, Osram/Sylvania, Magneter or approved.
- B. H.I.D. Ballasts: UL yellow card listed, high power factor, high reactance, Class 'H' (180 degrees C) insulation suitable for indoor application, with starting capacity to 20 degrees F. Sound level Class 'B' minimum.
- C. Voltage: Provide ballast for operation of fixtures at voltage shown by circuiting on Drawings, or otherwise indicated. Verify.
- D. Exterior Locations:
 - 1. Ballast for fixtures mounted in exterior locations shall be rated for —10° C.
 - 2. Fluorescent Low Temperature Ballasts. Zero degree ballasts for 425 and 440 ma. lamps, -20 degree ballasts for 800 and 1500 ma. lamps.
 - 3. Metal Halide and High Pressure Sodium: Constant wattage autotransformer type.

2.04 FIXTURE MOUNTING

- A. General: Provide all blocking and supports as required. Fixtures may be supported from ceiling system unless specifically indicated otherwise.
- B. Surface mounted fixtures: Provide UL approved fixtures at low-density cellulose fiber ceilings. 1-1/2 inch spacers not permitted unless specified fixture is unavailable with low-density rating.
- C. Positively attach all lighting fixtures to suspended ceiling systems. Attachment device to have capacity of 100 percent of lighting fixture weight acting in any direction.
- D. Lighting fixtures weighing more than 20 pounds but less than 56 pounds shall have in addition to the requirements outlined above, two No. 12 gauge hangers connected from fixture housing to structure above. These wires may be slack. See UBC

Lighting Fixtures
16500-4

Standards Sec. 47.1813 for additional requirements. Fixtures weighing more than 56 pounds are to be suspended from the structure and not from suspended ceilings.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify location, ceiling types and mounting requirements for each fixture prior to ordering fixtures.
- B. Verify voltage at each fixture outlet prior to installation.
- C. Examine fixtures for damage or broken parts and replace prior to installation.

3.02 INSTALLATION

- A. Coordinate installation of fixtures with other subcontractors, and verify methods of hanging and supporting required.
- B. All fixtures to be illuminated at time of acceptance.
- C. Fixtures located in mechanical and store rooms to be coordinated with ductwork, piping and structural members. Adjust stems as required for proper illumination of the area.
- D. All recessed fixtures to be flex connected to branch circuit outlet box unless fixture is provided with code approved junction box. Connection to conform to Article 410-67 of NEC.
- E. All light outlets shall be supplied with a fixture. Outlet symbols on the drawings without a type designation shall have a fixture the same as those used in similar or like locations.

3.03 ADJUSTMENT AND CLEANING

- A. Fixture supports shall provide proper alignment and leveling of fixtures.
- B. Aim adjustable fixtures as directed by Architect or Engineer. Exterior fixtures should be adjusted for proper illumination of areas.
- C. Clean all foreign matter from interior and exterior of fixtures and from exterior of poles, touch-up scratched or marred surfaces to match original finish.

3.04 TESTING

- A. Operate the complete exterior lighting system for seven (7) consecutive days. When the lighting performance is satisfactory to the Engineer, the system will be

Lighting Fixtures
16500-5

accepted.

END OF SECTION

SECTION 16620

TIME SWITCHES AND PHOTOCELLS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide time switches and photocells for control of power, lighting and equipment as indicated.

1.02 QUALITY ASSURANCE

- A. UL listed.

1.03 SUBMITTALS

- A. Submit equipment data sheets and shop drawings in accordance with 16050, Shop Drawings and Materials Lists, Basic Electrical Materials and Methods.
- B. Submit operation and maintenance data in accordance with 16050, Electrical Equipment Maintenance Manuals, Basic Electrical Materials and Methods.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver with UL Label and bearing manufacturer's name with equipment in manufacturer's original cartons with labels intact.
- B. Store and handle so as not to subject material to corrosion or mechanical damage from environment and construction operation.

PART 2 - PRODUCTS

2.01 TIME SWITCHES: Not on this project

2.02 PHOTOCELLS

- A. Flush mounted photo control with stainless steel finish plate and neoprene gasket, 1800 watt tungsten, 120 volt, Intermatic K-4021, 2000 watt tungsten, 208 volt, Intermatic K4024, 3000 watt tungsten, 277 volt, Intermatic K4033, 3000 watt tungsten 480V, Intermatic K4035.
- B. Conduit mounting, heavy duty, relay type, photo control, 1800 watt tungsten, 120 volt. Intermatic K-4121 or approved.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify mounting location of photo controls to insure proper operation from outside lighting. In general, photo control mounting exposed to north.

3.02 ADJUSTMENT AND CLEANING

- A. Clean all foreign matter from exterior and interior of equipment, and touch-up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16730

TELEMETRY SYSTEM

PART 1 - GENERAL

1.01 Summary

- A. Well No. 4 will be added to the city's existing telemetry system. The existing system is comprised of ESTeem radios with Zetron telemetry modules.
- B. The new system shall be a radio telemetry system for peer-to-peer communications with the EXISTING SCADA SYSTEM located at the Wastewater Treatment plant. The radio system shall be ESTeem serial radios with licensed frequency band communicating through Allen Bradley Micrologic 1200 PLCs.
- C. The following sites are included in the city's existing Telemetry System:
 - 1. Reservoir
 - 2. Well No. 1
 - 3. Well No. 2
 - 4. Well No. 3
 - 5. Wastewater Treatment Plant (for SCADA reporting and Alarm Control.)
- D. The Telemetry System contractor is responsible for coordinating with the Instrument and Control Contractor, SCADA System Programmer Electrical Contractor to provide a complete system for status annunciation, alarm control (indication and acknowledgement), and Autodialer.
- E. The Radio Telemetry Contractor shall coordinate with the Electrical Contractor to provide 120-volt power as required at each site for a complete installation. Care shall be taken to make sure that supply power is included in the appropriate bid item.
- F. All components shall be UL Listed or UL Recognized for the indented purpose. The entire assemblies shall be UL Listed. If a suitable component cannot be found with these ratings, follow UL508A guideline for installation requirements for the component

1.02 Related Work In Other Sections

- A. Section 16910, Instrumentation and Control.
- B. Section 16920, SCADA System.

1.03 Qualified Contractor: The contractor shall be pre-approved by The City, and have prior familiarity of the complete Control, Telemetry and SCADA systems currently in use by The City. Approved contractor shall have an office with service personnel within 100 miles

of the City of Sisters.

- A. Approved Contractors: Powers of Automation, Energyneering or as otherwise pre-approved by The City.

