

SPECIFICATIONS - DETAILED PROVISIONS
Section 17210 - Magnetic Flowmeters

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**SECTION 17210
MAGNETIC FLOWMETERS**

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Contractor shall furnish and install magnetic flowmeters and all appurtenant materials and equipment. Magnetic flowmeters shall be suitable for the services listed, complete and operable in accordance with requirements of the Contract Documents and in conformance with the manufacturer's recommendations.

1.02 PROJECT SPECIFIC REQUIREMENTS

Contractor shall furnish and install magnetic flowmeter(s) as shown on the Drawings, as specified in Section 17210.1, Detailed Magnetic Flowmeters, and as specified herein.

Section 17210.1 shall be utilized in conjunction with this Specification. Flowmeter location, service, nominal diameter, pressure rating, and flow range shall be as specified in Section 17210.1, and as shown on the Drawings.

1.03 RELATED SECTIONS

- A. The Contract Documents are a single integrated document, and as such all Specification Sections apply. It is the responsibility of the Contractor and its subcontractors to review all sections and ensure a complete and coordinated project.
- B. Related Specification Sections include, but are not limited to, the following:
 - 1. Division 11 – Equipment
 - 2. Division 13 – Special Construction
 - 3. Division 15 – Mechanical
 - 4. Division 16 – Electrical
 - 5. Division 17 – Instrumentation and Controls

1.04 SUBMITTALS

All submittals shall be in accordance with the General Conditions and requirements specified herein.

A. Shop Drawings

Contractor shall prepare and submit complete and organized information, drawings, and technical data for all equipment and components. All drawings shall be legible and reduced to a maximum size of 11" x 17" for inclusion within the submittal. Shop drawings shall include, but not be limited to, the following:

1. Detailed Bill of Materials for all equipment and components, listing: manufacturer's name, quantity, size, description, and catalog/part number.
2. Manufacturer's product literature, specifications, performance capabilities, features and accessories, materials of construction, illustrations, and data in sufficient detail to demonstrate compliance with Specification requirements. Manufacturer's literature and data shall be marked to clearly delineate all applicable information and crossing out all inapplicable information.
3. Dimensional drawings for each meter size.
4. Electrical wiring schematics for flow sensor and signal converter/transmitter. Interconnection wiring diagrams between signal converters/transmitters and related equipment and materials.
5. Diagrams showing meter grounding recommendations and grounding conductor/connection requirements (conductor size and connection type), including: connection from meter terminal box or signal converter (if integrally mounted) to grounding ring(s), connection between grounding rings, and connection from grounding rings to ground rod.
6. Meter cable product data sheets.
7. Manufacturer's application performance guarantee for each meter location, and recommendations for installation at each location.

B. Operation and Maintenance Manual

Contractor shall submit a detailed Operation and Maintenance Manual for all equipment and components specified herein and incorporated into the Work. The Operation and Maintenance Manual shall be provided in accordance with the requirements of the District's General Conditions, and Section 01430.

Operation and maintenance manuals shall include, but not be limited to, the following:

1. Equipment Performance Data and Drawings
 - a. Detailed Bill of Materials for all equipment and components, listing: manufacturer's name, quantity, size, description, and catalog/part number.
 - b. Manufacturer's product literature, specifications, performance capabilities, features and accessories, materials of construction, and illustrations.
 - c. Dimensional drawings for each meter size.
 - d. Electrical wiring schematics for flow sensor and signal converter/transmitter. Interconnection wiring diagrams between signal converters/transmitters and related equipment and materials.
2. Equipment Installation Requirements
 - a. Complete, detailed installation instructions for all equipment and components.
3. Equipment Operation Data
 - a. Complete and detailed operating instructions, including operator interface menus, programming, and setup parameters.
 - b. Printed list of all final setup parameters for each flowmeter, including factory settings and any field modifications to factory settings.
4. Equipment Service and Maintenance Data
 - a. Maintenance data shall include all information and instructions required by District's personnel to keep equipment properly cleaned and adjusted so that it functions economically throughout its full design life.
 - b. Unloading, handling, and long term storage requirements.
 - c. Explanation with illustrations as necessary for each maintenance task.
 - d. Recommended schedule of maintenance tasks.
 - e. Troubleshooting instructions.

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- f. List of maintenance tools and equipment.
 - g. Recommended spare parts list.
 - h. Name, address and phone number of manufacturer and manufacturer's local service representative.
- 5. Manufacturer's Warranty
 - 6. Provide a signed written certification report with the Final Operation and Maintenance Manuals, certifying that the magnetic flowmeters have been properly installed, calibrated and adjusted, and are suitable for satisfactory continuous operation under varying operating conditions, and meet all requirements specified in the Contract Documents.

1.05 COORDINATION

Flowmeters and control systems shall be designed and coordinated for proper operation with related equipment and materials furnished by other suppliers and manufacturers under other sections of these Specifications and where applicable, with related existing equipment. All flowmeter and control devices shall be applied in full conformity with the Construction Drawings and Specifications, and with the instructions and recommendations of the flowmeter manufacturer and the related equipment manufacturer.

