SECTION 15010

basic mechanical materials and methods

# GENERAL

## WORK INCLUDED

### Basic requirements for products which are specified in the following divisions.

#### Division 2 - Sitework

#### Division 11 - Equipment

#### Division 13 - Special Construction

#### Division 15 - Mechanical

#### Division 16 - Electrical

## RELATED WORK

### Section 01000 – General Requirements

### Section 01300 – Shop Drawings and Submittals

### Section 01630 – Product Substitution Requirements

### Section 01783 – Operating and Maintenance Data

### Section 01820 – Start-up, Testing, and Commissioning

## SYSTEM DESCRIPTION

### Furnish and install complete operating mechanical systems including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with manufacturer’s installation requirements, for compliance with applicable building codes and standards, and as needed to permit systems to perform all functions required by the Contract Documents and described in Manufacturer’s printed literature.

## QUALITY ASSURANCE

### Before shipping, operate valves, motors, pumps, actuators and mechanical equipment at factory to ensure products are complete and in working condition.

### Piping systems and elements shall comply with ASME Codes, and appropriate ASTM, API or AWWA standards.

### Welders on steel pressure piping or tank work shall be AWS certified as boiler and pressure vessel welders per Section IX Part A of AWS B2.1 as required by AWWA C200 paragraph 3.3.3.1.

### Products requiring electrical connection shall be listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose shown.

### Wiring terminations shall match branch circuit conductor quantities, sizes, and materials shown. Enclose terminal lugs in terminal box sized to NFPA 70.

### If products are furnished which differ from those shown and which require changes to enclosures, mounting and support structures, power and control circuitry or other work to accommodate furnished product, provide changes required at no additional cost to Owner and of same quality as shown.

## REFERENCES

### ANSI/AWS 2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination ANSI B1.1 Unified Screw Threads

### ASME Boiler and Pressure Vessel Code, Section VIII, Rules for Construction of Pressure Vessels, Division 1.

### ASME B31.3 Process Piping

### ANSI/AWS B2.1 Standard Welding Procedure Specifications

### AWWA C105 Polyethylene Encasement for Ductile-Iron Pipe Systems

### AWWA C200 Steel Water Pipe 6-inch and Larger

### NFPA 70 National Electrical Code

## SUBMITTALS

### Shop Drawings for piping shall include the following:

#### Key or index showing locations of spools and fittings.

#### Order of installation. Each spool shall receive a unique mark number. No other spool or fitting, even on separate pipelines or casings included in the contract, shall have the same mark number. The sequential order of the mark numbers shall correspond to a logical order of installation for each pipeline.

#### Laying lengths, dimensions, clearances and tolerances for all spools and fittings.

#### Station and invert elevation of all grade changes and changes in horizontal alignment

#### Slopes of pipe not vertical or horizontal.

#### Horizontal and vertical alignment data for all curves, bends, tees and outlets.

#### Couplings and end types of all pipe, spools, fittings, outlets and adjacent valves or pipeline equipment.

#### Proposed linings and coatings for pipe, fitting and couplings.

#### How connections will be made between Work under this contract and existing work or work under other contracts.

#### 1Pipe and valve support sizes and locations including anchor bolt sizes and embedment.

#### Relationship of piping to other Work.

### Shop Drawings for valves, pumps or pipeline equipment shall include the following:

#### Laying lengths and dimensions, clearances, tolerances and end types.

#### Weight and type of valves, pumps or equipment.

#### Valve and pump port sizes and tolerances.

#### Dimensions and orientation of actuators and pilot systems. Locations of actuator stops.

#### Proposed linings and coatings.

#### Performance characteristics.

#### Parts and materials lists and ratings and details of appurtenances to be furnished, along with references to appropriate ASTM, Federal Specifications and other reference standards and grades.

#### Piping and conduit attachments and sizes.

### Shop drawings for structures shall include the following:

#### Lengths, widths, thickness, embedment, dimensions and tolerances of structural members.

#### Detailing of openings and wall penetrations including doors, windows, hatches, louvers, vents, ducts, and all floor, wall and door penetrations.

#### Connection details including applicable sizes, diameters, thickness, spacing, embedment and edge distances of bolts, anchors, rivets, nails, screws, spikes, connection plates, holdowns and other fasteners.

#### Welding details using standard ANSI/AWS 2.4 symbols and showing type, electrode, length, spacing and thickness of welds.

#### Materials listing and properties including types, strengths and finishes of concrete, masonry, metals, wood, plastics and other construction materials.