1.04 Submittals. Post-Contract Award Submittals shall be in accordance with Division 1, GENERAL REQUIREMENTS and Section 16050, Electrical — Materials & Methods. The following information shall be provided.

- A. Catalog information and detail specification sheet on all controllers, recorders, indicators, transmitters, primary elements, and gauges that are provided under this section.
- B. Catalog information on all electrical devices furnished as part of the control panels and enclosures. Provide a Bill of Material (BOM) for the control panels and provide catalog information and/or specification sheet for each component with electrical ratings. Arrange the BOM and cut sheets in the order they appear in this specification.
- C. Shop drawings and catalog material for all control panels and enclosures.
- D. Panel elementary diagrams of pre-wired panels. Diagrams shall be similar to those diagrams shown on the Drawings, but with the addition of all switched analog signals and all auxiliary devices such as relays, terminals, alarms, fuses, lights, fans, heaters, etc.
- E. Interconnecting wiring diagrams, showing all components and panel terminal board identification numbers and external wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g., terminal junction boxes, motor control centers, etc.).
- F. Provide loop diagrams for each analog loop showing terminal numbers, power supply connections, isolation relays, dropping resistors, etc. The loop diagrams shall be divided into required areas which may include panel face, back panel, junction boxes, and field. Present a tabular summary of: (a) the device tag, (b) description of device, (c) range of instrument, (d) output type and load capacity, and (e) input impedance of receiving instruments.
- G. The control system shall be described in a Functional Specification (FS) document. The FS will describe each control function and include interlocks, operation, alarms, and the HMI displays and controls associated with the function. The FS will describe in detail the alarms generated by the system, alarm indication, and control action created by the alarm. The FS will describe the interface to other equipment (generator, telemetry, etc.) and security. The FS will be submitted to the City for approval before programming is started.

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- H. Submit a spare parts list showing quantities of spares per this specification. Include a material suppliers list with supplier name and phone numbers.
- I. Submit nameplate schedules for field devices, control panel door mounted devices, and other. Provide exact text description, text size, and color of tag background and color of text.
- J. Contractor shall create and submit test procedures in accordance with this specification.

1.05 Operations And Maintenance (O&M) Manuals

- A. At project completion, furnish 5 complete sets of O&M Manuals for the Telemetry System including:
 - 1. As-built, typed materials list and spare parts list.
 - 2. As-built panel construction drawings, schematic diagrams, loop diagrams as specified.
 - 3. Manufacturers published equipment user manuals, instruction sheets, and maintenance manuals for all items furnished under this section.
 - 4. Provide the O&M Manuals in 3 ring binders with title sheet including project name, date, equipment name, owner's name, supplier's company name. Provide typed tabular dividers for each section with a table of contents. If more than one volume is required, include the table of contents for all volumes in each volume.
 - 5. Provide as-built copies of each radio modern configuration.
 - 6. Provide complete parameter listing for all configurable devices provided under this contract.

1.06 STANDARDS

- A. NEC - National Electrical Code - 2005, NFPA No. 70.
- B. ISA - Instrument Society of America
- C. ICS - NEMA (National Electrical Manufacturer's Association) Industrial Control and Systems including:
 - 1. ICS-1 General Standards for Industrial Control and System.
 - 2. ICS-2 Standards for Industrial Control Devices, Controllers and Assemblies.
 - 3. ICS-3 Industrial Systems.
 - 4. ICS-4 Terminal Blocks for Industrial Control Equipment and Systems.
 - 5. ICS-6 Enclosures for Industrial Controls and Systems.
- D. UL508A Standard for Industrial Control Panels.

PART 2 - PRODUCTS

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- 2.01 **TELEMETRY HARDWARE:** The telemetry system will require hardware modifications by adding PLC, radio modem, antenna, cables, and lightning protection to each site listed.
- A. Provide Allen Bradley Micrologix 1200 model 1762-L24AWAR and analog input module 1762-IF4.
 - B. Provide ESTEEM radio modems, Model 192 with serial interface. Provide radios with frequency as licensed with the City of Sisters.
 - C. Provide antenna, required cabling, and lightning protection for installation by electrical sub-contractor.

PART 3 - EXECUTION

3.01 Installation

- A. Provide a site survey before the antennas are installed to ensure proper mounting height, location of repeater sites if required, and identify locations that may cause radio frequency interference with the telemetry system.
- B. The site shall have the PLC and radio modems installed in a NEMA 4 enclosure. All PLC IO shall be wired to terminal strips. All analog inputs shall be individual fused.
 - 1. Well No. 4 will be a new telemetry installation. The PLC in the control panel will be connected to the radio modem. Program the PLC as required to provide the desired functionality for these signals and include:
 - a. Well No. 4 Flow Totalizer,
 - b. Well No. 4 Pump Start Counter
 - c. Well No. 4 Run Time Accumulator.
 - 2. Interconnection between the Well No. 4 control panel and the telemetry panel will include:
 - a. Well No. 4 Pump Running,
 - b. Well No. 4 General Failure,
 - c. Well No. 4 Power Failure
 - d. Well No. 4 Flood Alarm,
 - e. Well No. 4 Intrusion Alarm,
 - f. Well No. 4 Pump Call to Run,
 - g. Well No. 4 System Pressure,
 - h. Well No. 4 Flow (gpm)
 - i. Well No. 4 Chemical Feed Failure.

3.02 Testing

- A. Testing of the telemetry system shall have the same requirements as the control

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system testing in accordance with section 16910.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 Payment for work described shall be included in the lump sum amounts stated in the Bid Schedule for Telemetry System.

END OF SECTION

SECTION 16910

INSTRUMENTATION AND CONTROL

PART 1 – GENERAL

1.01 Summary

- A. This section covers all work necessary for furnishing adjusting, testing, documenting, and starting up the Instrumentation and Control (I & C) System.
- B. Major constituents for this system include, but are not limited to, Well Pump Control Panel with Allen Bradley PLC and IO, Allen Bradley reduced Voltage starter, submersible level transmitter, and radio telemetry system for peer to peer communications with the existing telemetry system.
- C. Include all field devices specified and shown on the drawings. Field devices shall be installed by electrical contractor, tested and calibrated by Division 17 Sub-Contractor.
- D. Responsibility for Complete System:
 - 1. The Contractor shall be ultimately responsible and shall provide for the supply, adjustment, and start-up of a complete coordinated system, which shall reliably perform the specified functions.
 - 2. Work includes under this contract is programming, operator training, and documentation.

1.02 Related Work In Other Sections

- A. Electrical Service Entrance, Section 16210, Entrance Equipment and Metering.
- B. Section 16730, Telemetry System.
- C. Section 16920, SCADA System.

