SECTION 33 1900 – WATER UTILITY METERING EQUIPMENT (BMU)

PART 1.0 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

A. Pressure Regulator

B. Inside Meter Setters

C. Dismantling Joint

D. Water Meter (up to and including 2-inch)

E. Magnetic Water Meter (3-inch and Larger)

1.2 RELATED REQUIREMENTS

A. SECTION 01 3000 – ADMINISTRATIVE REQUIREMENTS

B. SECTION 33 1000 – WATER UTILITIES (BMU)

1.3 PRIOR APPROVAL

A. Approval prior to bidding is necessary if it is intended to use materials and equipment other than those specifically named in Approved Manufacturers. Instructions for obtaining such approval are specified in the General Requirements. Prior approved manufacturers shall be named by Addendum.

1.4 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American Society for Testing and Materials (ASTM)
2. American Water Works Association (AWWA)

1.5 DEFINITIONS

A. 3/4" (Standard) Meter - A standard 3/4" meter has a full 3/4" water flow capacity, or bore, and uses the same 3/4" AWWA meter threads as the 5/8" x 3/4" meter. However, the lay length is 9" inlet to outlet. It is normally used on 3/4" service lines where the full 3/4" flow capacity is required and can't be provided by a 5/8" x 3/4" meter.

B. 3/4" (Short) Meter - This is a full 3/4" bore and measuring capacity meter, but with a 7-1/2" lay length. It is often used to upgrade a formerly 5/8" x 3/4" meter to full 3/4" without having to re-plumb for the longer 3/4" standard lay length, or where space is not available for the longer meter. Internal parts and registers are generally interchangeable with the standard 3/4" meter.

C. Absolute Encoder - An encoder register that outputs the exact position of the number wheels or digital count rather than an incremental pulse.

D. AMR - Automatic Meter Reading. Generally a technology for reading water meters in drive-by mode via a short distance ratio signal.

E. AMI - Automated Metering Infrastructure. A technology where a network of antennas, towers or other fixed infrastructure is installed to automatically collect meter reading at set increments via radio transmitted signals.

F. Digital Pulse - A pulse output that is in digital format vs an analog pulse. A digital pulse will have a very consistent voltage and frequency. An analog pulse may vary.

G. Encoder - a meter register that sends the numerical reading directly out to a device in a coded format rather than a pulses that the external device has to count. A popular encoded output format is generically UI-1203 which was formerly and is sometimes still called the "Sensus protocol" as it was originally designed by Sensus company and provided to AWWA as a standard.

H. Encoded Output - Electronic Data output from an encoder type water meter register.

I. Lay Length - The total length of a water meter from inlet to outlet. On threaded end meters, it is the end to end of the meter threads. On flanged meters it is the furthest distance from the outer side of the inlet and outlet flange. Lay length does not include space for the gasket thickness, but is the ACTUAL length of the meter inlet to outlet.

J. Lead-free (low lead, no lead) - This is a standard set by the US Government through the Safe Drinking Water Act for the amount of lead (metal) that can legally be used in plumbing products. The amount has changed over time. The most recent change took effect in January 2014 when the amount of allowable lead in a metal allow was reduced from 8% to 0.25%. Brass plumbing products installed after 2014 must be marked "lead-free", "low lead" or "no lead" and meet NSF-61G standards for lead testing and approval. Older unused products are NOT grandfathered in and cannot be installed. However, existing installed products may be used in their current places.

K. Lead Wire - Electronic registers will have a wire lead between the register and electronics. This may be referred to an encoder with a 6' wire lead. (This is not referring to the metal element but to a length of wire)

L. Mag Meter (Electromagnetic Meter) - A meter that uses Faraday's law of physics to measure flow from two or more electrodes. The meters have no moving parts, but must have constant source of AC or DC power.

M. Meter Threads - In the USA, water meters meet specifications of the American Water Works Association. AWWA has specific thread size standards for water meters that are NOT the same as tapered pipe threads (NPT). Meter threads do not provide a waterproof seal, but have a coupling nut go over them and compress a meter gasket against the face of the meter spud for the watertight seal. AWWA threads are not tapered like NPT threads, but are straight. they are also named based on internal sizes, not external, and are one size larger than NPS threads. (3/4" meter threads are actually 1" NPS/NPST) You do NOT use pipe sealant on meter threads.