Related equipment and materials may include, but not be limited to: valve actuators, chemical feed equipment, analytical measuring devices, supervisory control equipment (SCADA), telemetry, conduit, cable, and piping, as described in other Sections associated with the project and shown on the Drawings.

Interconnection wiring diagrams shall be prepared between the related equipment and the equipment furnished under this Section. Interconnection wiring shall provide all functions specified herein and/or shown on the Drawings.

PART 2 - PRODUCTS

2.01 GENERAL

The magnetic flowmeter shall consist of a flow sensor and a signal converter/transmitter. The flow sensor shall utilize Faraday's Law of Electromagnetic Induction, to produce an electrical voltage that is proportional to the velocity of the flow of liquid through the sensor. The signal converter/transmitter shall be micro-processor based. Unless specified otherwise, the signal converter/transmitter shall be remote mounted.

2.02 FLOW SENSOR

- A. Each flow sensor shall be provided with a flanged end flow tube and a non-conductive liner suitable for the liquid being metered. Unless specified otherwise, the flow tube shall be constructed of Type 304 stainless steel with stainless steel or carbon steel flanged ends. Flanges shall be ANSI Class 150 for meter sizes up to 24", and AWWA Class D for meter sizes larger than 24". Unless specified otherwise, liner material shall be hard rubber or polyurethane. Flow sensors exposed to water with a chlorine concentration of 10 ppm or greater, such as recycled water, shall be provided with Teflon liner material
- B. The field coils of the flow sensor shall be supplied with a precisely adjusted bi-polar direct current. Coil drive power shall be supplied by the signal converter/transmitter. The output signal from the flow sensor shall be fed through cable to the signal converter/transmitter. There shall be no electronic components in the flow sensor.
- C. The flow sensor coil enclosure and cable connection housing shall be epoxy coated steel or epoxy coated aluminum. Plastic housings will not be acceptable.
- D. Flow sensors shall be weatherproof NEMA 4X at a minimum. Meters installed underground or in a below grade vault shall be manufactured to NEMA 6P standards to enable the meter to be submerged up to 30 feet for 48 hours and up to 10 feet with continuous submersion. Meters rated NEMA 6P shall have remote transmitters in separate NEMA 4X enclosures. The interconnecting cables shall be installed at the factory and the termination box filled with a non-setting, transparent potting material.
- E. When installed in metallic piping, the flow sensor shall be provided with integral grounding electrodes. When installed in lined or non-metallic piping, the flow sensor shall be provided with Type 304 stainless steel grounding rings (grounding electrodes will not be acceptable).
- F. When installed in piping conveying raw sewage or sludge, the flow sensor shall be certified for use in Class I, Division 2 hazardous locations.
- G. Flow sensor grounding electrode and sensing electrode material shall be compatible with the process fluid. Unless specified otherwise, electrodes shall be constructed of Type 316 stainless steel or Hastelloy C.
- H. Unless specified otherwise, the flow sensor lining material shall be hard rubber or polyurethane. The flow sensor, including liner material, shall be certified in accordance with National Sanitation Foundation Standard 61 for use with potable water. Accuracy shall not be affected by cuts or scratches in the flow sensor liner.

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- I. The flow sensor shall be provided with multiple sensing electrodes to accurately measure mean velocity. The flow sensor shall be capable of accurately measuring slurries and water with entrained air. Accuracy of the flowmeter system shall be $\pm 0.2\%$ of rate. Accuracy shall be traceable to the US National Institute of Standards and Technology (NIST), and shall be guaranteed on-site for applications such as drinking water, raw sewage, and similar media, even with a permanent coating of raw sewage or similar on the electrodes. A NIST traceable calibration certificate shall be provided with each flowmeter.
- J. The flow sensor shall incorporate an empty pipe detection feature, which shall cause the meter to register zero flow when the sensor is not full.
- K. Unless specified otherwise, the flow sensor shall be rated for a minimum working pressure of 150 psig.
- L. The flow sensor shall be suitable for operating temperatures ranging from -4°F to $+122^{\circ}\text{F}$ (minimum).

2.03 SIGNAL CONVERTER/TRANSMITTER

- A. Unless specified otherwise, the signal converter/transmitter shall be remote mounted from the flow sensor. Where special signal cable is required and recommended by the manufacturer, the cable shall be supplied by the meter manufacturer. Supplier shall confirm the length and installation requirements. Where signal converter/transmitter location is not shown on the Drawings, each flowmeter shall be furnished with a minimum of 200 feet of signal cable.
- B. The signal converter/transmitter shall be suitable for outdoor exposure and shall be rated NEMA 4X.
- C. The signal converter/transmitter shall be provided with an alphanumeric, 3-line, 16-character (minimum), backlit display to indicate flow rate, totalized values, settings, and faults. Unless specified otherwise, the display shall indicate flow in gallons per minute and total flow in acre feet. All programming shall be accomplished through an integral keypad or touch screen operation and all programming shall be protected by a user-defined password. The signal converter/transmitter shall be provided with a fault and status log.
- D. The signal converter shall be coordinated with the flow sensor selection for accurately measuring potable water, raw sewage, slurries, and water with entrained air.
- E. The signal converter/transmitter shall be capable of measuring bi-directional flow and shall have three separate totalizers.