1.03 Qualified Contractor: The contractor shall be pre-approved by The City, and have prior familiarity of the complete Control, Telemetry and SCADA systems currently in use by The City. Approved contractor shall have an office with service personnel within 100 miles of the City of Sisters.

- A. Approved Contractors: Powers of Automation, Energyneering or as otherwise pre-approved by The City.

1.04 Quality Assurance

- A. NEC - National Electrical Code - 2005, NFPA No. 70.

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- B. ISA - Instrument Society of America
- C. ICS - NEMA (National Electrical Manufacture's Association) Industrial Control and Systems including:
 - 1. ICS-1 General Standards for Industrial Control and System.
 - 2. ICS-2 Standards for Industrial Control Devices, Controllers and Assemblies.
 - 3. ICS-3 Industrial Systems.
 - 4. ICS-4 Terminal Blocks for Industrial Control Equipment and Systems.
 - 5. ICS-6 Enclosures for Industrial Controls and Systems.
- D. UL508A Standard for Industrial Control Panels.

1.05 Submittal Data

- A. Post-Contract Award Submittals shall be in accordance with Division 1, General Requirements and Section 16050, ELECTRICAL - Materials and Methods. The following information shall be provided.
 - 1. Catalog information and detail specification sheet on all controllers, recorders, indicators, transmitters, primary elements, gauges which are provided under this section.
 - 2. Catalog information on all electrical devices furnished as part of the control panels and enclosures. Provide a Bill of Material (BOM) for the control panels and provide catalog information and/or specification sheet for each component with electrical ratings. Arrange the BOM and cut sheets in the order they appear in this specification.
 - 3. Shop drawings and catalog material for all control panels and enclosures.
 - 4. Panel elementary diagrams of pre-wired panels. Diagrams shall be similar to those diagrams shown on the Drawings, but with the addition of all switched analog signals and all auxiliary devices such as relays, terminals, alarms, fuses, lights, fans, heaters, etc.
 - 5. Interconnecting wiring diagrams, showing all components and panel terminal board identification numbers and external wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g., terminal junction boxes, motor control centers, etc.).
 - 6. Provide loop diagrams for each analog loop showing terminal numbers, power supply connections, isolation relays, dropping resistors, etc. The loop diagrams shall be divided into required areas which may include panel face, back panel, junction boxes, and field. Present a tabular summary of: (a) the device tag, (b) description of device, (c) range of instrument, (d) output type and load capacity, and (e) input impedance of receiving instruments.
 - 7. Submit a spare parts list showing quantities of spares per this specification. Include a material suppliers list with supplier name and phone numbers.
 - 8. Submit nameplate schedules Koi field devices, control panel door mounted devices, and other. Provide exact text description, text size, and

9. color of tag background and color of text.
9. Contractor shall create and submit test procedures in accordance with this specification.

1.06 Operations And Maintenance Manuals

- A. At project completion, furnish 5 complete sets of O&M Manuals for the pump station including:
 1. As-built, typed materials list and spare parts list.
 2. As-built panel construction drawings, schematic diagrams, loop diagrams as specified.
 3. Manufacturers published equipment user manuals, instruction sheets, and maintenance manuals for all items furnished under this section.
 4. Provide the O&M Manuals in 3 ring binders with title sheet including project name, date, equipment name, owner's name, supplier's company name. Provide typed tabular dividers for each section with a table of contents. If more than one volume is required, include the table of contents for all volumes in each volume.
 5. Provide as-built copies of each PLC program.
 6. Provide complete parameter listing for all configurable devices provided under this contract. This includes but is not limited to the soft start, flow meters, panel mounted displays, etc.

PART 2 - PRODUCTS

2.01 CONTROL PANELS

- A. Panel shall be completely fabricated; instruments installed, and wired in the manufacturer's factory. All wiring shall be completed and tested prior to shipment. All external connections shall be by way of numbered terminal blocks.
 1. The Control Panel shall include:
 - a. Main breaker with door interlock mechanism
 - b. 480-Volt Power Distribution to 120/240-volt transformer and facility heater.
 - c. Control transformer and associated power distribution
 - d. PLC and associated IO
 - e. Instrumentation power supply
 - f. Radio modem (see Section 16730)
 - g. Thermal management including ventilation fan
 - h. Reduced voltage starter.
 2. Panels shall be NEMA 3R/12. In addition to the NEMA standards, the panels shall conform to the following requirements.
 - a. Minimum metal thickness shall be 14-gauge.
 - b. All doors shall be rubber gasketed with continuous hinge.
 - c. Provide, Hoffman, H.F. Cox, or equal.
 - d. Panels shall be so sized as to adequately dissipate heat generated

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- e. by equipment mounted in or on the panel.
Provide enclosure manufacturer's doorstop kit.
- B. Control Panel Electrical:
- 1. Power Distribution within Panels, provide circuit breakers instead of fuses wherever practical.
 - 2. Wiring:
 - a. All electrical wiring shall be in accordance with the applicable requirements.
 - b. Power wiring shall be 600 volt rated; PVC insulated stranded copper and shall be of the size required for the current to be carried, but not below 14 AWG.
 - c. Control wiring shall be 600 volt rated, type MTW, and not less than 16 AWG.
 - d. Wiring for signal circuits shall be twisted shielded pairs no smaller than No.18 AWG, and be separated from any power wiring and routed to minimize induction of electrical noise.
 - e. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks.
 - f. Numbering. Provide vinyl cloth or plastic machine numbered labels or machine printed heat shrink labels at each end of each control, signal, and power conductor termination. This shall be done at all terminations including at terminal blocks, I-O terminals (even if number is duplicated on the terminal), and the back panel termination at panel mounted devices.
- C. Label all components within the control panels with their tags as identified on the wiring diagrams or other identifying designations so that they can be easily identified. Miscellaneous components such as relays may be labeled using a "Dynamo" type plastic tape label and may be affixed to an adjacent location when the component is removable.
- D. Packing. Panels requiring shipment or storage shall be crated with solid plywood sheeting and sufficient blocking and protective material to prevent damage during shipment and storage.
- E. Provide control transformer sized adequately for the load. Provide a 120 VAC GFI outlet with minimum 5 amps power and labeled "no motors, 5 amps only". Provide Square D 9070TF series, Allen Bradley, or approved equal.
- F. Provide thermostatically controlled cooling fan package including fan, intake and exhaust filters, stainless steel grills, finger protection, and thermostat. All components shall maintain the NEMA 12 rating of the control panel. Provide

Hoffman fan kits or approved equal.

- G. Provide panel interior light, 2-tube fluorescent, with door activation switch. Provide light kit accessory from panel manufacturer.