N. Normal Flow Range - The expected, standard, and recommended flow range for a meter to

O. NSF (NSF-61g) - National Science Foundation - NSF-61G is a standard for testing and approval of plumbing materials to be free of lead and other harmful contaminants for potable water.

P. Pulse Output - Electronic meter output in pulse format. for example a mete might generate one electronic pulse for every 10, 100, or 1000 gallons. The pulse can go to a remote

register or an electronic device. The external device must be capable of counting the pulses and totaling them. Older remote meters often had an analog pulse put out by a generator register. Newer meters have a digital pulse put out by a battery operated device or a switched current (dry contact switch)

Q. Remote Register - A secondary register normally wired to the meter installed register that can be installed a short distance away from the meter itself. Commonly mounted on an outside wall to read a meter in a basement or inside a building without having to enter.

R. Sensus Protocol (UI-1203) - A standard of data transfer from an encoded register to an external device such as a radio transmitter, electronic display, or touch pad. Adopted by AWWA as an industry standard.

S. Ultrasonic Meter (Transit Time, Dopler) - Ultrasonic meters use either Transit time or Dopler sound waves to measure the flow of water. They have no moving parts, but operate with transducers to measure the flow rate of the water and therefore the volume at a given velocity. They are very accurate, have no moving parts to wear, require no strainer, and can be installed in multiple configurations such as vertically where a PD meter cannot.

T. Register - The usually topmost part of a meter that keeps track of the numerical usage of the meter on a mechanical odometer or electronically on a solid state meter. It may also be an encoder or pulse register and send the reading out to an external device such as a counter, remote, touchpad, or radio MIU

U. Strainer - A strainer is a filter or screen that allows water to pass, but will catch objects and debris that could damage a meters internal components. Strainers may be a small screen on the inlet side of a meter, or a separate device installed prior to the meter. They are generally required for mechanical meter types such as PD, Multijet, Turbine, and Compound meters. They are not generally required for meters without moving parts such as Ultrasonic and Mag Meters.

V. Tamper Seal - a device to seal any removable parts of a meter to prevent tamper by those not authorized. Some may be proprietary screws, pins, or covers. some are simply wires threaded through holes in the screws or bolts and sealed with a tamper evident device.

W. Touch Read (Also touch pad, Read Pad, Touch remote) - a meter with a wire output to an external wire going to an inductive remote touch pad. A technology where a touch reader can send an inductive pulse into a touch pad and the meter replies with the an encoded meter reading. True touch is technically not required as the inductive signal can be up to 1/2" from the coil.

X. Turbine (Turbo) - Turbine meters have a propeller like device in the flow of water that moves with the water current and translates into the register for measurement. Turbine water meters are generally best for only larger meters 2" and larger and high consistent high flow rates. compound meters have a turbine measuring element for high flow rates, as well as another technology for low flow rates.

Y. Wheels (encoder) (significant digits) - Most mechanical meters have a series of odometer wheels that move and increment water usage. Electronic meters have LCD numbers that simulate the same. A meter with 6 moving odometer wheels is referred to as a "6-wheel encoder". If only the last 4 wheels send out output electronically, it would be "4 wheel output". It refers to either the number of moving digits or number of significant digits used for billing.

1.6 SUBMITTALS

A. The Contractor shall submit the number of copies that the contract requires plus one copy that the Engineer of Record will retain. The Contractor shall obtain shop drawing approval before any of the work related to that material is performed.

B. Shop drawings and data shall be submitted for, but not be limited to, the following items:
   1. Pipe, pipe fittings, bedding material, stabilization material, road topping material, and any other pertinent information concerning construction materials that the Engineer of Record deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.

C. The Contractor shall submit appropriate documentation to the Engineer of Record for any materials not listed in these specifications. The Engineer of Record may forward any shop drawing to the BMU Engineer for consideration. Correspondence shall indicate any discrepancies between the BMU specification requirements and the Contractor provided submittal.
   1. BMU Engineer reserves the right to reject any and all materials that do not meet the requirements for water mains as indicated in these standard specifications.

PART 2.0 - PRODUCTS

2.1 PRESSURE REGULATOR

A. Valve shall be dial set, spring loaded pressure regulating valve capable of providing a constant downstream pressure over a wide range of inlet supply pressures. Valve shall be suitable for potable water applications.

B. Pressure regulating valve shall be constructed of a low lead content brass body with stainless steel and engineered plastics for the internal parts. Regulator mechanism shall be fabric-reinforced diaphragm.

