

ITEM 35

FLOW METERS

1.0 DESCRIPTION. The Contractor shall furnish all labor, equipment and material necessary to install the type of flow meter and accessories specified in the plans for use in measuring sanitary sewer flows in strict accordance with the requirements hereinafter specified. The installation of the magnetic flow meter (MAG Meter) system for the proposed lift station site, shall be as indicated on all contract drawings and include transmitter and all accessories for use in measuring sanitary sewer flows in strict accordance with the requirements hereinafter specified. This specification shall be understood to mean, but not be limited to the flow meter, remote transmitter, all componentry, hardware, wiring, conduit, mounting hardware, programming, calibration, and spare parts as specified herein for the provision and/or installation of said meter.

2.0 SUBMITTALS. The electrical Contractor shall provide the following submittals and information to the Stark County Sanitary Engineer for review and approval within 30 days after receipt of written "Notice to Proceed" in accordance with this specification.

A. Reference Standards. Latest versions:

1. Alarm and warning functions: NAMUR NE 107 Standards.
2. ANSI B16.5 Class 150 carbon steel flanges for 4" to 24", and AWWA Class D flanges for 30" and above.
3. ASME B16.5 and B16.47.
4. NEMA 6P (IP68).
5. NEMA 4X.
6. NIST Standards (calibration).
7. NFPA 70.
8. Nation Electric Code (NEC).
9. UL 508A (transmitter).

B. Shop Drawings.

1. Shop drawings shall include but not be limited to the proposed flow meter, control panel, and all ancillary components.
2. Indicate all principal dimensions, general construction and materials of all equipment, outputs, set points, transmission frequency, ranges and accuracy pertaining to all equipment as specified herein.
3. Shop drawings shall include all Manufacturer's specific, illustrated catalog data and parts schedule in sufficient detail to serve as a guide in assembly and disassembly of all components.
4. Include information for recommended repair parts as specified under this item.
5. Manufacturer's general web-site information will not be sufficient to fulfill shop-drawing requirements.

6. The Contractor shall provide one (1) electronic copy of all materials listed below for shop drawing approval. All shop drawings submitted for review and approval shall be returned within 10 working days either approved or marked up for further design.
7. Shop drawings shall complete in detail and indicate the flow meter and all flow meter componentry as listed in the materials section below.
8. After examination of such drawings by the Engineer and the return thereof, the Contractor shall make such correction to the drawings as have been indicated and shall furnish the Engineer with electronic corrections. If requested by the Engineer, the Contractor must furnish additional hard copies.
9. Schedule: The contractor shall provide a proposed installation schedule for said flow meter system. Said schedule shall include:
 - a. Shop drawing submittal dates.
 - b. Equipment order dates.
 - c. Equipment delivery dates.
 - d. Installation start date.
 - e. Installation completion date.
 - f. Flow Meter start up, calibration and prove out period.
10. O&M Manuals - The Contractor shall provide two (2) sets of system O & M manuals, electronically on USB's, for each meter necessary for maintenance and operation of the system. Prior to or with the delivery of equipment, including any necessary warranty information in accordance with requirements herein. Manuals shall include not less than the following information as applicable, for each major item of equipment:
 - a. General, introduction and overall description, purpose, functions, simplified theory of operation, etc; specifications; installation, instruction, procedures, sequences, tolerances and precautions; operational procedures; shut-down procedures; maintenance, and service instructions; parts list and spare parts recommendations.
 - b. Use drawings and pictorials to illustrate the text to the extent necessary to insure a clear, concise presentation. If manuals have been written to cover a family of similar equipment, strike out non-applicable information in a neat fashion.
 - c. Bind the manual in a cover which indicates the system to which it applies, manufacturer's name, local address and telephone number, and year of purchase. Punch manuals less than one-inch thick for standard three-ring binders. Bind larger manuals in hard covers and include system name and manufacturer's name on binding.

C. Calculations. This section is not applicable.

D. Certifications.

1. The meter manufacturer's technician shall provide to the County a written report certifying the meter system indicating:
 - a. The condition of the meter system and all component systems.

- b. All repairs and/or adjustments.
- c. All components, parts or program/firmware updates utilized.
- d. Certification of the meter system calibration. (This report will be used by the Electrical Contractor to integrate the flow meters analog outputs to the County's SCADA system radio field unit's analog inputs. This calibration and report shall be done at no additional cost to the County and shall be done immediately after the flow meter is installed and in working condition at each site.)
- e. Any potential future concerns or recommendations.