2.02 Indicating Lights, Switches, Pushbuttons

- A. All panel mounted control switches (pushbutton or selector type) and indicating lights shall be of heavy-duty, oil-tight construction. Units shall be of round construction. The devices shall have custom Legends, button and lens colors as indicated.
- B. All indicating units shall be 120-volt AC. Provide "push-to-test" type indicating units, unless a "Lamp Test" switch is provided to test the units.
- C. Switches shall be provided with sufficient contact blocks to accomplish the desired switching functions as shown.
- D. The switches and indicator lights shall be of one manufacturer. Units for this project are designed based on the Square D. Co. Type T or Allen-Bradley Type 800T components, or approved equal. Provide LED lamps, full voltage, with high density clusters to ensure visibility during day light operation.
- E. Provide RED exterior (weatherproof alarm strobe to be mounted where shown on plans. Strobe shall be energized upon any critical alarm. Coordinate with owners and engineer.

2.03 Reduced Voltage Starter (Softstart)

- A. Provide reduced voltage starter with internal bypass contactor, sized adequately per the electrical drawings and environment conditions at the site, and with pump start option. Mount the Human Interface Module (HIM) on the control panel door. Provide Allen Bradley SMC Flex with Pump Option, no substitutions to match existing City equipment.
 - 1. Mount the motor controller securely, utilizing threaded steel inserts (1/4- 20 minimum) permanently fixed to the back panel. Fasteners shall allow installation and removal of the controller unit with common tools, from the front of the back panel. Unit features and options shall include:
 - 2. Pump Control option for "pump curve" start and stop.
 - 3. Built in SCR Bypass/Run contactor.
 - 4. Electronic motor overload protection.
 - 5. Under-voltage, over-voltage, and voltage unbalance protection.
 - 6. 480V MOV protective modules for both line and load sides.
 - 7. Furnish line and load side lugs for power conductors. Lugs shall be as specified by the controller manufacturer. They shall be UL rated for the conductors used and 125% of motor nameplate current.

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8. Furnish door-mounted Human Interface Module, Allen-Bradley Part No. 20-HIM-CSS. Provide HIM cable 1202-H30 (3 meters).

2.04 Panel Mounted Display

- A. The well level and system pressure will require a panel mounted display, each with one alarm output. The unit will require a 4 - 20 mA or 1 to 5 VDC input and a form C alarm output. Provide Precision Digital PD690, Watlow 93 series, or approved equal.

2.05 Programmable Logic Controller (PLC)

- A. The Programmable logic controller processor shall be Allen-Bradley Micrologix 1400 model 1762-L24AWAR, unless otherwise specified.
- B. Analog input module required shall be 1762-IF4 unless otherwise specified.
- C. 120 VAC discrete input modules are required and shall be 1762-IA16 unless otherwise specified.
- D. 24 VDC discrete input modules are required and shall be 1762-IB16 unless otherwise specified.
- E. Relay output modules are required and shall be 1762-OW16 unless otherwise specified.

2.06 DC Power Supplies

- A. A 24 VDC Class 2 power supply is required and shall be Allen-Bradley 1606 Series, Sol a Heavy Duty SDN Series, or approved equal.

2.07 General Purpose Relays

- A. Provide general-purpose relays and bases as required by the drawings. Provide 1 spare contact for each when feasible. Provide Square D 850IRS series with LED indication or approved equal.

2.08 Time Delay Relays

- A. Provide time delay relays as required by the drawings. Provide solid-state digital-set timer with 0.1 second to 9,990 hours range and 8 field-selectable operation modes. Operations include ON-delay, Repeat cycle, Signal Interval/OFF-delay, Signal-OFF delay (I and II), Interval, Cycle and Signal ON-delay/OFF-delay. Timers shall operate on 120 VAC control voltage. Control output rated for 3A, 250 VAC.
 1. Provide Omron H3CA-A or approved equal.

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2. Provide 11-pin tubular relay socket for DIN rail mounting.

2.09 Terminal Blocks

- A. Provide terminal blocks for all field wiring and as required for internal panel wiring. Provide Allen Bradley 1494-J series, or approved equal, with terminal marking system by manufacturer. Provide knife type disconnect terminals blocks for analog circuit troubleshooting and calibration purposes.

2.10 Uninterruptible Power Supply

- B. Provide double conversion UPS, 1000 VA minimum. UPS must be UL Listed or Recognized.

2.11 Surge Suppression

- A. Provide 3-phase surge suppression for the control panel with status LEDs which show the unit needs to be replaced. Provide Square D SDSA3650 or approved equal.

2.12 Pressure Sensor

- A. The Pressure Sensor shall be provided by the Control Contractor and installed by the Piping Contractor. The function of the pressure Sensor is to determine if the pump is operating with a closed valve.
- B. The system pressure transducer will measure system pressure in the range of 30 in. HG Vac to 200 psi. Provide WIKA pressure sensor model 892-13-520 or approved equal.

2.13 Level Sensors

- A. Provide monitoring relays required for Well Depth Monitor provided under Division 11, Section 11275 (specified item is Sierra Control Systems, Inc., Series WD 22 Well Depth Monitor - Verify all requirements with actual equipment supplied).
- B. Provide digital input for Low Level Alarm and Pump Shutdown.
- C. Provide digital input for Compressor Failure Alarm.
- D. Provide input (verify analog or digital) for Well Depth Monitor.

2.14 Flow Meter

- A. Provide monitoring relays required for Flow Meter provided under Division 13, Section 13420 (specified item is Endress+Hauser Promag 50W — Verify all requirements with actual equipment supplied).

- B. The outflow from the well will be monitored by a flow meter with instantaneous rate (4-20 ma output) and total flow (pulse output). Coordinate the installation of the flow transmitter's panel mounted display in the control panel door and connect the transmitter's output to the PLC input.
- C. Flow Meter shall be used to provide input to the Chemical Feed System.

2.15 Chemical Feed System

- A. Provide monitoring relays and current loop isolator required for Chemical Feed System provided under Division 11, Section 11234. Verify all requirements with actual equipment supplied.
- B. Provide output control signal to Chemical Feed System based on flow.
- C. Provide alarm and status input signals from Chemical Feed System that are transmitted via the Telemetry System to the Wonderware SCADA system.

2.16 Spare Parts List

- A. Provide spare parts as follows:
 - 1. One spare LED bulb for each color used.
 - 2. Two spare fuses for each type and amperage rating used.
 - 3. Provide 2 each spare desiccant dryers for submersible level transducer.