### Shop Drawings for Equipment shall include the following:

#### Dimensions, clearances and floor space requirements.

#### Weight and type of equipment.

#### Location where product will be installed.

#### Anchor bolt sizes and embedment.

#### Finishes and coatings.

#### Performance characteristics.

#### Parts and materials lists and ratings and details of appurtenances to be furnished, along with references to appropriate ASTM, Federal Specifications and other reference standards and grades.

#### Piping and conduit attachments and sizes.

#### operation and Maintenance Manuals (separate submittal).

### Shop Drawings for Electrically Powered or Controlled Equipment shall include the following in addition to the above requirements for Shop Drawings for Equipment:

#### Elevations showing arrangements and positions of all panel components including nameplates.

#### Electrical diagrams as needed to show wiring circuit schematics, single line diagrams, voltage wire numbers and identified interlocks and terminals.

#### Logic diagrams for programmable controllers or relays if used.

#### Nameplate data showing nameplate material, height of letters, number of lines, inscriptions and dimensions.

### Shop Drawings for replacement items shall include field measurements needed to verify fit in existing spaces.

### Catalog Data shall clearly indicate applicable items when several products are covered on one page. Using black ink, indicate on submitted catalog data, specification section or plan reference being satisfied.

### Installation or Application Instructions shall be manufacturer's printed instructions including warranty requirements, clearances required and proper field procedures to deliver, handle, install and prepare product for use. In the absence of manufacturer's published literature, ASTM, AWWA or trade standards for proper installation will usually be accepted. If no instructions at all are submitted for installing or applying an item of Work, the Owner reserves the right to stop work on the subject item at any time, and to retain experts of his choosing to prepare appropriate installation or application instructions to control the Contractor’s work.

### Operation and Maintenance Instructions shall be manufacturer's printed instructions for correct operation and maintenance procedures for product, along with data which must accompany manual as directed by current regulations of government agency. Include operating instructions for each piece of equipment. Describe equipment function, operating characteristics, limiting conditions, operating instructions, startup procedures, normal and emergency conditions, regulation and control, and shutdown. Include preventative maintenance instructions. List warranty requirements. Explain and illustrate preventative maintenance tasks. Include lubrication charts, lists of acceptable lubricants, trouble shooting instructions, and lists of required maintenance tools and equipment. List recommended spare parts, their costs, and ordering information for 1 manufacturer who can supply these parts. Index instructions for easy reference. Include information for installed equipment only.

### Manufacturer's Statement of Responsibility shall be copy of form attached, signed by authorized factory representative for manufacturer whose product is being furnished.

### Certificate of Compliance shall certify materials have been sampled, tested and found to comply with applicable reference standards.

### Engineering Calculations shall be clearly legible, and shall demonstrate compliance with state and local codes, applicable standards, and contract requirements. Calculations shall be sealed by a licensed engineer.

### Foundry or test record transcripts shall fully describe required tests in accordance with specified test standards.

### Furnish the following submittals

| **Submittal** | **Description** |
| --- | --- |
| Motor Data | Submit the following data in tabular form for each motor:   1. Equipment driven 2. Motor locked rotor and full load currents 3. Voltage 4. Power factors & efficiencies at full load, 3/4 load and ½ load 5. Motor housing material and winding material 6. NEMA design letter, code letter and insulation class 7. Ambient temperature and maximum elevation for which motor is designed to operate continuously 8. Service factor 9. Temperature rise 10. Type of enclosure 11. Bearing life 12. Dynamic balance 13. Nameplate data 14. Speed/torque/current at 100% voltage 15. Overload device catalog number 16. Overload device current range and setting. 17. Energy efficiency rating |
| Schedule for lubrication and run-in procedures | Submit 2 weeks before beginning procedures. |
| Welder Qualification Certificates | Submit on Owner’s Representative’s request. |
| Warranty | Unless otherwise stated, furnish 1-year warranty from date of final acceptance. |

### All manufacturer's of equipment which requires the tightening of materials or bolts to join, secure or otherwise fasten equipment to structures or each, shall submit with the shop drawing information the maximum torque required to properly join, secure or otherwise fasten said materials or equipment.

### Use of contract drawing reproductions for shop drawings is subject to rejection.

## DELIVERY, STORAGE AND HANDLING

### Manufacturer’s instruction and warranty requirements for delivery, storage and handling of products shall be strictly followed.

### Deliver products to jobsite in manufacturer's original, unopened, labeled packaging. Tag or label packages as needed to identify contents and name of equipment of which contents form a part.