3.0 MATERIALS. All material handling, installation, and technical requirements shall be as follows:

A. New and Unused Condition.

- 1. Including installation hardware, new and unused unless otherwise specified and in accordance with all manufacturers' recommendations for types and corrosive resistance.
- 2. Care should be taken to assure no dissimilar metals are utilized between these components.
- 3. Source Limitations: The entire meter system shall be obtained through one source manufacturer.

B. Summary of Components.

- 1. The flow meter and accessories shall include but not be limited to: the flow meter, transmitter, probes, quick disconnects and extensions, power, power packs, couplings, replacement spool, electrical conduits and wiring, programing, calibration, and any other necessary appurtenances.
- 2. These specifications are intended to illustrate and define the equipment; however, the Contractor shall be responsible for all the details, which may be necessary to properly install, adjust and place into operation the proposed flow meter system and appurtenances.
- 3. The Contractor shall be responsible for any additional costs, which may result from unauthorized deviations from these Specifications.
- 4. All equipment and materials shall conform to the Specifications unless otherwise noted on the equipment schedule or changed in writing by the Engineer.
- 5. Under no circumstances shall any material be substituted without written approval by the Engineer.
- 6. Standard products: The equipment to be furnished under this specification shall be essentially the standard products in regular production by manufacturers regularly engaged in the production of high-quality equipment of this type, and shall essentially duplicate, mechanically in performance, equipment that has been in satisfactory and successful operation for a period of at least ten (10) years.
- 7. Where items and materials required under this contract, unless noted as

- required for base bid, are designated by proprietary name, the purpose of such designation is to specify standards of quality, workmanship, and performance and does not indicate a preference for this particular manufacturer's equipment.
8. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, providing there are not integrity issues or concerns the component parts of the equipment need not be the products of the same manufacturer.
 9. Flow meters and accessories. The Contractor shall furnish and install complete and in place, a magnetic flow meter(s), control panel, and accessories for the type or types as specified in the plans and as follows:

C. Requirements.

1. The magnetic flow meter shall be manufactured specifically for wastewater conditions and be an ABB - Process Master Mag Meter, Rosemount 8700 Series, Yokogawa ADMAG AXW or SCMSD approved equal.
2. There shall be furnished a pulsed DC electromagnetic flow meter suitable for fixed-site measurement of bi-directional flow in a full pipe.
3. The flow meter shall consist of a flow tube and a remote transmitter, which shall indicate, instantaneous, peak, average daily and totalized flows.
4. The transmitter shall also be capable of logging 31 days of continuous data.

D. Flow Tube & Sensors.

1. A spool piece configuration is required.
2. The nominal diameter of the flow tube shall be as shown on the plans.
3. The flow tube shall be made of stainless steel with carbon steel flanges and shall be powder coated with a corrosion resistant electrostatic polyurethane finish inside and outside and shall include Type 316 stainless steel bolts.
4. The flow tube shall have a Polytetrafluoroethylene (PTFE) liner for all sludge applications, neoprene liner for raw sewage applications; polyurethane can be used on clean fluids, suitable for all wastewater conditions.
5. The flow tube shall be complete with two (2) 316 stainless steel grounding rings. Grounding rings shall be properly sized based upon the specified unit as shown on all drawing.
6. Flow sensor shall be sized based upon specified flow requirements and fabricated from stainless steel and provide a hermetic seal that protects against moisture and other contaminants.
7. Flow tube shall be welded design.
8. The sensors shall use solid-state design, with the coils, electrodes, and other sensor components encapsulated in the liner and shall be calibrated traceable with a 3-point computer printout calibration. Meters using OIML calibration are not acceptable to the county. Electrodes shall be made of Hastalloy C.

E. Operating Ranges.

1. For the mag meter, measurement shall be from 0 to 1000 GPM. The normal

operating design flow range shall be in accord with project drawing requirements.