PART 3 - EXECUTION

- 3.01 Panels And Panel Mounted Equipment: Panels and panel-mounted equipment shall be preassembled at the control supplier's factory. No work, other than correction of minor defects or minor transit damage, shall be done to the panels at the job site.
- 3.02 Installation: Protection During Construction: Throughout this Contract, the Contractor shall provide protection for materials and equipment against loss or damage and from the effects of the weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions.
- 3.03 Electrical Power And Signal Wiring:
 - A. Plastic ties or ducts shall restrain control and signal wiring in control panels. Hinge wiring shall be secured at each end so that any bending or twisting will be around the longitudinal axis of the wire and the bend area shall be protected with a sleeve.
 - B. Arrange wiring neatly, cut to proper length, and remove surplus wire. Provide abrasion protection for any wire bundles, which pass through holes or across edges of sheet metal.

- C. Use manufacturer's recommended tool with the proper sized anvil for all crimp terminations. No more than two wires may be terminated in a single crimp lug and no more than two lugs may be installed on a single screw terminal.
- D. Wiring shall not be spliced or tapped except at device terminals or terminal blocks.

3.04 Control Description

- A. General
 - 1. The pump station will provide the following control functions:
 - a. Pump motor soft start, overload, and short circuit protection.
 - b. Hand-Off-Automatic functions.
 - c. Variable Frequency Drive functions
 - d. Alarm Monitoring and Indication.
 - e. Interface with telemetry system.
 - 2. The Pump Station control system interfaces with the Telemetry system for alarm monitoring. The PLC communicates with the telemetry system via the PLC's channel 0 (serial port) or Ethernet switch.

3.05 Functions:

- A. PUMP Control: The pump panel will control the pump motor starting and stopping, provide Hand Off Automatic function, pre-lube solenoid function, alarm monitoring and indication, interface with SCADA system, and well level monitoring. In Automatic mode, the pump will receive a start signal from Well No. 2 through the telemetry system, open the pre-lube solenoid for a set time delay, then start the well pump to provide water to the system and reservoir at a set system pressure controlled by a Variable Frequency Drive, and stop when commanded. If an alarm is activated, the system will shutdown. The Telemetry/SCADA system will be notified and appropriate personnel will be notified. In Hand operation, the start command from the Telemetry system will be ignored, the pre-lube solenoid will function normally, and the pump will start after the pre-lube time delay. The pump will continue to run until the operator turns the pump to Automatic or Off. The alarms will NOT be overridden in Hand as the alarms are for equipment protection.
- B. Automatic Operation:
 - 1. The operator places the HAND-OFF-AUTO switch in the AUTO position.
 - 2. The operator places the LUBE SOLENOID HAND-OFF-AUTO switch to the AUTO position.
 - 3. The Telemetry system sends a request for the pump to start.
 - 4. The pre-lube solenoid is opened and the pre-lube timer is started.
 - 5. The pre-lube time elapses, and the soft start controls the motors starting with a limited current.
 - 6. If an alarm is activated, the pump is stopped.

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7. When the Telemetry system removes the call to run, the pump is stopped.
 8. If the operator turns the WELL PUMP HAND-OFF-AUTO switch to OFF, the pump is stopped.
- C. Hand Operation:
1. The operator places the WELL PUMP HAND-OFF-AUTO switch in the HAND position and presses the PUMP START button.
 2. The operator places the LUBE SOLENOID HAND-OFF-AUTO switch to the AUTO position.
 3. The pre-lube solenoid is opened and the pre-lube timer is started.
 4. The pre-lube time elapses, and the soft start controls the motors starting with a limited current.
 5. If an alarm is activated, the pump is stopped.
 6. The operator places the WELL PUMP HAND-OFF-AUTO switch to the OFF position, the pump is stopped.
 7. If the LUBE SOLENOID HOA is placed in HAND to test the solenoid and set the flow rates.
- D. Alarms: Program each alarm with an adjustable on time delays. Program each alarm as a latching alarm. All latching alarms shall activate an external red strobe. See electrical plans for mounting location.
1. Well Pump 4 Failure
 2. Well Pump 4 High Pressure Shutdown
 3. Well Pump 4 Low Well Level Shutdown
 4. Well Pump 4 Emergency Stop
 5. Alarms shall include any and all Chemical Feed System alarms. Coordinate with equipment manufacturer.
- E. The following are accessed on the Control Panel Door:
1. WELL PUMP HOA (Hand Off Auto) 3 position selector switch.
 2. LUBE SOLENOID HOA (Hand Off Auto) 3 position selector switch.
 3. WELL PUMP ON red LED light, illuminates when the pump motor is running.
 4. LUBE ON red LED light, illuminates when the lube solenoid is commanded open.
 5. ALARM RESET momentary push button.
 6. EMERGENCY STOP maintained push button.
 7. HIGH PRESSURE SHUTDOWN red LED light, illuminates when alarm is active.
 8. LOW WELL WATER SHUTDOWN red LED light, illuminates when alarm is active.
 9. SYSTEM PRESSURE digital panel meter. The pressure is displayed as - 30 to 200 PSI.
 10. WELL FLOW RATE / TOTAL flow meter transmitter display. Display rate in GPM and total in GAL or a multiple of GAL.
 11. WELL PUMP 4 COUNTS digital panel meter, displays pump starts, no

reset.

12. The HIM (soft start human interface module) displays the motor current and elapsed time meter on the main display. Using the menu, the pump motor status can be displayed.

3.06 Testing And Start-Up:

- A. All elements of the Instrumentation and Control System shall be tested to demonstrate that the total system satisfies all of the requirements of this Specification.
- B. All special testing materials and equipment shall be provided under this contract.
- C. The I & C subcontractor shall coordinate all testing with the City.
- D. As a minimum, the testing shall include the following:
 1. Factory tests: Prior to shipment, all analog panels and panel assemblies shall be tested for proper operation at the manufacturer's factory. Results of the factory tests shall be recorded and submitted for approval before shipment of any panel or panel assembly to the plant.
 2. Operational Acceptance Tests:
 - a. The objective of these tests is to demonstrate that the system of Instrumentation and Control is READY for final operation.
 - b. The Control System shall be checked for proper installation, adjusted, and calibrated on an element-by-element basis to verify that it is ready to function as specified.
 - c. All system elements shall be checked to verify that they have been installed properly and that all terminations have been made correctly.
 - d. All discrete elements and systems, shall have their set points adjusted and shall be checked for proper operation (e.g., interlock function, contact closure on rising/falling P.V., etc.).
 - e. All continuous elements and systems shall have three-point calibrations performed. All controller-tuning constants shall be adjusted to preliminary settings.
 - f. The "Operational Acceptance Tests" shall be completed prior to starting the "Functional Acceptance Tests". The actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required hereinafter.
 3. Functional Acceptance Tests:
 - a. The objective of these tests is to demonstrate that the system of Instrumentation and Controls is operating and complying with the specified performance requirements.
 - b. A witnessed, "Functional Acceptance Tests" shall be performed on

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the complete system of Instrumentation and Controls. Each function shall be demonstrated to the satisfaction of the City.