### Oil lubricated gearing, bearings and other lubricated components shall be shipped with oil soluble protective coating as described in warranty requirements or recommended by manufacturer. Coating shall provide protection for one year after final acceptance.

### Only products of approved manufacturers shall be delivered and stored at the site.

### Do not accept delivery of equipment not meeting Contract requirements.

### Store materials in a protected area at a temperature between 35 F and 110 F.

### Store products so as to preserve their quality and fitness for the Work. Locate stored products and equipment to be incorporated in the Work to facilitate prompt inspection. Contractor shall be responsible for damage or loss to products until Final Acceptance.

### Protect products against moisture, weather, temperature extremes, dust, debris, tampering, vandalism, ultraviolet radiation, or damage from improper handling, storage, or exposure. Protect exposed metals from rust and corrosion even though they will be sandblasted or otherwise cleaned before painting.

### Store flammable products to conform with City, County, State and Federal safety codes for storage of flammable materials.

### Cover pipe ends with rubber, plastic or canvas to prevent intrusion or contamination.

### Openings on valves and equipment shall be covered, plugged or capped.

### Stringing of pipe along right of way shall be done in a manner that will not interfere with free passage of vehicles.

### Store items not designed for outdoor exposure off ground and under cover.

### Handle products with care and using proper equipment according to manufacturer's recommendations. Lift large heavy items only at points designated by manufacturer. Do not drop, drag, bump or handle products in manner that causes bruises, cracks, scratches or other damage. Use padded slings and hooks for lifting as needed to prevent damage. Improper handling shall be cause to reject mishandled products.

### Coated pipe, valves and other products shall be lifted, lowered or suspended using rubber or canvas belt slings or pneumatic-tired cradles. Sling width shall equal or exceed pipe or product diameter. Do not handle coated products using ropes, hooks, chains, calipers or cables. Store such materials on padded skids.

### Inspect each product item for damage, defects, completeness and correct operation before installing.

### Before installation, swab joints and interiors of piping materials to remove foreign matter.

### Notify Owner in writing if delivered or stored product is damaged. Exterior surfaces of delivered items shall be in perfect unblemished condition. Do not repair damaged products without prior written approval.

### Clean and protect machined surfaces and shafting from corrosion using proper type and amount of coating as described in warranty requirements to assure protection to one year after final acceptance.

### Maintain records for Owner's review of deliveries to show Contractor's order number, purchase order number and equipment number. Include labeling or shipping tag in records.

## UNIT PRICES

### Payment for the Work in this section shall be included as part of the lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

# MATERIALS

## GENERAL PRODUCT REQUIREMENTS

### Products shall be new and of current design and manufacture, free from defects and imperfection that might affect serviceability of the product for its intended purpose, unless otherwise stated.

### Products or work for which no technical specifications are set forth shall be of the best grade in quality and workmanship obtainable in the market from firms of established good reputation, or, if not ordinarily carried in stock, shall conform to usual standards for first class products of the kind required, considering the use to which they are to be put. Work shall be in full conformity and harmony with the intent to secure the best standard of products and construction.

### Products and workmanship shall match Contractor's submittals as approved by Owner's Representative.

### Connections and mountings required to install products shall comply with connections and mountings shown in the Contract Documents and Submittals on a location-specific basis. Do not assume that approval of connections or mountings at a specific location constitutes approval of same at all locations.

### Conform to federal, state and local regulations governing VOC content, percentage solids by volume, and other paint and solvent properties.

### Corresponding parts of identical products shall be interchangeable.

### Materials for a complete paint or sealant system, including primer, finish coats, thinners, cleaners and drying agents, and other additives shall be the end products of one manufacturer to ensure product compatibility and unit responsibility.

### Design and fabrication of products shall ensure products withstand stresses and loads which may occur during testing, installation, start-up and normal operation.

### Products shall be capable of fulfilling their intended purpose in the environment in which they are installed. Allow for local temperature extremes, climactic conditions and corrosive environments where necessary to ensure proper functioning of furnished products.

## MATERIALS

### Dissimilar metals, when used in conjunction with each other, shall have suitable insulation provided between adjoining surfaces to eliminate direct contact and resultant current. Insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators, washers, or other approved materials.

### Mating ends of pipe shall match.

### Mating ends of valves, meters and couplings shall match ends of adjacent pipe.

### Minimum working pressure of valves, couplings and fittings shall equal or exceed class of pipe to which they are attached or 150 psi, whichever is higher.