- F. The signal converter/transmitter shall operate on 120V, 60 Hz supply power.
- G. The signal converter/transmitter shall produce a 4-20 mA DC output signal into a minimum load of 800 ohms, linear to flow. Output shall be selectable as unidirectional or bi-directional. In addition, the signal converter/transmitter shall provide a digital scaled pulse output for external display/recording of flow rate or total flow.
- H. Where indicated on the Drawings or in Section 17210.1, the signal converter/transmitter shall be provided with a positive zero circuit to register zero flow when pumping units are not operating. A closed external dry contact (generated by pump "off" or other similar equipment control signal) input to the signal converter/transmitter shall drive the meter output to zero.
- I. The signal converter/transmitter shall be suitable for operation in ambient temperatures ranging from -4°F to +140°F (minimum).
- J. Where located indoors, the signal converter/transmitter shall be wall mounted or flush panel door mounted as indicated on the Drawings.
- K. Where located outdoors, signal converter/transmitter shall be suitable for mounting inside a NEMA 4X stainless steel enclosure, Hoffman, or equal. The stainless steel enclosure shall be provided with a swing-out door panel and back panel. The signal converter/transmitter shall be flush mounted on the swing-out door panel or back panel mounted with a cut-out in the swing-out door panel for the display. The enclosure shall be provided with side mounted air supply fan, side mounted louvered and filtered air supply and exhaust openings, 120V supply power circuit breaker for the signal converter and air supply fan, and fuses for each.
- L. The signal converter/transmitter shall be capable of verifying the performance of the measuring system in the field without removing the meter tube from the process. The field verification feature shall be integral to the signal converter/transmitter and shall be capable of continuously monitoring electronic parameters within the flow meter and signal converter/transmitter. If any value deviates from an acceptable range, the signal converter/transmitter shall acknowledge the event and a relay shall be activated. A summary report of the verification shall be downloadable directly through the service port of the signal converter/transmitter or while logged onto the manufacturer's webserver for an Ethernet/IP capable signal converter/transmitter. The integral verification system shall be Endress+Hauser Heartbeat Technology, or equal.
- M. Where specified, local service communication with the meter shall be capable via a RJ-45 port and an Ethernet cable regardless of the output. The signal converter/transmitter shall have integral webserver capabilities with an unique IP address.

2.04 MANUFACTURERS

Magnetic flowmeters and manufacturers shall be as follows (no substitutes):

- A. Promag W 400 Electromagnetic Flowmeter, as manufactured by Endress+Hauser. Unless specified otherwise, the signal converter/transmitter shall be provided with the following input/output signal capabilities: HART/4-20 mA; frequency, relay, and status input (flexible module); and Ethernet/IP.
- B. Electromagnetic Flowmeter WaterMaster FE_12 or FE_32 with full bore flow sensor and remote mount signal converter/transmitter, as manufactured by ABB. Unless specified otherwise, the signal converter/transmitter shall be provided with the following input/output signal capabilities: HART/4-20 mA, pulse, and contact output.
- C. Electromagnetic Flowmeter Sensor SITRANS F M MAG 5100 W with MAG 6000 signal converter/transmitter, as manufactured by Siemens. Unless specified otherwise, the signal converter/transmitter shall be provided with the following input/output signal capabilities: 4-20 mA output, pulse/frequency, relay output, and MODBUS RTU/RS 485.

Model numbers supplied herein are provided for information purposes only, to assist Contractor in selecting equipment that conforms to the Specification and Drawing requirements. In case of any conflict between model numbers provided and the descriptive requirements specified herein, the descriptive requirements shall govern.

Manufacturers shall modify or supplement standard equipment to provide all features and capabilities specified herein.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation of magnetic flowmeters and signal converters/transmitters shall be in accordance with manufacturer's written instructions.
- B. Wiring between flow sensors and remote mounted signal converters shall be supplied by the meter manufacturer.
- C. All magnetic flowmeters shall be grounded per manufacturer's requirements. Contractor shall coordinate grounding between signal converter, flow sensor, grounding rings, and ground rod to ensure compliance with the manufacturer's recommended grounding procedures. Prior to start up, manufacturer shall provide written certification that the meter installation is in accordance with their requirements, including grounding.

- D. Unless specified or shown otherwise, outdoor signal converters/transmitters shall be remote mounted within NEMA 4X stainless steel enclosures. The enclosures shall be mounted on stanchions adjacent to the respective meters.

3.02 MANUFACTURER'S WARRANTY

Manufacturer shall guarantee all equipment against defects in material and workmanship for a period of two years from date of project acceptance. During the warranty period, manufacturer shall provide all labor and material required to repair or replace defective equipment at no cost to the District.

END OF SECTION 17210

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