- c. Each test shall be witnessed and signed off by the Contractor and the City upon satisfactory completion.
- d. The actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required hereinafter.
- e. The Contractor shall notify the City at least 1 week prior to the date of the "Functional Acceptance Test".

E. Test Procedure Development and Test Documentation:

- 1. Within 3 weeks of starting operational testing, the Contractor shall prepare and submit to the City for review, a detailed description of the test procedures that he proposed to perform to demonstrate conformance of the complete system of instrumentation and controls to this Specification. The decision of the City upon the acceptability of the test procedures shall be final.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 Payment for work described shall be included in the lump sum amounts stated in the Bid Schedule for Controls, and Testing and Start-up.

END OF SECTION

SECTION 16920

SCADA SYSTEM

PART 1 - GENERAL

1.01 Summary:

- A. The City's SCADA System is comprised of Wonderware Software at their Wastewater Treatment Facility with a Radio Telemetry system (see Section 16730, Telemetry System). Wonderware Intouch 2014 software is used to display information and alarms for the wastewater system. The fresh water information shall be integrated into the Wonderware system.
- B. Provide Wonderware upgrade to Intouch 2014. The license is for 500 tags with sufficient unused tags for this project.
- C. Provide programming additions to the Wonderware system to update all fresh water screens to include Well #4 controls, status and alarm functions similar to Well's 1,2, and 3. Update alarm information graphically, in an alarm banner on the main screen, and in the alarm history screens. Update trend screens for pressure and flow as applicable. Provide run time accumulation for pump motor and start counter.

1.02 Related Work In Other Sections

- A. Section 16730, Telemetry System.
- B. Section 16910, Instrumentation and Control.

1.03 Qualified Contractor: The contractor shall be pre-approved by The City, and have prior familiarity of the complete Control, Telemetry and SCADA systems currently in use by The City. Approved contractor shall have an office with service personnel within 100 miles of the City of Sisters.

- A. Approved Contractors: Powers of Automation, Energyneering or as otherwise pre-approved by The City.

1.04 Submittals

- A. The SCADA system modifications shall be described in a Functional Specification (FS) document. The FS will describe each display screen including screen layout shown graphically, describe equipment color changes based on status, numeric display with valid ranges, and navigation buttons. The FS will describe in detail the alarm messages and alarm indications on each screen. The FS will be submitted to and approved by the City before program modifications are started.

1.05 Operation and Maintenance Manual

- A. Provide as-built copies of the modified Wonderware application on CD or DVD media with each of the 5 required Operation and Maintenance Manuals.

PART 2 - PRODUCTS

- A. Materials: Software upgrade to Wonderware Intouch 9 with a 500-tag license.

PART 3 - EXECUTION

3.01 SCADA Software Modifications:

- A. The existing SCADA system will be updated to show data from Well #4.
- B. The Well #4 alarms will be displayed on each screens alarm banner and in the alarm history screen.
 - 1. WELL PUMP 4
 - a. WELL PUMP 4 FAILURE
 - b. WELL PUMP 4 HIGH PRESSURE SHUTDOWN
 - c. WELL PUMP 4 LOW WELL LEVEL SHUTDOWN
 - d. WELL PUMP 4 EMERGENCY STOP
 - e. WELL PUMP 4 CHEMICAL FEED FAILURE
 - f. WELL PUMP 4 COMMUNICATION FAILURE
 - g. WELL PUMP 4 FIRE/SMOKE ALARM
 - h. WELL PUMP 4 INTRUSION ALARM
 - i. WELL PUMP 4 FLOODING ALARM
 - j. WELL PUMP 4 GENERATOR FAILURE
- C. FRESH WATER SYSTEM OVERVIEW SCREEN will be updated with the following:
 - 1. WELL PUMP 4 STATUS is shown graphically with the pump icon turning green when ON, grey when OFF, flash red if in ALARM.
 - 2. WELL PUMP 4 PRESSURE numeric display, -30 to 200 PSI, flashes red if in alarm.
 - 3. WELL 4 LEVEL numeric display, 0 to xxx.x FT, flashes red if in alarm.
 - 4. WELL 4 FLOW numeric display, 0 to xxx GPM.
 - 5. WELL 4 FLOW TOTAL X 1000 numeric display, 0 to 999,999,999 Gal.
- D. FRESH WATER WELL SCREEN. A fresh water well screen shall be created for Well #4. The information listed below shall be shown.
 - 1. WELL PUMP x STATUS is shown graphically with the pump icon turning green when ON, grey when OFF, flash red if in ALARM.
 - 2. WELL PUMP x PRESSURE numeric display, -30 to 200 PSI, flashes red

if in alarm.

3. WELL x FLOW numeric display, 0 to xxx GPM.
4. WELL x FLOW TOTAL X 1000 numeric display, 0 to 999,999,999 Gal.
5. WELL x LEVEL numeric display, 0 to xxx.x FT, flashes red if in alarm.
6. WELL PUMP x RUN TIME numeric display, 0 — 999,999. 9 hours.
7. WELL PUMP x COUNTS numeric display, 0 — 999,999 counts.
8. WELL x FIRE/SMOKE ALARM status.
9. WELL x FLOODING ALARM status.
10. WELL x INTRUSION ALARM status.
11. WELL x GENERATOR FAILURE status.

- E. Configure Wonderware communication driver to communicate with the radio telemetry system.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 Payment for work described shall be included in the lump sum amounts stated in the Bid Schedule for SCADA System.