## EQUIPMENT

### Stainless steel inscribed nameplates shall be securely fastened in conspicuous locations for mechanical equipment having moving parts. Show manufacturer's name, year of manufacture, serial number, principal rating data and equipment item number. Nameplates shall be in English and use American measuring units.

### Valves shall be marked to show name of manufacturer, year of manufacture, size of valve, maximum working pressure, and arrow to show direction of flow.

### Valves shall close drip tight.

### Motors shall meet, as minimum requirements, the published standards, rules and regulations of NEMA, ANSI and IEEE as to application, manufacture and tests. Motor windings shall be insulated and braced for full voltage operation.

### Motors shall develop sufficient torque for required service throughout acceleration range at voltage 10 percent less than motor nameplate rating. Motors shall develop sufficient torque when started using reduced voltage starters.

### Provide grounding lugs inside conduit boxes for motor frame grounding.

### Motor grease lubricated bearings shall be regreasable with a grease reservoir above the bearing to ensure proper flow of lubricating oil. Regreasing must purge grease cavity above bearings to ensure an adequate supply of fresh grease.

### Grease fittings shall be standard button-head type. Grease fittings shall be serviceable by a single type of grease gun. Extend fittings as necessary to provide easy access, or as directed by Owner's Representative.

### Furnish special tools, wrenches and appliances needed to adjust, operate, maintain or repair mechanical equipment supplied.

# EXECUTION

## PREPARATION

### Carefully lay out work in advance to minimize cutting, channeling, chasing or drilling of structural pads or elements. Cuts, channeling, drilling, or welding required to accommodate mechanical or electrical equipment shall be reviewed in advance with Owner’s Representative. Do not begin such work until notified by Owner’s Representative. Repair damage to structures, piping equipment or finishes using skilled workers of appropriate trades

### Relocations or adjustment of existing facilities needed to facilitate construction must be approved in writing by the Owner’s Representative and subsequently relocated or adjusted by the Contractor as directed. If existing items are lost or damaged during construction, replace with new items of equal or better quality.

### Make field measurements needed to fabricate and install Work before ordering or beginning work. Make minor changes in alignments and dimensions as needed to remedy or avoid utilities and structural conflicts.

### Clean and wire brush flange faces of pipe, valves and pipeline equipment before joining to adjacent flanges. Flange bolts and nuts shall be cleaned by wire brushing, threads lubricated with oil and graphite and nuts tightened uniformly and progressively.

### Threaded pipe joints shall be cleaned by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves.

### For existing facilities, make field measurements needed to install mechanical equipment before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

## INSTALLATION

### Maintain complete set of Contract Documents at jobsite field office or superintendent's truck at all times.

### Install mechanical equipment according to manufacturer’s installation and warranty requirements. Manufacturer’s requirements for installation, application, connection, erection, maintenance, operating, cleaning, conditioning and startup of products shall be strictly followed.

### Install mechanical equipment to tolerances recommended by manufacturer. Unless otherwise shown, install mechanical equipment true and level using precision gauges and levels.

### Refer variances between manufacturer’s installation instructions and Contract Documents to Owner’s Representative.

### Before welding, abutting joints shall be free of strain.

### Do not force fit or spring pipe, conduit or equipment into place. Corrective measures for cases of poor alignment shall be approved in advance by Owner's Representative.

### Deflections at joints shall fall within manufacturers' published tolerance limits.

### Mitered piping joints are not permitted.

### Pipe bends shall conform to ASME B31.3 and be free from wrinkles, creases or corrugations.

### Water pipe bends shall use approved AWWA fittings.

### Pipe threads shall be cut with sharp dies and made up with an approved thread sealing compound. Threads to be seal welded shall be made up dry. Do not use Teflon sealers.

### Upon request by Owner, during performance test, furnish services of factory-authorized manufacturer's representative to inspect and approve, in writing, installation of mechanical equipment furnished by that manufacturer, to place it into operation, to assist in necessary adjustments and tests and to instruct operating personnel in equipment operation and maintenance.

### Epoxy coated pipe, valves and fittings shall be fabricated and installed without cutting, notching or welding.

### Install valves and equipment so as to be easy to operate and service. Where the geometry of manufactured valves and equipment and field conditions bring about a condition where it is difficult or impossible for an average worker to operate or service an installed valve or piece of equipment, notify the Owner’s Representative of the conflict before installing the valve or piece of equipment.

### Provide stem extensions on buried valves where the depth of the valve nut exceeds 4 feet. Pin valve extensions to the valve operating nut.