2. The minimum media conductivity shall be 5 micro-mhos/cm.
3. The maximum media temperature shall be 190° F (88° C).
4. Sensor ambient temperature limits shall be -20 to 140° F.
5. Process temperature limits for PTFE lining shall be -20 to 248° F.
6. Maximum pressure shall be 275 psi in accordance with ASME.
7. Flow rate change shall be between 0.04 and 30.00 ft/s (0.01 – 10 m/s) for both forward and reverse flows in the required sensor size.
8. Full scale continuously adjustable between -30 and 30 ft/s (-10 – 10 m/s).
9. Accuracy: System accuracy shall be 0.25% of rate from 1 – 30 ft/s., this includes combined effects of linearity, hysteresis and repeatability. Accuracy is 0.005 ft/s from low flow cutoff to 1.0 ft/s (0.3m/s).

F. Transmitter.

1. The transmitter shall be a remote modular designed transmitter that allows for easy disassembly without the need to unscrew cables or unplug connectors.
2. The remote transmitter shall be housed in a rugged, watertight, dust-tight, corrosion resistant glass loaded polypropylene enclosure suitable for conduit connections.
3. The enclosure rating shall be NEMA 4X rectangular dual compartment housing with built in surge protection and removable fuse IP65/NEMA 6P. The enclosure shall include a clear polycarbonate window for viewing the LCD and totalizer without opening the enclosure.
4. The remote transmitter shall be installed/located at the pump station electrical control panel as shown on all detail drawing.
5. Local operator interface (LOI) capabilities:
 - a. Self-diagnostic functions which monitor both operability and process.
 - b. Provision of security lockout capabilities to protect against unwanted or accidental change of programmed values.
 - c. Alarm and warning functions: NAMUR NE 107 Standards.
 - d. Intuitive fifteen (15) button (minimum) keypad for instant access to most commonly used functions.
 - e. Two (2) line twenty (20) character digital backlit LCD display (minimum). Display shall be capable of reading in extreme sunlight environments.
 - f. A minimum of two (2) operating values shall be capable of being displayed at all times.
 - g. The display shall be in English for words and numerals.
 - h. The transmitter shall include three (3); nine (9)-digit, non-resettable LCD totalizers for forward, reverse and net flow. In addition, the transmitter shall be capable of displaying and/or reporting all current flow values and alarm warnings.
 - i. Capable of indicating instantaneous, peak, average daily and totalized daily & monthly flows.
 - j. Ability to log 31 consecutive days of data.

6. Ethernet connection for downloading data, trouble shooting, maintenance, updating and calibrating the meter system.
7. Analog output for connection to the Stark County Sanitary Engineers SCADA System web site. Available data shall be both numeric and graphic.
8. Transmitter shall have the capability to dampen the flow rate display to provide an average value of readings over a selectable time interval from 0 to 60 seconds.
9. Transmitter communication protocol utilized shall be HART protocol. The Contractor shall be responsible for all integration required to enable the transmitter to communicate to and with the County SCADA system and web site.
 - a. An input impedance of 1015 ohms;
 - b. An isolated 4 to 20 mA output based on flow rate; (800 ohms).
 - c. The transmitter shall have the capability to dampen the 4 to 20 mA output to provide an average value of readings over a selectable time interval from 0 to 60 seconds.
 - d. The transmitter shall include a pulse frequency output based on flow rate, selectable from either open collector output saleable from 10 pulses per hour to 10,000 pulses per second, rated 30 volts, 100 mA or isolated relay contact scalable from 10 pulses/hour to 10 pulses per second, rated 125 volts AC, 1 A, 30 VA.
 - e. The transmitter shall include a low flow cutoff, adjustable from 1 – 100% of full scale, below which the pulse frequency output shall halt and the totalizer shall stop incrementing.
 - f. The transmitter shall include isolated, normally open relay contacts, activated based on minimum flow, maximum flow, low flow cutoff and non-full pipe, rated 125 volts AC, 1 A, 30 VA.
 - g. The transmitter shall operate on 120 VAC, 50/60 Hz line power. Power consumption shall be <20 VA.

4.0 EXECUTION. The Electrical Contractor shall provide all labor, material and equipment necessary to install, calibrate and test the flow meter and remote transmitter complete, in accordance with all detail drawing, SCSE specifications, the County's SCADA integration consultant requirements (Samsara System Inc.), the SCSE's IT's department and Manufacturer requirements. Any deviation specifications, requirements and plans shall be pre-approved by the Stark County Sanitary Engineering representative.

A. Contractor's Qualifications.

1. The Contractor and all employees utilized on the flow meter system installation and calibration shall have performed least three (3) similar installations with references including the following:
 - a. Project owner:
 - b. Point of Contact. (Owner)
 - c. Phone Number
 - d. Project description including:

- e. Location.
- f. Scope of work
- g. Description of flow meter system to include flows, flow ranges, set points. Calibration I/O points, readouts etc.
- h. Start and completion dates.