END OF SECTION

SECTION 16930

STANDBY GENERATOR

1. Furnish and install standby electrical generator for the Well, complete and ready for operation in the space provided. See drawings and these specifications. To include a dual wall sub-base diesel tank and automatic transfer switch.
2. Certificates. The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed. The generator set shall be IBC certified meeting the required maximum seismic design required.
3. General.
 - A. Test. This entire system shall be built, tested and shipped by the manufacturer of the alternator or the motor so that there is one source of supply and one responsibility.
 - B. The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.
 - C. Manufacturer. Kohler, or approved equal
4. Equipment. The generator shall be a Kohler Model 250REOZJE with a 4UA 13 alternator or approved equal. It shall provide 318.75 kVA and 255.00 kW when operating at 277/480 volts, 60 Hz, 0.80 power factor. The generator set shall be capable of a 130 degree Celsius Standby rating while operating in an ambient condition of less than or equal to 77 degrees F and a maximum elevation of 3200 ft above sea level. The standby rating shall be available for the duration of the outage. electric generating plant and a Kohler automatic transfer switch herein specified: The unit shall be rated to deliver 250 KW continuously standby for duration of power outage. The voltage shall be 480 volts, 3 phase, 4 wire, 60 hertz. Electrical generating plant shall be mounted onto skids via vibration isolators.
5. Engine. The minimum 9 liter displacement engine shall deliver a minimum of 385 HP at a governed engine speed of 1800 rpm. Engine shall be diesel driven four cycle, liquid cooled. It shall have a minimum of 6 cylinders turbo charged and be liquid cooled. Engine speed will be governed by a mechanical governor to maintain generator speed within 3 cycles from no load to full generator output. Engine shall have a 60-ampere automatic battery charging alternator with an automatic charge solid state rate voltage regulation. Starting shall be by a 24 volt positive-engagement solenoid shift-starting motor. Starting batteries shall be a BCI group 31 batteries which must meet manufacturers specifications for the ambient conditions and have a cold cranking amp of 950 amps.
6. Housing. The generator shall be supplied with a Level 2 Sound attenuated enclosure that is UL2200 listed providing a sound level of 75.2 dB(A) while the generator is operating at 100% load at 7 meters (23 feet) using acoustic insulation and acoustic lined inlet hoods constructed from high strength low alloy 14 gauge galvanized steel. The acoustic insulation shall meet UL94 HF1 flammability classification. The enclosure shall use a vertically louvered air inlet and outlet hood with 90-degree angle to discharge air up and reduce noise. The snow load rating shall be 70 lbs/sq ft or greater.

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7. Fuel oil storage. A double wall secondary containment sub-base fuel tank shall be supplied with a capacity of 500 gallons of diesel fuel. The above ground rectangular tank shall be used as a sub base for the diesel generator and have a 2" NPT opening with a lockable manual fill cap. A float switch shall be provided for low level condition and a direct reading UL listed magnetic fuel level gauge with a hermetically sealed, vacuum tested dial to eliminate fogging shall be provided. The venting shall be sized and installed according to the American Petroleum Institute Standards. The exterior finish shall be Power Armor Plus, a polyurea textured rubberized coating.
8. Alternator frequency regulation shall be plus or minus 3% no load to continuous rated load. Voltage regulation shall be plus or minus 2% across same range. Voltage Adjustment – a rheostat shall provide plus or minus 5% voltage adjustment.
9. Controller. The Advanced Power Management 402 (APM402) Generator Set Controller shall be a microprocessor-based control system that will provide automatic starting, system monitoring and protection. The controller shall be mounted on the generator and shall have integral vibration isolation. The controller shall be a standard offering in the manufacturer's controller product line.

Engine Controls.

- (a) Run Mode – when in run mode the generator set shall start.
- (b) Off/Reset Mode – when in Off/Reset mode the generator set shall not accept any remote start commands and shall be capable of resetting faults, allowing for the restarting of the generator set after shut down.
- (c) Auto Mode – when in auto mode, the generator set shall be ready to accept a signal from a remote device.
- (d) Emergency Stop that is red in color and will immediately stop the generator set and lockout the generator from any remote starting.
- (e) Alarm Horn – the horn sounds when any faults are present or the controller is not in auto mode.
- (f) Mini – USB Connection for a PC connection shall be provided.
- (g) Overspeed shutdown – shall be mechanical device separated and apart from engine speed control governor
- (h) Over cranking shutdown (after a cranking cycle of one minute, cranking shall discontinue).
- (i) Indicator panel light
- (j) Red indicating lights and alarm terminals for remote alarm shall be incorporated for each of the four main shutdown features (a remote alarm shall be installed and interconnected with main electrical panel alarm system and dialer to call operator if problems occur).
- (k) All generator shut down or alarm features shall have an indicator light on the generator control panel. The alarm failure shall be tied to the alarm panel.

Generator Controls.

- (a) Manual reset circuit breaker, main line, size as indicated on drawings.
- (b) Voltmeter dual range – internally connected for all output voltage connections

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- (c) Ammeter dual range – internally connected for all output voltage connections.
- (d) Combination voltmeter-ammeter selector switch and range indicating light.
- (e) Running time meter, Number of starts meter, Oil Pressure, Coolant Temperature, Battery Voltage, Fuel level, .
- (f) Frequency meter (need type)
- (g) Voltage adjusting rheostat
- (h) Current transformers

Generator Overcurrent and Fault Protection. The generator shall be provided with a factory installed 80% rated line circuit breaker rated at 400.00 amperes that UL 489 listed.

Automatic Transfer Switch (ATS)

- (a) An automatic system load transfer control, 400 amp Kohler and Breaker Rated – Programmed Transition (KCP)/KCP – AMTA-0400#. Any alternate shall be submitted for approval to the City Engineer.
- (b) Enclosure. The ATS shall be furnished in a NEMA 1 enclosure for outdoor installation.
- (c) Construction. The automatic transfer switch design shall incorporate interchangeable modules to provide maximum flexibility and ease of service. The enclosure with key-operated door lock, shall contain a swing-out control accessory panel shall accommodate future control accessory additions.

The transfer switch shall be electrically operated and mechanically interlocked to positively prevent the load from being simultaneously energized by normal power and emergency power, and shall be mechanically held on line side of transfer switch. Each set of contacts shall be of double break design for fast arc suppression. The contacts shall consist of solid silver cadmium oxide.

Individual heat resistant contact chambers shall completely enclose the contacts.

- (d) Include adjustable solid state low and high voltage sensing relays, under voltage 5% to 20%, below start 75-100%. Stop and over voltage 101-116%, start and 2 – 15% below to stop.
- (e) Provide a solid state timer to signal the generating set to start after an adjustable time delay of 0.5 to 10 seconds.
- (f) Provide a time delay on transfer to allow the engine generator to stabilize after reaching proper voltage and frequency, before automatically transferring the load to the emergency generating set.
- (g) Provide automatic retransfer (with 0 to 30 minute adjustable time delay) of the load from generating set to the normal source.
- (h) Provide an automatic bypass to retransfer the load from generating set to normal source if generating set output interrupts after normal sources restores voltage.
- (i) Provide a solid state time delay on stop to signal the generating set to continue running unloaded for an adjustable 0.5 minutes after retransfer.
- (j) Provide a 2-amp, SCR voltage regulated, current limited float charger to maintain