C. Valve shall be capable of reducing downstream pressure from 25 to 90 psi. Valve shall be set at 60 psi at the factory.

D. Provide valve with internal and external threading that allows use in thread-by-thread, single union NPT configurations.

E. Acceptable Manufacturers for pressure regulators are Honeywell DS06-101/102 or prebid BMU Engineer approved equal.

2.2 INSIDE METER SETTERS

A. Inside meter setters shall be horn style interior setting that automatically ensure proper spacing and orientation of water meters. Setter shall include meter coupling threads with rubber meter gasket and meter nut.

B. Provide 7½ -inch laying length for 3/4-inch meters and 10¾ -inch laying length for 1-inch meter setters.

C. Copper tubing shall be constructed with full diameter bends to provide excellent flow capacity and characteristics. Copper shall conform to ASTM B75.

D. All brass that comes in contact with the potable water shall conform to AWWA C800. The product shall have the letter "NL" cast into the main body for lead-free identification.

E. Acceptable Manufacturers for interior meter setter are Ford Meter Box Copperhorns, AY McDonald NL 740-XInside Setter or prebid BMU Engineer approved equal.

2.3 DISMANTLING JOINT

A. Flange spool piece shall be fabricated to meet AWWA Class D Steel ring flange, compatible with ANSI Class 125 and 150 bolt patterns, pipe shall be std weight class per ASTM A53.

B. End ring and body shall be made from ASTM A536 Ductile Iron

C. Provide NBR gaskets made from rubber compound for water and sewer service in accordance with ASTM D200.

D. Provide stainless steel type 304 bolts, nuts and tie-rods.

E. Provide fusion bonded epoxy coating, interior and exterior of dismantling joint.

F. When properly installed on pipe that is within the coupling manufacturer's tolerances, dismantling joint shall be capable of operation at working pressures equal to the maximum rating of the flange.

G. Dismantling joint shall be manufactured by Viking Johnson, Romac, Smith Blair or equal.

2.4 WATER METER (UP TO AND INCLUDING 2-INCH)

A. Meter shall utilize ultrasonic transit time measurement technology and have no moving parts within the meter to wear or replace. The ultrasonic meter shall be fully electronic with encapsulated and sealed circuitry, display and battery.

B. Ultrasonic meters shall meet or exceed the most recent revisions of AWWA C715 Standards. The ultrasonic meters shall comply with the lead-free provisions of the Safe Drinking Water Act and NSF/ANSI Standards 61 and 372.

C. The housing shall be constructed of a lead-free bronze alloy or stainless steel and shall be designed so that at a maximum working pressure, any distortion will not affect the accuracy of the meter. Ultrasonic meters shall operate to a maximum pressure of 175 psi and to a temperature of 140º F without leakage or damage.

D. Manufacture shall be capable of producing 5/8-inch, 5/8 by 3/4-inch, 3/4-inch, 1-inch, 1-1/2-inch and 2-inch ultrasonic water meters. 3/4-inch meters shall be capable of being provided with either 7.5-inch or 9-inch laying length.

E. The metering tube shall have an unobstructed flow passage and shall not be repaired in any manner. The flow direction, meter size, and NSF-61 shall also be cast in the meter housing.

F. The electronic circuit shall be microprocessor based and include nonvolatile memory capable of storing all programmable and accumulated data.

1. The circuit shall control the ultrasonic transducers. The entire meter circuit and related components shall be fully potted and sealed from water intrusion.

2. The registration shall consist of an electronic local display combined with electronic circuitry to provide a high-resolution absolute encoder output. The electronic register assembly shall transmit a signal through properly shielded transmission wire for AMR/AMI connectivity.

a. Meters shall be equipped with an encoder head that is compatible with the Elster EA Water 4.0 Module (Contact Elster Meter Co. for Specifications). Meters shall be provided with pre-wired 25-foot wire leads.

3. High resolution absolute encoder registration shall be capable of sending an 8-digit or 9-digit encoder output to the endpoint as well as extended status messages. Reading resolution sent to the reading software is based on the output of the endpoint technology the meter is connected to.

G. The register shall be encased in non-corrosive plastic housing, with the circuit board, display, and battery completely potted and epoxy-sealed within to provide moisture resistance to flooded pit or submerged conditions. Ultrasonic meters shall meet and exceed IP 68 rating for submergence.

1. The size, model, and direction of flow through the meters shall be permanently visible on the topside of all meter displays.