### Unless otherwise shown, encase buried valves in two layers of 8 mil polyethylene wrap in accordance with AWWA C105.

### Exposed surfaces shall be finished in appearance. Grind smooth exposed welds. Round or chamfer corners of exposed structural shapes for personnel protection.

### Prime and paint exposed surfaces of ferrous products, piping, and conduit except for stainless steel or galvanized or sherardized surfaces or unless otherwise shown. Clean painted surfaces and touch up bare or marred spots with finish to match factory finish.

### Paint and coat in workmanlike manner so as to produce an even film of uniform thickness. Pay attention to edges, angles, flanges, corners, crevices, and joints to insure that they have been thoroughly cleaned and that they receive specified thickness of paint or coating. Finished surfaces shall be free from runs, drops, ridges, waves, shiners, laps, brush marks, and variations in color, texture and finish. The hiding shall be so complete that addition of another coat would not increase the hiding. Apply coats so as to produce film of uniform thickness.

### Repair damage to work that is not cause for rejection.

### Repair, correct or replace Work failing tests or inspection. Repeat tests until results satisfy specifications. Repair damages resulting from tests.

### Furnish mounts, guides, bearing plates, flanges, anchor and attachment bolts and screws, saddles, supports, pads and skids necessary to securely mount products and equipment.

### Tighten bolts to manufacturers' specifications using torque wrenches. Unless otherwise directed, use lubricant such as Copperkote when making up bolts.

### Manufacturer's instructions and warranty requirements for installation, application, connection, erection, maintenance, operating, cleaning and conditioning of products shall be strictly followed.

## FIELD QUALITY CONTROL

### Pipework, valves, fittings, tanks and appurtenances shall have no leaks at design pressures.

### If flanges leak under pressure testing, nuts and bolts shall be loosened or removed, the gasket reseated or replaced, bolts and nuts reinstalled or retightened and the joints retested.

### Eleven month warranty inspection shall be conducted prior to release of bonds. Any work failing to comply with specifications or performance standards stated in manufacturers submittals or printed promotional literature will at that time be tagged as defective and scheduled for repair. Repair all defective work in strict accordance with the Contract Documents and to the satisfaction of the Owner’s Representative.

## ADJUSTING, LUBRICATING AND CLEANING

### Pre-startup checkout shall be conducted upon completion of Work. Clean foreign material. Lubricate equipment in accordance with manufacturer's instructions. To extent possible, turn rotating equipment, operate valves and gates, and check for binding or interference. Check incoming electric power for voltage amplitude and voltage balance. Check motor driven equipment for correct rotation. Check power draw of equipment. Verify that safety equipment is in place.

### Debugging, tuneup and adjustments shall be done as needed.

### Lubricate mechanical equipment in accordance with manufacturer's instructions. Lubricating oils and greases shall be of type and viscosity recommended by manufacturer. Furnish lubricants with flushing oils as recommended by manufacturer. Following flushing, fill oil lubrication system with "run-in" oil as recommended by manufacturer. Run in equipment at no load condition for 2 hours. Drain and flush equipment again with flushing oil and refill with lubricant recommended by manufacturer.

### Upon request by Owner, during performance test, furnish services of factory-authorized manufacturer's representative to inspect and approve, in writing, installation of mechanical equipment furnished by that manufacturer, to place it into operation, to assist in necessary adjustments and tests and to instruct operating personnel in equipment operation and maintenance.

**MANUFACTURER'S STATEMENT OF RESPONSIBILITY**

Project Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Specification Section Number: \_\_\_\_\_\_\_\_\_\_\_

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Owner:

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Contractor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Supplier: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### We have reviewed the applicable sections of the Contract Documents describing requirements for our product, including Sections entitled "Submittals", "Quality Control", "Material and Equipment", "Starting of Systems", "Contract Closeout", "Operating and Maintenance Data and Training", "Painting and Coating", "Basic Mechanical Requirements", "Basic Electrical Requirements".

#### Before shipping, we certify that we shall review Contractor's submittals from other manufacturers who will supply products that interface with our product, and may affect our product's performance. In addition we state that it is our intent to request and review data concerning quality of water, soils or any other materials which may contact or adversely impact the performance of our product.

#### Should we have cause to believe that our product is, for any reason, incompatible with an interfacing product or material, we will inform the Owner of our concern before we ship our product. In such case, we will not ship our product until our concerns have been satisfactorily resolved.

#### We further understand that Owner reserves the right to request a factory authorized representative's written approval of installation, application and/or erection of our product as described in the Section of the Contract Documents entitled “Starting of Systems”, before paying Contractor for our product.

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Authorized Factory Representative

END OF SECTION