B. Work Summary.

1. This work includes all labor, material and equipment required to furnish, install, calibrate and warranty the flow meter, control panel and associated appurtenances for recording all flows in accordance with all design specifications and plans, requirements, codes and ordinances of the owner/manufacturers and shall meet the inspection of same.
2. Workmanship shall be first class in every respect and all work shall be carried out by persons who are thoroughly experienced in this line of work. Only qualified and skilled workmen/women shall be employed for all phases of this project.
3. The final installation shall be complete in all respects and the Electrical Contractor shall be responsible for minor details and any necessary special construction requirements not specifically included in the Drawings or Specifications.

C. Complete Installation.

1. Complete shall mean all electrical work, programming, integration between the meter system and County SCADA system and calibration necessary to power and assure proper commissioning and operation of said metering system for its intended purpose.
2. Only qualified and skilled workmen, competent in the handling, piping, electrical installation, programming and calibration of flow meters system shall be employed for all phases of this project.
3. The flow tube and accessories in the force main piping; including all valves and stems for the meters shall be installed by the General Contractor where shown on the plans or as directed by the Engineer and in accordance with these specifications.
4. Installation of the flow meter system which includes but is not limited to: the flow meter, remote transmitter, probes, quick disconnects and extensions, power packs, couplings, electrical conduits, wiring, programming, calibration, and any other necessary appurtenances shall be in accordance with all detail drawings, this specification and meter manufacturers installation specifications inclusive.
5. Placement of the meter shall be in accordance with all detail drawings however, the electrical contractor shall be responsible to verify with the meter manufacturer the required up and down stream pipe straight pipe diameters required for proper installation.
6. Based upon field conditions, if the actual up and down stream lay length is less than normally ideal length conditions the contractor shall work with the meter

manufacturer consultant to maximize straight run conditions required.

7. The Contractor shall follow all generally accepted, industry standard construction and installation procedures throughout the installation of the meter system to assure all handling, storage, placement, installation, programming and calibration processes assure the meter and remote transmitter are not damaged, and that acceptable operation results are achieved.

5.0 ELECTRICAL.

A. Installation.

1. The Electrical Contractor shall be responsible for the installation of the remote transmitter.
2. This work shall include but not be limited to provision of all power, instrument cables, sensors, conduit, programming, integration with the County SCADA system (Samsara), calibration and other equipment required to complete the flow meter installation as shown on the plans or as directed by the Engineer and in accordance with these specifications.
3. The Electrical Contractor shall be responsible for all labor, materials and equipment necessary for integration of the meter/transmitter into the County's SCADA system in accordance with SCSE IT department requirements.
4. All electrical work shall comply with NFPA 70, Nation Electric Codes (NEC), State of Ohio and Local Building Codes (OBC) Requirements and IEC Codes.
5. Wiring from the transmitter to the meter/sensors shall in accordance with all meter manufacturers recommendations. The cable shall be supplied by the manufacturer and shall be a minimum of 50 feet, not to exceed 150'.
6. The flow tube and sensors shall be permanently submersible to NEMA 6P (IP68) to 30 feet (9 m). Cable shall be factory potted. Only one cable is acceptable to connect flow tube to transmitter. Potting kits are not acceptable.

6.0 QUALITY ASSURANCE. Work covered under this section is intended for the complete installation and all requirements described in entire specification for intended usage by the SCMSD.

- A. Spare Parts.** As part of this specification the Contractor shall provide to the Owner the following spare parts and/or equipment.

All spare parts and/or equipment shall be included as part of the unit pricing as indicated below and NO separate payment shall be made for spare parts and/or equipment.

1. **Flow Meter.** A complete flow meter system shall be provided in accordance with all above material specifications.
 - a. The Flow meter system shall include but not be limited to the flow meter,

transmitter, probes, quick disconnects and extensions, power packs, couplings, replacement spool, electrical conduits, programming software and any other required appurtenances for meter operation/installation.

- b. In the event the specification covers multiple meter sites/locations a complete spare flow meter system shall be provided for each site as specified above in Section 03 "Materials".