2. To minimize expense, the ultrasonic meter encoder design shall allow for replaceable registration and transducers that are protected from tampering. The meter must have the ability to detect removal of registration and transducers, and report an empty pipe alarm as indication of removal.

3. The registration enclosure face shall be slightly curved to prevent sediment buildup, and the registration housing shall have a molded-in clip to provide the option of mounting an approved endpoint to the side.

4. The LCD shall display the following information:

a. 8-digit or 9-digit consumption display with decimal and comma separator

b. Icons for units of measure and time to represent total consumption and flow rate

c. Icons to represent alarm conditions

d. Segmented lines above and below digits to represent standard visual billing units for manual reading purposes

5. The digital display shall provide a totalized consumption resolution to 0.01 cubic feet for 3/4 inch meters.

6. To conserve battery life, the display shall be off while in resting state. The display shall be activated by a change in light level through the infrared (IR) port. Meter shall not require special tools to activate the display. Opening/closing the lid or blocking/ unblocking the IR port will activate the display to cycle through display screens showing different meter information.

7. Ultrasonic meters shall be factory programmed to display the following screens.

a. Standard Total Consumption

b. Rate of Flow

c. Alarm and Operating Mode shall display current active alarms since the last transmission to the endpoint.

d. Firmware Version

H. Register box enclosures and lids shall be made of engineering thermoplastic or other suitable synthetic polymer.

1. The lid shall have a snap close feature to prevent the lid from opening if installed in a vertical up position. The lid shall overlap the registration enclosure to protect the lens.
2. The name or logo of the manufacturer shall be permanently molded into the lid, and at the option of the utility, a serial number shall be imprinted on the registration lid.

I. Acceptable Manufacturers for water meters shall be Badger E-Series Ultrasonic Meter or Neptune MACH 10 Ultrasonic Meter, No Approved Equals.

2.5 MAGNETIC FLOW METER (3-INCH AND LARGER)

A. The meter shall include bidirectional metering capabilities with programmable totalizers. The meter shall allow for an accuracy of +/-0.25 percent with a flow range of 300:1.

B. The amplifier shall be integrally mounted to the detector or shall available remote mounted. The amplifier shall be housed in a cast aluminum, powered coated, NEMA 4X enclosure. The amplifier shall receive the detectors analog signal, amplify the signal and convert the signal into digital information. The signal shall be converted to both analog and digital signals that shall display rate of flow and totalization. The processor shall control zero-flow stability, analog and frequency outputs, serial communications and a variety of other parameters. It shall include a four-line, 20-character LCD display to at shall indicate rate of flow, forward and reverse totalizers and diagnostic messages.

C. The display shall also serve to guide the user in simple terms though a user-friendly programmable routine. Programmable parameters of the amplifier shall include (but are not limited to) calibration factors, totalizer resets, unit of measure, analog and pulse output scaling, flow alarm functions, language selection, low flow cutoff, noise dampening factor and excitation frequency selection. The amplifiers main function is to detect and condition flow information from the electromagnetic detector.

1. Meters shall be equipped with transmitter that is capable of generating an high-resolution absolute encoder output, compatible with the Elster EA Water 4.0 Module (Contact Elster Meter Co. for Specifications).

D. The power consumption shall be 120 VAC, 15 watts. The meter shall provide a variety of analog outputs, digital outputs, pulse outputs, frequency output and miscellaneous outputs. Units of measure shall include ounces, pounds, liters, US gallon, cubic meters, cubic feet and acre feet.

E. The meter shall be supplied and installed with a dismantling joint and stainless-steel ground rings.

F. Acceptable Manufacturers for water meters shall be Badger M Series Magnetic Flow meter with M2000 amplifier, No Approved Equals.

PART 3.0 - EXECUTION

3.1 WATER METER INSTALLATION

A. Contractor shall purchase meter from BMU and install the meter, make meter connections, install remote reading device, cable and caulking, as required. BMU must be notified during appropriate construction phases so proper meter installations can be complete. Contractor shall schedule a new meter install with BMU a minimum of 24 hours prior.