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- fully charged cranking batteries. Mounted as part of the transfer switch.
- (k) Provide a test switch to simulate an interruption of power from the normal source.
 - (l) Provide an exerciser clock to automatically simulate a normal source of interruption on a predetermined schedule, such as 30 minutes every week.
 - (m) Provide a switch to select “with load” or “without load” to test or exercise as follows:
 - 01 “Without Load”, the generating set runs unloaded.
 - 02 “With Load”, the automatic transfer switch transfers load to generating set, after time delay, the same as it would for a normal source interruption.
 - (n) Provide a device to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.
 - (o) Provide a battery voltage sensor with indicating lamps and isolated alarm contacts to signal a battery charger malfunction.
 - (p) Meter and lamp combination. Indicating meters and lamps shall be front mounted for easy reading without opening doors.
 - (q) Warranty. The generator set shall include a standard warranty covering five years or 3000 hours of operation after the Electric Standby Power System is first placed in service, whichever occurs first. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. A service agreement shall be available.
 - (r) Field tests. The Electric Standby Power System shall be field tested in the presence of the Engineer’s representative. This test shall include, but not be limited to, a 2 hour full load test. An auxiliary load bank with appropriate cables, meters, etc., shall be provided. Recordings at regular intervals shall be made of voltage, frequency amperage, engine temperature, and lube oil pressure. A report shall be furnished to the Engineer detailing the test results. Any failure to comply with the specifications shall be immediately rectified without additional cost to the Owner.

END OF SECTION

SECTION 16940

VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.02 Summary

- A. This section covers all work necessary for furnishing adjusting, testing, documenting, and starting up the variable frequency drives (VFD) System.
- B. Major constituents for this system include, but are not limited to, variable frequency drives (VFD), VFD controls, pump controller and submersible level transmitter.

PART 2 - PRODUCTS

- 2.01 Acceptable manufacturers: Danfoss or equivalent as approved by the City.

PART 3 - PUMP CONTROLLER

3.01 Description

- A. The pump controller shall consist of all the components, hardware and software necessary for pump operation.

3.02 Operation

- A. The control system shall be designed to operate multiple pumps.
- B. The control function shall provide for the operation of the pumps under normal conditions, and shall alternate the pumps on each pump down cycle to equalize the run times. In the event the incoming flow exceeds the pumping capacity of the lead pump, subsequent pumps shall automatically start to handle the increased flow. As the flow decreases, the pumps shall cut off at the elevations specified.
- C. The control shall function as described below. The equipment listed below is minimum requirements and do not limit the use of necessary components to provide a system that will function as required.

3.03 Project Conditions

- A. The Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated.
 - 1. Ambient Temperature: No less than -20 deg F (- 28 deg C) or exceeding

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- 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24- hour period.
2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
3. Humidity: Up to 100 percent.

- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for pump controls, including clearances between pump controls and adjacent surfaces and other items.

3.04 Coordination

- A. Coordinate features of control panels, VFDs and accessory devices with remote pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each pump control panel, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

PART 4 - VARIABLE FREQUENCY DRIVES

4.01 Description

A variable-frequency power converter/drive will allow variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency. The intent of the VFD system is to operate each pump at the most efficient speed and frequency. The VFD will be sized for the pumps supplied. The VFDs will be mounted remotely inside the main control cabinet.

4.02 Hardware

- A. General Requirements for VFDs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.
- B. Application: Constant torque.
1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
 2. Units suitable for operation of inverter-duty motors as defined by NEMA MG
 3. Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 4. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
 5. Listed and labeled for single-phase use by an NRTL acceptable to authorities having jurisdiction

6. Design and Rating: Match load type which is 120/240 voltage.
- C. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- D. Unit Operating Requirements:
 1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFD input voltage rating.
 2. Input AC Voltage Unbalance: Not exceeding 3 percent.
 3. Input Frequency Tolerance: Plus or minus 3 percent of VFD frequency rating.
 4. Minimum Efficiency: 98 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
 6. Overload Capability: 1.1 times the base load current for 60 seconds.
 7. Starting Torque: Minimum of 100 percent of rated torque from 3 to 60 Hz.
 8. Speed Regulation: Plus or minus 5 percent.
 9. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
 10. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

PART 5 - VFD CONTROLS AND INDICATION

5.01 Description

The VFD controls shall consist of all the components, hardware and software necessary for VFD operation.

5.02 Hardware

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
 1. Power on.
 2. Run.
 3. Overvoltage.
 4. Line fault.

5. Overcurrent.
 6. External fault.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 3. Control Authority: Supports at least four conditions: Off, local manual control at VFD, local automatic control at VFD, and automatic control through a remote source.
- C. Historical Logging Information and Displays:
1. Running log of total power versus time.
 2. Total run time.
 3. Fault log, maintaining last four faults with time and date stamp for each.
- D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFD parameters, including, but not limited to:
1. Output frequency (Hz)
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent)
 8. DC-link voltage (V dc).
 9. Set point frequency (Hz).
 10. Motor output voltage (V ac).

PART 6 - SUBMERSIBLE LEVEL TRANSMITTER

6.01 Description

Sensors, signal processors, hardware and wiring to produce local sensing and transmitting a linear signal proportional to the water level.

6.02 Hardware

A. System Description:

1. The level transmitter shall have equal to or better than $\pm 1\%$ full scale accuracy, less than $0.05\%/^{\circ}\text{F}$ drift, direct air pressure compensation, temperature compensation, and less than 0.1% drift during the first year of operation.
2. The level transmitter shall produce a linear 4-20mA signal proportional to the measured level, and capable of transmission over a maximum 600-ohm loop resistance.
3. The level transmitter shall have a ceramic diaphragm in an iron rod reinforced NEMA 6P polypropylene and POM housing, or equivalent.
4. The level transmitter shall have an oil resistant PVC jacketed, 2x AWG-20 wire shielded cable, or equivalent.
5. The level transmitter shall be CE compliant.
6. The level transmitter shall be UL certified and approved for use in Class 1 Division 1 Groups A-D hazardous atmospheres.
7. The level transmitter shall have a minimum operating temperature range from 32 to 140°F.
8. The level transmitter shall be 10-29VDC loop powered from the flow converter, or equivalent.
9. System shall include optional cable bracket

PART 7 - SOURCE QUALITY CONTROL

7.01 Description

During completion of the system installation, the Contractor shall provide a two day site visit from a technical representative to ensure that the system meets all manufacturer specifications in addition to the following quality control requirements:

- A. Testing: Inspect and test according to requirements in NEMA ICS 18.
- B. VFD Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2.
 1. Test each VFC while connected to its specified motor.

2. Verification of Performance: Rate VFDs according to operation of functions and features specified.

- C. Controls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 8 - WARRANTY

- A. All applicable third party warranties on materials will be transferred to the City of Sisters.

END OF SECTION