2. Ductile Iron Flanged Spool Piece A ductile iron flanged spool piece for each meter installation shall be provided.

- a. The ductile iron spool piece shall comply with SCSE Item 11 and be the same length as the specified flow tube. This spool piece can be used to keep the force main active in the event that the flow meter(tube) has to be removed.
- b. In the event the specification covers multiple flow meter sites/locations a DI flanged spool piece shall be provided for each site/location.

B. Testing.

1. Flow meters shall be calibrated in accordance with the manufacture recommendations for each meter installed by the Electrical Contractor.
2. The Contractor shall hire the manufacturer's representative or independent consultant certified by the manufacturer to perform initial calibration of the flow meter at each site.
3. Factory Testing Documentation: Prior to shipment and receipt of the flow meter and remote transmitter the contractor shall provide manufacturer's factory testing documentation verifying the meter and transmitter were factory benched flow tested and successfully met and passed all design flow monitoring requirements.
4. Insitu calibration verification: This system shall be able to verify in a quantifiable manner the meters current conditions vs. the meters condition when originally manufactured.
5. This calibration verification of the meter shall be performed without need for physical access to the meter flow tube.

C. Observation.

1. The manufacture of the flow meters shall provide a representative to check the installation, make final adjustments, supervise initial startup of each site, and prepare a written report thereof for the Engineer.
2. The representative shall also instruct the Engineer's personnel in the operation and maintenance of the equipment.
 - a. The Engineer shall decide the type and timing interval of the output at each site in the field at time of installation.
 - b. Provide the ability to verify the accuracy of the unit and the integrity of the current loop without any external equipment.
3. It is the responsibility of the Contractor to schedule and coordinate these items

- with the manufacturer and engineer.
4. No separate payment for these items shall be made.

D. Warranty. The Contractor shall provide the following guarantee for all labor, materials and equipment utilized on this project.

1. Standard Manufacturer Warranties. The Contractor shall provide all standard manufacturer warranties for all materials and componentry as set forth and described within this specification.
2. Manufacturers & Quality Assurance/Workmanship Comprehensive Warranty: The Electrical Contractor shall provide a three (3) year comprehensive manufacturer's and quality assurance/workmanship warranty against defects in all material and workmanship pertaining to the provision, installation and operation of meter system in accordance with all drawings, specifications and standards.
 - a. The warranty shall include, but not be limited to:
 - i. Meter, meter tube, remote transmitter, provision of power, electrical service, programming, SCADA integration, calibration and operating conditions.
 - b. The warranty shall commence upon project final approval as determined by the SCMSD.
3. Any defects in materials or workmanship or in the event a deficiency occurs pertaining to the installation, SCADA system integration, system componentry, programming, system operation or calibration during the comprehensive warranty period, the Contractor shall be responsible to repair or replace the deficiency, under the warranty, at no cost to the County.
4. The Contractor shall respond to and initiate repairs within 24 hours of notification by the County.
5. Annual Warranty Inspection Recalibrations. As part of the three (3) year comprehensive manufactures & quality assurance warranty the Electrical Contractor shall provide the following annual service.
 - a. On or about the first, second and third anniversary dates of project final approval, the contractor shall supply an authorized manufacturer's technician to provide an annual service inspection and calibration of the meter system.
 - b. This work shall include verification of proper operation of the meter system, program/firmware updates (to the most current versions) and repair or replacement of any defective parts discovered, as part of this service.
 - c. All labor, transportation, equipment and material costs shall be chargeable to the warranty and NO costs shall be borne by the County throughout the duration of the comprehensive three (3) year warranty.

7.0 MEASUREMENT. The unit of measurement shall be the actual number of each meter, including appurtenances, as specified herein, installed and fully operational; exception to work paid under other Items.

8.0 PAYMENT. This unit price stipulated for provision of labor, materials and equipment necessary to provide, install, power, calibrate and integrate the meter system completely, including electrical, in accordance with all specifications, drawings, or as directed by the engineer is below. Exception to the unit pricing is when Item 28 is included in the contract. In those cases, all labor materials & equipment necessary for the Contractor to install the flow tube and fabricate and provide the spool piece shall be paid for under Item 28.

NO additional payment shall be made under this Item, for any electrical or general contractor work, necessary for the provision and installation of the meter system as specified herein. These costs shall be provided under Items 28 and 29 respectively.

<u>Item</u>	<u>Unit</u>	<u>Description</u>
35	EA	Flow Meter, Complete

END OF SECTION