B. BMU will install water meters in water meter settings which conform with the following standards:

1. The water meter shall be located inside the building and as close as possible to the point at which the water service pipe enters the building. The water meter must be located in an area which is heated by the building's heating system. Meters shall NOT be installed in crawl spaces, NO EXCEPTION. The customer is ultimately responsible for protecting the water meter from freezing; heat tapes and building insulation are not recommended for this purpose;

2. The pipe adjacent to the water meter setting shall be arranged so the water meter is, and will remain, accessible for installation, reading, inspecting and changing the water meter. The meter and adjacent valves shall not be obstructed as to prevent meter installation or replacement. Enough working room, typically two feet in front of the meter, must be cleared by the property owner as to allow for meter replacement, as well as a clear path to the water meter. Property owners are responsible to maintain accessibility to the water meter.

3. It is recommended that a floor drain be located near the water meter setting.

4. The water meter shall be installed in a vertical run of pipe, copper male by female swivel jointed meter yoke, ball valve with a graspable handle upstream of the meter, a suitable reducer/s and a pipe support on each side of the water meter; the vertical run of pipe shall be at least 1 foot, but not more than 3 feet from the floor. Piping and yoke shall be mounted so that the meter dial is mounted in the horizontal plane, NO EXCEPTION.

   a. Backflow prevention devices are required and must be installed immediately downstream of meter setter. No connections are allowed between the meter and the backflow preventer.

   b. The isolation ball valve shall be immediately upstream of the meter setter. The meter isolation valve shall be the only valve on the water service between the water meter and the curb stop valve, NO EXCEPTION.

5. Complete installation of empty ¾-inch or larger Flexible PVC electrical conduit shall be installed from the meter setter to the remote reading point.

   a. Total length of conduit from the meter setter to the remote reading point shall not exceed 90 feet. Flexible PVC conduit shall be installed in such a manner that pull boxes and splices to the conduit are unnecessary.

   b. The remote reading point shall be a box that BMU will supply for structure with only one (1) water meter. All other types of installations must be pre-approved by the BMU water department.

   c. The remote reading point box shall be mounted to the structure and connected to conduit.

      - The remote reading point shall be mounted on the outside wall of the building, 48 to 66 inches above the ground and within five (5) feet of the electrical meter.

      - The remote reading point shall not be covered or enclosed as to inhibit meter reading or meter maintenance.

C. If two or more water meters are to be installed per account holder, the piping shall be arranged to prevent the water meters from operating in series.

1. Water meters may be installed in parallel piping arrangements for redundancy, or to increase water flow capability while not sacrificing low flow registration capability provided a swing check valve is installed in the outlet piping of both meters.
2. Irrigation meters shall be plumbed prior to the domestic meter and installed in parallel piping. In no case shall the domestic and irrigation be installed in series such that metering and billing for the irrigation meter being a series of calculation to determine monthly irrigation water. NO EXCEPTIONS

D. BMU will analyze each building's water requirements to ensure adequate water meter size. Meter sizing decisions are at the sole discretion of BMU.

E. Commercial meter (3-inch and Larger) installations shall include a 120 VAC, single phase power supply to power the meter. The commercial customer shall be responsible for paying for all costs associated with installation and powering the water meter.

1. Commercial meter installations shall also include a dismantling joint immediately upstream or downstream of the meter. Location of the dismantling joint shall be determined in the field to avoid conflict with adjacent plumbing devices. Preference is downstream of the meter.
2. For commercial water meters, BMU shall furnish the water meter for installation by others. All work is subject to inspection and approval by BMU.

PART 4.0 - MEASUREMENT AND PAYMENT

4.1 X" PRESSURE REGULATOR

A. Pressure regulators shall be measured for per each type and size of pressure regulator furnished and installed. Payment shall be full compensation for pressure regulator, labor, equipment, and incidentals necessary to complete the work.

4.2 X" x X" INSIDE METER SETTER

A. Inside meter setters shall be measured for per each size of meter setter furnished and installed. Payment shall be full compensation for meter setter, labor, equipment, and incidentals necessary to complete the work.

4.3 X" DISMANTLING JOINT

A. Payment for dismantling joints shall be at the contract unit price per each type and size of dismantling joints. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to dismantling joints, restraints, bolts, and gaskets.

4.4 X" WATER METER

A. Water meters shall be measured for per each type and size of water meter furnished and installed. Payment shall be full compensation for water meter, gaskets, miscellaneous fittings, materials, labor, equipment, and incidentals necessary to complete the work.

4.5 X" MAGNETIC WATER METER

A. Water meters shall be measured for per each type and size of magnetic water meter furnished and installed. Payment shall be full compensation for magnetic water meter, gaskets, miscellaneous fittings, materials, labor, equipment, and incidentals necessary to complete the work.

END OF SECTION 33 1900